A practical treatise on the diseases of children / by J. Forsyth Meigs and William Pepper.

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Meigs, J. Forsyth 1818-1882.
Pepper, William, 1843-1898.

Publication/Creation

London : Henry King Lewis, 1877.

Persistent URL

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A

PRACTICAL TREATISE

ON THE

DISEASES OF CHILDREN.

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PRACTICAL TREATISE

ON THE

DISEASES OF CHILDREN.

BY

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Sixth Edition,

REVISED AND ENLARGED.

LONDON:

HENRY KING LEWIS,

136 GOWER STREET.

1877.

PREFACE

TO THE SIXTH EDITION.

In preparing the present edition for the press, attention has been devoted rather to the careful revision of the text than to the addition of new articles. A few have, however, been added, as upon Night Terrors, and on Epidemic Cerebro-spinal Meningitis; while others have been rewritten, as in the case of the article on Cerebral Congestion. Wherever our own views have undergone modification since the publication of the last edition, it has been carefully noted; and the attempt has been made to incorporate whatever is most important and trustworthy among the recent additions to our knowledge of children's diseases. It is hoped that the thorough revision which has thus been given may entitle the present edition to as favorable a reception as has been accorded to its predecessors.

Philadelphia, January, 1877.

PREFACE

TO THE FIFTH EDITION.

Owing to the comparatively short time which has elapsed since the appearance of the last edition of this work, it has not been thought necessary to introduce any extensive changes in many parts of the text. All of it has, however, been subjected to careful revision, and such modifications made as were called for by changes in our own views, or by the results of the recent researches of others. In addition to this, several important articles have been almost entirely rewritten; among which may be mentioned that on the Diseases of the Heart; on Progressive Muscular Sclerosis; on the treatment of Scarlet Fever, and of Measles; on Variola, and on the Vaccine Disease.

Some of the articles which seem appropriate in a systematic work on the diseases of children, but which were unavoidably omitted in the last edition, have been supplied. Among these will be found articles on Pulmonary Emphysema, Pneumothorax, Affections of the Tonsils, Retropharyngeal Abscess, Malarial Fevers, and Scrofula. To obviate the increase in the size of the work necessitated by these additions, most of the illustrative cases, the number of which has been considerably increased, have been placed in smaller type, and in many places the former text has been condensed. Despite these changes, however, an increase of ninety pages has resulted from the large amount of new matter added. On the whole, it is felt that the hope may reasonably be entertained that the work in its present form will prove of more practical utility than heretofore, and will continue to serve the purpose, which has actuated its authors, of facilitating the study and treatment of this interesting and important class of diseases.

Philadelphia, January, 1874.

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A

PRACTICAL TREATISE

ON THE

DISEASES OF CHILDREN.

INTRODUCTORY ESSAY.

ON THE CLINICAL EXAMINATION OF CHILDREN.

The clinical examination of children, and particularly of young infants, cannot be successfully practiced upon the same method as that habitually made use of in the case of adults. The truth of this statement will be readily assented to by all who have had much experience in the treatment of the diseases of the two ages, by those who will reflect for a moment on the great differences in the expressions of the various organs in early and adult life, and by those who are acquainted with the opinions of distinguished writers upon children's diseases. It is proper and useful, therefore, to preface a practical work on the diseases of children, with a sketch or plan of the best method to be pursued in forming a diagnosis of these diseases, and with remarks upon the physiological characters which distinguish the organization of early life from that of maturity.

The difficulties that beset the path of the practitioner in his clinical examination of children are so great that he who has not been prepared by preliminary study to surmount these obstacles, will find it a most uncertain and dubious task to unravel the history and nature of any case that may be set before him. The helpless silence of the infant,—the wilful silence, or the loose and inconsistent answers of the older child, which lead astray the mind rather than guide it to true results,—the agitation and fright produced by the examination, rendering it impossible at times to ascertain the real state of the different functions of the economy,—and, lastly, the difficulty of obtaining accurate and reliable accounts of the history of the case from the attendants, all combine to make the duty of the physician most perplexing, and, unless he be gifted with a large share of patient and philosophic calmness, most irksome and trying to the temper.

So great, indeed, are the difficulties encountered by some practitioners who enter upon this branch of the practice of medicine without proper preliminary preparation, that they never overcome them; but, to use the words of Dr. West, "grow satisfied with their ignorance, and will then, with the greatest gravity, assure you that the attempt to understand these affections is useless." That it is possible, however, to overcome, in great measure, these obstacles, and to arrive at a correct diagnosis in nearly all cases, is quite as true as that these obstacles really exist. But, in order to do this, the physician must first be aware that difficulties exist, and must have formed in his mind some plan or method by which to surmount or elude them.

Before proceeding to show what is the best method of examining or exploring disease in children, we must state that our remarks apply chiefly to infants and very young subjects; for, after the age of eight and ten years, the physical and intellectual development have progressed to such a point as to render the method of diagnosis nearly the same as that employed in adults.

The chief causes which render the diagnosis of disease in young children difficult, are the absence of the faculty of speech, and the violent agitation generally caused by the examination, which prevents a proper appreciation of the state of certain organs and functions.

It is easy to understand how much our means of diagnosis are restricted by the absence of the faculty of speech. How many symptoms are there in the case of adults with which we become acquainted only through the patient's own account of his sensations; and, consequently of how many must we be deprived in children by the absence of this account. It might, indeed, at first view, seem impossible to detect the nature of the sickness without the assistance of this means, so greatly do we depend upon it in our examination of adults. Nevertheless, we shall find ourselves enabled, by an attentive consideration of other resources in the child, by a close study of its physiognomical expression, its decubitus, the nature of its cry, and by the most rigidly careful physical examination, to form our conclusions with almost as great a degree of precision as in older patients.

The other causes of difficulty,—the violent disturbance, both physical and moral, of the child, its fright, agitation, and cries,—constitute, when they are present in a high degree, much greater embarrassments than the want of speech. To overcome these, the physician must use all his skill, tact, and patience; for, unless they can be avoided by art, or overcome by soothing and gentle persuasion, he can learn but little that will be of essential service to him in making up his opinion. He can neither read the countenance of the little patient, nor judge by its attitudes or decubitus of the state of the various organs, whether internal or external; he will be unable to ascertain the rate, force, or regularity of the circulatory or respiratory functions; he cannot, to any useful purpose, examine the abdomen, to learn whether it be tender on pressure, or whether its contained organs be in their natural condition as to size and position; and, lastly, he will find that the physical exploration of the lungs and heart, by auscultation and percussion, yield him at best only imperfect results.

To avoid the difficulties just detailed, it is always useful, if not absolutely necessary, to conduct certain portions of the examination whilst the child is calm and quiet, and certain others whilst it is disturbed and agitated. This distinction of the examination into two periods, or stages, is one of the utmost importance in a practical point of view, and should never be forgotten by the physician during his clinical observation of the various symptoms the patient may present.

By the period of calm is meant a condition of total quiescence, in which the child is undisturbed either by internal or external causes of irritation. This condition is best found in the state of sleep. If this cannot be obtained, the one most nearly approaching to it is that which exists during the act of nursing, or which follows that act. Suckling is usually followed, even in the sick child, by a condition of drowsiness or by a gentle and languid slumber, during which it will allow a careful examination upon many points without agitation. If possible, therefore, the physician should always see the child when asleep, and if the mother or nurse propose, on the occasion of his visit, to hurry upstairs to prepare the child, or to bring it down into the parlor or lower room, he should ask, as a favor, that he may see it asleep.

If, in spite of having just been nursed, the child be awake and fretting, and when, also, it is more advanced in age, we should endeavor, by the attraction of toys, by gentle and soothing words and manners, by fondling, or by having it carried about the room, to get it quiet.

Before proceeding to a consideration of the particular means by which we are to judge of the state of health or sickness of young subjects, it is proper to call attention to the great importance of a careful examination of the attendants, in regard to the history of the case, previous to and between the medical visits. In the instance of children, their inability to describe their own symptoms compels us to depend entirely upon the mother or nurse for all detail of the case previous to our first visit, and for all accounts of what may have happened between two subsequent ones. It is, therefore, extremely important that this part of the examination should be conducted with every care and caution. Very much that is useful may be learned from it, if it be well managed. A great deal of skill and art are required in putting the questions, and in sifting the evidence thus collected. We should always bear in mind the character of the persons questioned. Much depends upon their education, and much more on their natural powers of observation, and manner of relating what they may have seen. The degree of credence to be attached to their answers must rest upon their probable intelligence. Nurses and mothers will often give accounts of their charges which must be received with large allowance, and even in some few instances with disbelief. We would, however, in this place, most earnestly caution the young practitioner of medicine to be very careful not to misbelieve, or even mistrust, without well-poised reasons, the account of a sick child given by a mother; for though a foolish, weak woman will often give a false or exaggerated statement of the symptoms of her child, an observant and intelligent, and sometimes a foolish and weak one, when guided by maternal instinct, will detect variations from the healthful con-

dition of the child, which may entirely escape the search of the most acute and rigorous medical observer. A mother may perceive a change in the expression of the face, in the manner of the muscular movements, in the temper or conduct of her child, which shall fail to attract the attention of the practitioner; or it may be that the symptom which has caused the parent to take alarm occurs only during the absence of the physician. The medical attendant ought, for these reasons, to listen patiently and kindly to whatever the mother or nurse may have to say, and if unable to detect immediately what they assert they have seen, let him not determine at once that there has been a mistake, that their anxiety has deceived them; but let him examine the patient yet again, and more carefully, or let him pay another visit to learn whether the symptom or symptoms continue, or have occurred again. Our own rule, in a doubtful case, is to listen with religious attention to the mother, and unless she be far beneath the average of human intelligence, our opinion as to the fact of some deviation from the ordinary health of the child is considerably influenced by what she tells us.

The inquiry in regard to the history of the case, previous to the first visit of the physician, should bear particularly upon the causes of the sickness, its precise moment and mode of attack, and its course and symptoms up to the present time. The most important points to be considered in connection with these objects, are the health of the parents, including their ordinary health, or their habitual diseases, the causes and periods of their death, if they are not living, and the state of health of the child at the moment of birth and since. The hygienic conditions in which the patient has been placed ought always to be investigated; the place of habitation; the kind of house, and whether a large well-ventilated room, or a small, narrow, and close one; the clothing; the food; and lastly, whether the infant has been suckled, or brought up on artificial diet. The state of the health just anterior to the attack ought always to be examined into. Has it been good and strong, or feeble and delicate? If delicate, what diseases? If the approach of any of the eruptive fevers be suspected from the character of the symptoms, the question as to whether the child has previously had measles or scarlet fever, or has been vaccinated or had variola, should always be asked.

It is next necessary to fix as accurately as possible, the precise period of the onset of the sickness. If the question, "When was the child taken sick?" be asked, as it usually is, the answer will be, "Oh, several days ago," or, "I don't recollect exactly—I think yesterday, or the day before," or some such loose answer. The best way to learn the exact period in a recent case, is to go back, day by day, or else to inquire as to some particular day. We may ask, was the child quite well day before yesterday; was it well last Sunday? did it play and amuse itself? was it as gay and good-tempered as usual yesterday, or the day before, or the day before that? Did it sleep well night before last, or the night before that? A sick child never scarcely sleeps well at night, and very often we may learn by close inquiry into this particular, the exact time at which the attack began. In this way, by forcing the attendant to tax her memory, and to

go minutely over the events of the several days previous, we shall nearly always succeed in fixing very precisely the moment of onset.

Having determined these points, we should proceed to inquire in regard to the course of the disease prior to the first visit. This is to be done only by patient and repeated questioning. The questions must be so framed as to elicit free and unbiassed answers. They should be general, and not leading. Lastly, we are to inquire into the treatment of the case up to the present time.

It is best that all these interrogatories should be made previous to seeing the child, in some other room than the nursery, in order to avoid the risk of alarming the child by the presence, during an unnecessary length of time, of a stranger. If, however, the child be well acquainted with the physician, it matters not where the inquiries are made.

Having now obtained from the attendants all the information they can give in regard to the history and nature of the case, the physician must proceed to the personal examination of the patient, in order to determine, by his own observation, the exact nature of the sickness, and the treatment it may require.

The most important points to be attended to during the clinical examination, are the countenance or facies, noting its expression, coloration, the presence or absence of furrows and wrinkles from pain, from emaciation, or from disordered muscular action, the appearances presented by the nasal orifices, and especially by the alæ nasi, and the characters exhibited by the mouth; the sleep; the cry; the state of embonpoint or emaciation; the condition of the skin as to coloration, temperature, moisture or dryness, the presence of swellings of any kind, such as those produced by dropsy or by affections of the joints, and the existence of eruptions; the pulse; impulse of the heart; the respiration; the signs furnished by the state of the mouth and throat, and by the disposition towards and power of sucking, or by the manner in which drinks are taken; and lastly, the state of the abdomen.

The Countenance.—The countenance of a young and healthy infant, who is sleeping or perfectly quiet, wears no expression except that of comfort and content. It is composed and still; no movement disturbs its innocent tranquillity, unless, perhaps, some gentle smile light it up from time to time, when we might well believe the happy superstition of the fond mother, who will tell us that angels are whispering it. In sickness, even when slight, the countenance soon loses this expressionless character. In all acute disorders the alteration is very great, such indeed as to strike the most careless and inexperienced observer. The features become contracted, furrows and wrinkles appear about the forehead, the nostrils are dilated, or pinched and thin, and the mouth becomes drawn and rigid. The extent of the change is generally in proportion to the severity of the attack. The part of the face most altered will depend very much upon the particular system of organs implicated in the disease.

Some authors have endeavored to show that different diseases give to the physiognomy certain peculiar and characteristic *expressions*. This is true only to a certain extent. Thus, the facies is very different in abdom-

inal from that observed in thoracic or cerebral diseases; but though it is *generally* easy for a practiced physician to distinguish by the facies alone between a cerebral and thoracic disorder, it is quite impossible for him to distinguish between any two cerebral, thoracic, or abdominal affections. The particular changes impressed upon the face by different diseases cannot, however, be discussed in this place, but must be considered in the separate articles upon each disease. Here it can only be stated in general terms, that, in diseases of the brain, the upper part of the face, the forehead, and the eyes are chiefly affected; that in diseases of the thoracic organs, the middle portion of the face, and especially the nostrils; while in those of the digestive organs, the lower part of the face, the mouth and lips, are the parts which undergo the greatest changes in their expression.

Pain may almost always be detected by the expression of the face. It gives to the countenance various shades of expression, according to its degree of severity, and its permanency or recurrence at intervals. Pain in the head is said, by Dr. M. Hall, to produce a contracted brow, pain in the belly to occasion an elevation of the upper lip, whilst pain in the chest is chiefly denoted by sharpness of the nostrils. We doubt, however, whether pain in any particular organ imparts an expression to one part of the face rather than to another, for indeed pain in any part of the body, whether the head, chest, abdomen, or limbs, gives rise to a contraction of all the features. Not one part of the face alone, but the forehead, mouth, nose, and the whole face, become changed in expression and contracted, when there is severe pain in any part of the body, so that we deem it impossible from the expression alone, to determine where the painful sensation may be seated. The countenance merely tells us there is pain, but not where it is located. The painful expression will be permanent or occasional, as the pain itself is constant or only paroxysmal.

The *coloration* of the face becomes often an important means of diagnosis. In all the fevers, phlegmasiæ, and diseases of general excitement, the face will be more or less suffused and red, unless the attack be so severe as to occasion a violent shock to the nervous system, in which event the countenance instead of being suffused, is paler than natural. In such cases the face becomes of a dead white, all traces of red disappear, and the skin at the same time has often a slightly shining or varnished appearance. We have not unfrequently observed this symptom in pneumonia and bronchitis, and also in the latter stages of true croup. It is a very striking phenomenon, and one which portends great danger.

In chronic cases of all kinds in which the hematosic and nutritive functions are enfeebled, the face assumes a pallid and waxen hue, which is very characteristic. In the various digestive ailments it becomes icterode or sallow, and in affections of the liver more or less yellow. Lastly, in certain diseases and malformations of the heart or lungs, it becomes bluish or livid, constituting one of the most important signs of what is called morbus cœruleus, blue disease, or cyanosis.

In reading the countenance of a sick child, the practitioner should always notice the play of the nostrils, since this reveals, to a certain extent, the state of the lungs. In pneumonia, bronchitis, and pleurisy, the

movements of the alæ nasi become rapid and energetic, expressing, by the degree of their violence and extent, the amount of embarrassment under which the respiratory function is laboring.

The nostrils and nasal passages should always be examined also to ascertain the presence of mucous or purulent secretions, or of pseudo-membranous deposits, since these fluids or their inspissated products interfere more or less with the free passage of air through those canals.

Of the Sleep.—Much useful information as to the state of health of infants and children may be obtained from a careful consideration of the various phenomena connected with their sleep. Of this we are fully convinced from somewhat long and patient observation. We cannot ascertain, indeed, the nature of the disease under which the child may be laboring, but we can detect, with very great certainty, the existence of a deviation from health. We know of few more certain means of fixing the period at which any attack of illness may have begun, than by inquiring at what time the child began to have restless or broken sleep, or insomnia.

A perfectly healthy infant, within the month, who is suckled at an abundant and wholesome breast, will usually sleep twenty out of the twenty-four hours, waking to nurse every two or three hours during daylight, and twice or three times during the night. After the age of two or three months, the child is much more wakeful during the day, though it will still take a nap of two or three hours in the morning, and a shorter one in the afternoon, while it will sleep from early evening until the following morning, waking but once or twice to suck. Indeed, many perfectly healthy infants, of between three and six or seven months of age, sleep without waking from nine or ten o'clock in the evening until six the next morning. After the latter age the sleep is seldom so unbroken; the child begins to undergo the first considerable trial to its health, dentition, and it is rendered thereby more or less ailing and irritable, and consequently restless and troublesome at night.

Children who have passed through the epoch of dentition, and who are *perfectly well*, usually go to sleep soon after being put to bed, and never wake until the following morning. Not only so, but they sleep soundly and quietly, without being disturbed by slight sounds, and without tossing or turning much in their sleep.

In healthful sleep the whole appearance of the child, its expression of countenance, its attitude, and its breathing, all declare a most perfect and beautiful ease and tranquillity. Nothing can be more suggestive of the comfort and well-being that naturally attend upon health, than the perfect composure and graceful postures exhibited by a hearty child during profound sleep.

It needs, however, but a slight disturbance of the health of a child to break in upon its ordinarily calm and peaceful sleep, and to render this restless, fitful, interrupted by startings, cries, or dreams, or insufficient. The most trifling irritations, as the pressure of a tooth against the gum, the presence in the digestive canal of a little imperfectly digested food, or of one, two, or three lumbricoides, or the slightest fever from any cause,

are sufficient to produce this effect, and hence it is that the character of the sleep will often become to a watchful practitioner the first sign of disorder held out by nature.

The degree of disturbance of this function will vary with the nature and severity of the disturbing cause. When slight, the child will continue to sleep throughout the ordinary period, but the sleep will be somewhat uneasy. The countenance will be disturbed. There will be contractions of the brow, and momentary workings of the features, which express the perception of some unhealthful sensation. Often the child will toss and turn, and change its position more frequently than natural. Sometimes it will cry out, and appear distressed by some dream or painful sensation. When the cause of disturbance is more serious, the sleep is more broken, the child wakes often, and lies awake for a longer or shorter time, and it becomes very difficult to lull it to sleep again. Or it has painful dreams or nightmare, causing it to scream and struggle in sleep, and then to wake in the most violent affright. In severe instances it becomes almost sleepless. We have very often known teething children not to sleep more than half as much as in health, and to wear out, by the long continuance of this sleeplessness, the patience and even the health of their attendants. In some instances they will no longer sleep in the bed or crib, and the nurse is obliged to get up and walk with them, or soothe them by the movement of a rocking-chair or cradle. In other cases, the derangement of the health is shown by grinding of the teeth, and by the most violent tossing and tumbling about the bed. We have frequently seen a child lying with its head where its feet should be, or across the bed, and with all the coverings thrown off, in spite of the most careful arrangement of the bedclothes.

These various disturbances are therefore signs of some alteration in the health of the child. They do not lead to an appreciation of the precise nature of that alteration, but they are invaluable as affording indications of the existence of some morbid condition of the economy. Very often, as above stated, they are the first symptoms of the approach of some more or less serious sickness, and as such will often enable us to determine, with much precision, the moment of onset of the attack.

The Cry.—Crying is one of the modes of expression of the child. Indeed, this, with the expression of the face, are, according to M. Billard, the only means of expression with which nature has endowed the young infant. This is, however, scarcely correct, since we may also class amongst its means of expression the various spontaneous muscular movements indicative of uneasiness, or of pain, or pleasure; the manner in which it drinks or sucks, whether eagerly, and with appetite, or languidly, or carelessly, or not at all; the enjoyment it receives from pleasant sounds; and the evident delight it takes in regarding the light. Nevertheless, the cry and the expression of the countenance are the two means on which the physician must chiefly rely for early information of the occurrence of sickness in the young infant. These are the trusty sentinels of nature. By them she first gives notice of the approach of danger, and then measures the amount of mischief that may have been done.

The cry which a child utters during sleep, or even when awake, and when nothing has been done to excite or disturb it, is always indicative of some uneasiness. If the cry be caused by pain, or by any considerable disturbance, it will be accompanied by certain contractions of the features and movements of the body and limbs, which will still more strikingly show that the pain, or other exciting cause, is of a serious nature. Violent and obstinate crying is almost always caused by severe pain,—such as the pain of earache. Indeed, obstinate and long-continued crying, lasting for hours, is rarely met with except from one of two causes, earache or hunger. The cry of earache is often incessant and unappeasable, the pain being generally constant and not paroxysmal, as are most other pains. It is to be silenced only by the application of remedies to the ear, or by the internal administration of opiates. We have known an infant, three months old, to scream with earache for two days and nights, with only short lulls of a few hours when brought under the influence of large doses of laudanum. As soon as the ear began to discharge, the cry ceased. We are constantly called to see infants and young children who have been crying most violently for hours, and who are thought to have colic, or to have hurt themselves, but who are, in fact, tortured with that most violent of all pains, earache. We have met with few instances in which such severe and *constant* crying has depended on other causes; for, though children scream violently and obstinately from hunger and thirst, they may always be quieted by the supply of either want, whilst in earache the infant generally refuses the breast, or takes it only for a few instants, and then lets go to resume his almost automatic scream.

To show the difficulty of sometimes determining the cause of crying, we may mention that one of us once attended a nursing baby through a severe attack of bronchitis. Just as the child was recovering from the attack it began to cry without any apparent cause. The cry was so constant, violent, and severe, that, feeling certain from the symptoms that it could not be from any dangerous cause, we concluded, by the method of exclusion, though, to be sure, there was neither tenderness of the ear to touch, redness or swelling of the meatus, nor discharge, that it must be an earache. Hot applications and opiates applied to the ears did no good, and the constant scream set the mother half wild. At length, the grandmother came in and said she thought the child wanted the breast. Sure enough, there was the trouble; the child lay at the breast almost continuously for twenty-four hours, and earache, crying and all, vanished.

In not a few instances we have thus known infants to cry very often in the day and night, and sometimes very obstinately, too, from hunger. In such cases the child is thought to have colic, and as it is not unfrequently costive, it is dosed with cathartics, carminatives, and opiates; or it is being brought up partially or wholly upon artificial diet, and, as a consequence, has some disorder of the bowels, which is thought to require other kinds of medicaments for its relief. When the stools are natural in appearance, or merely costive, and when the child does not labor under flatulence, it is easy, by careful questioning of the mother, to discern whether she has milk enough, and by examination of the size and weight of the child, to judge

whether growth and nutrition go on in their proper ratio; and if it be found that the mother is a poor nurse, and that the development of the child is slow and imperfect, we should at once direct an additional supply of nourishment, and the suspension of all mere drugs. We have often been surprised and delighted to find how soon, under the new treatment, the child becomes placid and comfortable, how well and how long it sleeps, and at what a rapid rate it develops its form and size. So, when the circumstances above referred to coincide with a somewhat disordered state of the bowels, we should first choose for the child the diet most appropriate to its age and state of health, and then, if after inquiry it appears that the whole quantity taken in the twenty-four hours is below the proper standard, the amount allowed must be augmented.

The crying occasioned by pain in the head, by the pain which accompanies pneumonia or pleurisy, or that which is attendant upon abdominal inflammations, is never scarcely constant, though it may be violent while it lasts. Pain in the head usually causes a sudden and sharp cry or shriek, which is over as soon almost as heard, and which has been called the hydrencephalic cry. The pain of pneumonia, which, it should be remarked, is not unfrequently absent, or so slight as not to be noticed, commonly occasions crying only during coughing, and for a short time after, and is accompanied by distortion or grimacing of the features. In pleurisy, again, the cry is also heard generally at the moment of coughing, but it is produced also by the act of moving the child, and by pressure on the affected side. It is commonly much louder, shriller, and indicative of greater suffering than in pneumonia, and in some cases that we have seen, has been very frequent and difficult to appease.

The cry of intestinal pain may almost always be recognized by the fact that it takes place just before or after a stool, that it is accompanied by wriggling and twisting movements of the trunk, and especially of the pelvis, or, in very young infants, by its coincidence with more or less flatulence, which is revealed by a tympanitic condition of the abdomen, and by frequent regurgitations of gas.

Children not unfrequently cry much and very obstinately from mere fretfulness and general distress or malaise. This kind of crying may be recognized by its peculiar tone, which is short, sharp, and irritable. It is a fret rather than a scream; it is occasioned by the least disturbance offered to the child, by the attempt to move it, to dress it, to attend to any of its wants, even to look at or notice it; it is moreover possible, generally, to still such a cry by soothing treatment, or by the endeavor to amuse the little thing with toys.

Lastly, a child will sometimes attempt to cry, but is unable to utter any or only a very faint sound. This depends commonly upon some laryngeal impediment, but may be also the result of pure exhaustion; there is not sufficient strength to sound a cry.

The cry of the young child has been divided by M. Billard into the cry proper and the return; and inasmuch as these two portions of the cry are differently affected in different diseased conditions, it is important that we

should be aware of their existence, and of the effects produced upon their manifestations by disease.

The cry proper is produced during the act of expiration, while the return occurs during inspiration. The cry proper is sonorous and prolonged, the return is much shorter and sharper. The return is feeble in young infants, and becomes stronger as they advance in age. In different states of health, the mode of crying will vary to a considerable extent. The cry may exist alone, or in combination with the return; or again the return only may be heard, whilst the cry is from some cause suppressed. The distinction between the two portions of the cry may always be distinctly perceived in a child who is crying violently from any recent cause, whether ill-temper, fright, or pain, unless one or other has been suppressed by some morbid condition which interferes with the perfect performance of the vocal function. After a time, however, when the infant has become fatigued with its efforts, the cry proper ceases in part, and we have only the return, which is heard from time to time between the sobs. According to M. Valleix, it is the return which becomes enfeebled and disappears first, whenever one portion only of the cry is heard. Towards the fatal termination of all diseases, the return ceases more or less completely, and the cry assumes a peculiar moaning or murmuring character, which must be familiar to all who have been much in the sick-rooms of children.

With a remark upon the condition of the lachrymal secretion in disease, we shall conclude this division of the subject.

The infant does not begin to secrete tears until towards the third or fourth month, and of course this function can furnish no sign previous to that time. After that period, however, the suppression of this secretion becomes, according to M. Trousseau, a valuable aid to prognosis, as this suppression occurs generally in all dangerous acute diseases. The occurrence of this symptom in any acute case should be looked upon, therefore, as one of dangerous augury, while the continuance of the secretion, or its reappearance after it has been suppressed, is, on the contrary, a highly favorable omen.

General Appearance of the Child; Development; Embonpoint; State of the Skin, Etc.—While occupied in hearing the account of the sickness given by the mother or attendants, and even while asking questions in regard to the present state of the patient, the physician may learn a great deal that is useful by an attentive observation of the general appearance of the child as it lies before him. He should study its size and development, its state of embonpoint or emaciation, its decubitus and gestures, the color, temperature, and dryness or humidity of the skin, and the presence of eruptions or swellings of any kind. Having remarked these various matters during the early part of the examination, he should proceed to inspect carefully the whole external surface by touch and sight, in order to acquire precise and accurate information upon these points.

A child who has been healthy from its birth ought to have attained a certain average size and development at a certain age. If it be much below the average size, if at three months it look like a new-born child, or at a year old like one of six months, it is very clear that something has

acted to determine such slow and insufficient growth, and it becomes the business of the practitioner to discover what the impeding cause has been. Not only ought a child to have a certain size and stature, but it should also be possessed of a certain degree of embonpoint. A perfectly healthy young child, one under four years of age, usually presents a much greater fulness and rotundity of the trunk and limbs than does the adult. Its tissues are firm and solid, its surface of a cool and pleasant temperature, its coloration of a clear and exquisite white, finely tempered with a faint rosy tint in a warm atmosphere, or slightly marbled with light bluish spots in a colder air. Few marks more certainly indicate a healthful temper of the constitution than the clear and exquisitely tinted pink color of the palmar and plantar surfaces of the hands and feet of a young child. Nothing, indeed, can be more beautiful or perfect in shape or contour than the figure of a fine hearty young child; nothing more pleasing to the eye than its delicate but vivid coloring; and nothing more expressive of the fulness of health and vitality than its whole appearance.

When, therefore, instead of these marks of a pure and active state of the health, we meet with stunted growth, emaciation, soft and flaccid tissues, sallow and dingy tint of the cutaneous surface, pallid or bluish feet and hands, weak and listless movements,—how easy the conclusion that some jarring agent is at work to hinder and obstruct the machinery of life.

In acute diseases emaciation takes place rapidly, but the tissues still retain some degree of elasticity and firmness. In chronic diseases the emaciation is of course slower, but it is more complete, so that, in some instances, the frame seems to consist merely of the bones wrapped round with a dark and unhealthy skin. The tissues beneath the skin, the cellular, adipose, and muscular, are in great part absorbed, and the skin falls into wrinkles and irregularities on the least movement of the child. In some cases of disease, and particularly in those of the abdomen, the derm loses almost entirely its elasticity, so that when pinched into a fold by the fingers, it retains for some time the form that has been given to it.

The *decubitus* and gestures of the child ought to be noticed. Healthy children are, when awake, almost always in motion. Those who have attained the habit of walking are tempted to active exercise by their various plays and amusements. Infants, though they sleep much more than older children, are also, when awake, constantly moving their limbs; they are seldom still. When asleep they rest quietly and comfortably, generally upon the side, though often upon the back. How different when the child is laboring under disease of any kind. The disposition to movement is gone; the older child insists upon lying on the lap, or in the cradle or bed, and the infant is to be soothed of its crying and fretfulness only by rocking and fondling in the arms. Instead of the free and spontaneous movements of health, we now see only the sudden, impatient, and causeless tossing on the bed or lap, or the constant changing of position, with fretting or complaining, which constitute the *agitation* of sickness; or else the slow, languid, and hesitating movements of weakness or prostration; or, lastly, the stillness and immobility of stupor or of coma.

There is nothing peculiar about the decubitus of pneumonia or bronchitis except when there is severe dyspnœa, in which case the child, if old enough to select its own position, lies high upon the pillows, while those who are younger evidently prefer to rest on the lap of the nurse, with the trunk and head supported in her arms, and express by crying and agitation their discomfort and uneasiness when placed in the recumbent position on the lap, or in the cradle or crib. We have seen several young children affected with severe bronchitis or pneumonia, who have preferred to any other position that of being held in the nurse's arms, with the front of the chest placed against her chest, and the head hanging over her shoulder. When the dyspnœa is so severe as to produce, by slow degrees, a partial asphyxia and consequent dulness of perceptivity, the child becomes soporous or comatose, and lies usually upon the back, as in diseases attended with prostration of strength.

In pleurisy and peritonitis the decubitus is usually dorsal, and the child dislikes to be moved or nursed often crying violently when touched or disturbed.

In intestinal inflammations the young patient is usually excessively restless at first, and very fretful, unless the attack be grave and threatening, when it often lies still for a time from the prostration of strength which attends violent attacks, but becomes restless, turns and twists in the bed, cries out, and agitates the lower extremities at each evacuation of the bowels.

In the early period of cerebral inflammation there is generally excessive restlessness, and great irritability of all the senses and temper, but as the case goes on, and passes into the stage of coma, the child becomes still and quiet, assuming very often the decubitus called by the French "*en chien de fusil;*" that is to say, on the side, with the inferior extremities strongly flexed, and the arms drawn close to, or crossed over the thorax. This position is especially characteristic of the latter stages of tubercular meningitis.

Extreme restlessness, constant tossing upon the bed, or incessant changing from the arms to the bed, or from bed to bed, is a very bad sign. We have observed it in several different affections; especially in obstinate pneumonia, in long-continued intestinal disorders, and in the secondary inflammations of measles and scarlet fever.

Amongst the gestures most deserving of attention are the sudden starts, attended with cries, which indicate the occurrence of some painful sensation, as that of colic, of stitch in the side in pneumonia and pleurisy, and sometimes of shooting pain in the head. The frequent carrying of the hand to the head, or to the ear, ought not to pass unnoticed, as this is often indicative of headache or earache. So also of the constant application of the hand to the mouth, or the introduction of the fingers into that cavity, which often occurs when the child is suffering the odontalgic pain of dentition. Nor should the physician ever neglect to observe any peculiar and especially any automatic movements of the limbs, and particularly of the fingers or toes. Nature often heralds the approach of a convulsive seizure by certain peculiar muscular movements. The thumbs are drawn into

the palms of the hand, and the fingers clasped over them; or the toes are strongly bent towards the sole of the foot, or rigidly extended; sometimes the fingers are for an instant convulsively extended upon the hand and drawn widely apart from each other; or lastly, the muscular movements, instead of being easy, steady, and natural, are badly co-ordinated; they are irregular, uncertain, and tremulous. This latter character, tremulousness and uncertainty, we have often noticed.

The occurrence of paralysis will often be unperceived for some length of time by an inattentive observer. It is to be discovered by the failure of the child to move one limb, whilst the others are more or less agitated, or by taking hold of the limb, and comparing the total want of resistance in it, with a certain stiffness and opposition to movement almost invariably present in the healthful condition.

The state of the cutaneous surface is always important, and ought to be carefully and systematically examined. The points most requiring to be noted are its temperature, dryness or moisture, coloration, and the presence of eruptions or swellings. By the temperature, and dryness or moisture, taken in connection with the rate of circulation, we must judge as to the existence of fever. The inferences to be drawn from the condition of the surface in these respects are the same in children as in adults, and they need therefore no particular consideration in this place.

The coloration of the skin, on the contrary, owing to its great susceptibility to change in certain affections, becomes, in the diseases of early life, of very considerable importance in diagnosis, and deserves therefore some special remarks.

The physician should be aware, in the first place, that the color of a newborn infant is some shade of red, varying from a deep brick-red tint, to one of a much lighter hue. The red appearance fades aways usually in about four or five days, and leaves the surface of a yellowish-white, or in some instances of a decidedly yellow color. The yellow color is sometimes so marked as to impose very readily upon an inexperienced person the idea that it must depend on an affection of the liver, or, in other words, that it constitutes a true jaundice. In a very large majority of cases, however, the conjunctiva retains its natural white tint, the digestive functions go on with perfect regularity, there is no fever, and indeed no marks of decided disorder of the health, so that the icterode hue cannot depend, under these circumstances, on any serious lesion of the liver or its appendages, and it is manifestly wrong to regard the case as one of disease, or as requiring any treatment.

Besides the yellow color just described, the cutaneous surface in children, and particularly in those under three or four years of age, very often exhibits different shades of a bluish color, which need some attention. When the whole skin assumes a decidedly blue tint, the case is one of cyanosis or morbus cœruleus, depending on some malformation or disease of the heart or lungs. In severe cases of this kind, the blue color deepens into a purple or even blackish hue. If this appearance last more than a very few days, there can be little doubt that it depends on some malformation or disease of the heart.

It is quite common to observe in new-born and very young infants, a bluish tint of the hands and feet, and of the parts around the mouth, whilst the rest of the body is pale. These appearances depend usually on some obstruction to the pulmonary circulation, as that caused by atelectasis pulmonum, bronchitis, or pneumonia, and they increase, diminish, or disappear, according to the course of the causative malady. In older children, the blue color of the skin is rarely of any considerable intensity, unless the condition has existed from birth, or soon after; but it is not at all uncommon to meet with faint, but quite perceptible shades of that color, depending on the asphyxiated state which occurs in croup, capillary bronchitis, pneumonia, and sometimes in laryngismus stridulus. It is hardly necessary to add, that a very slight blueness of the fingers and toes is sometimes observed in the cold stage of intermittents.

Occasionally we meet with an excessive harshness, aridity, and scurviness, or with a wrinkled appearance of the skin, especially upon the abdomen and thorax. This symptom, when strongly marked, is usually attended with enlargement of the superficial veins of that part, and is then very striking even to a careless observer. It accompanies very generally the abdominal tuberculosis of children, and should not pass unobserved. Though generally indicative of tubercular peritonitis, or of tuberculosis of the mesenteric glands, it is not always so, since in a case that occurred to one of us, and in which it was perfectly well marked, a post-mortem examination showed it to have been caused by a chronic peritonitis, resulting from inflammation and suppuration of the mesenteric glands entirely independent of tubercular disease. The peritonitis had given rise to extensive adhesions amongst the intestines, and the pus had found its way by a tortuous sinus between the intestines into the vagina, through which it was discharged externally.

There is one other alteration in the color of the skin which is deserving of notice in a practical point of view. It is an excessive pallor, occurring sometimes in diseases which obstruct the respiratory function. We have been most struck with it in the capillary bronchitis, or suffocative catarrh, of young children, and in membranous croup. The whole surface assumes a dead white hue, which seems to depend on a total want of blood in the cutaneous capillaries. The nose is white, the ears become white and diaphanous, and the only relief the eye meets with in gazing upon what seems an almost alabaster countenance, is the still pink or bluish lips, the dark eyebrows and eyes, and perhaps a somewhat leaden tint of the circumference of the mouth and of the forehead. In strongly marked cases the whole surface, even of the fingers and toes, exhibits this white or blanched appearance. When this condition has lasted for several hours, or a day or two, the hands and feet sometimes assume a bluish look, which may last until death occurs, or until the attack approaches a favorable termination. This condition of the surface, when occurring in cases attended with obstruction of the respiratory function, has always appeared to us an indication of imminent danger to the patient; and, indeed, when it lasts more than one or two days, it has very generally proved the harbinger of death.

The clinical examination of the cutaneous surface cannot be considered complete until it has been made with reference to the presence of eruptions, of swellings from œdema, of inflammation, tumors, and, lastly, of diseases of the joints. The inquiry in regard to the presence of eruptions is a very important one, from the fact that children are particularly liable to attacks of the exanthematous and other eruptive affections. Many attacks of sickness, beginning with violent fever and other serious symptoms, which would otherwise remain entirely obscure or unexplained, until a much later period from the onset, may be accounted for at an early period by a minute examination of the skin. So, in the latter stages of long and debilitating maladies, in the disorders which follow scarlatina, and in cardiac and hepatic diseases, a proper inspection of the surface will reveal œdematous effusions that might, if this search were neglected or carelessly prosecuted, remain undiscovered. The same remarks will apply to inflammations of the auricular cavities, to the swelling of the joints produced by rheumatism, and to some obscure suppurative inflammations in the limbs of children. A most instructive example of the necessity of this close examination, occurred some years ago in the practice of one of us. A healthy male infant, five weeks of age, was seized suddenly with most violent fever, the reaction being not unlike in character that of acute rheumatic fever. The only visible disturbance of the health, to explain this violent attack, was a certain amount of digestive derangement, and for this the patient was treated. After three days of most severe illness, with strong tendency to convulsion, and with some stiffening of the lower jaw, we were asked to look at the right thigh. It was largely swelled, especially in its lower half; it was hard to the touch, and the skin over the outside of the limb, just above the knee, had assumed an inflammatory redness. It was clear that the child had been attacked with an acute inflammation of the deep tissues of the thigh, and that this was now approaching the surface and becoming visible. Careful inquiry now brought to light the fact that the baby, all through the sickness, had cried severely, as though in sharp pain, whenever it was moved, and especially when its napkins were changed. The distress observed when the napkins were being changed, had been ascribed to some smarting from the urine. Had the surface of the child been more carefully examined at an early period, the swelling of the thigh, and the pain on motion, might, no doubt, have been detected then, and the intense febrile reaction, with the nervous symptoms, which were thought too great for simple functional disorder of the digestive functions, would at once have been explained.

It is clear, therefore, that in infants and in children under six or even eight years of age, the physician must depend, in great measure for information as to the nature of the case, on his own unassisted explorations; and, knowing this, he should leave nothing neglected that may aid him to gauge with accuracy the state of health of the individual before him. He should cultivate a *habit* of minute, systematic, and patient investigation, since by accustoming himself to such a method in his daily walks, he will assuredly attain, in the end, a tact and sagacity that will not often be at fault.

The Pulse.—The pulse of the child, in order to be judged of to any real advantage, must be examined during the state of quiet, and, if possible, it should be felt whilst the child is either asleep or dozing. During the waking state a young infant is in such constant motion, that it is very difficult to perceive the pulsations of the radial artery, and impossible to judge of their force or volume, in consequence of the rising and falling of the flexor tendons of the forearm, and because, also, of the natural softness and delicacy of the pulse at that age. In older children, the moral disturbance occasioned by the visit of the physician in most instances, and the irritability and nervousness accompanying the sickness, will either cause the patient to resist the attempt to touch the arm, or else produce so great an effect upon the rate and force of the circulation, as to render very uncertain and unsatisfactory any conclusions to be drawn from the examination. If possible, therefore, the circulation should be examined during sleep. If this be impracticable, the child ought, when still nursing, to be put to the breast, or, when weaned, it ought to be quieted by soothing treatment, by toys, or by the promise of a toy.

It is essential that we should know what is the average of the healthy pulsations of the child, in order to obtain a standard of comparison by which to judge of any departure from that average in disease. Observers have varied not a little in the results at which they have arrived by their examinations upon this point. By selecting those, however, which appear to have been made with the greatest care, and under the most favorable circumstances, we shall, doubtless, obtain an average entirely worthy of confidence. It will be necessary, also, to obtain averages for different periods of childhood, since the rate of the circulation varies to a very great extent at different ages. We shall, therefore, give the rate of the circulation for new-born children (one to ten days old), for the period from four months to six years, for that from six to nine years, and for those from nine to twelve, and from twelve to fifteen years of age.

The average rate of the circulation in very young infants, is from one hundred and one to one hundred and two in the minute, the former being the result obtained by M. Billard in children from one to ten days old, as nearly as it can be gained from his statements, and the latter the one obtained by M. Roger, in infants from one to seven days old (*De la Température chez les Enfants*, Paris, 1844). The physician ought, however, to be aware of the fact that, though the above is the average rate of the circulation at the age mentioned, the pulse may range very much above or below that average, without necessarily indicating a morbid state of the health. Thus, though the average frequency in forty children, from one to ten days old, observed by M. Billard, was one hundred and one, it was less than eighty in eighteen, whilst in fourteen it was between one hundred and one hundred and twenty-five, and in six between one hundred and thirty and one hundred and eighty. All these children, he assures us, presented every mark of good health.

The average frequency of the pulse during the first year may be stated at about one hundred and fifteen; at least such is the result obtained by us from an examination of seven observations by M. Roger of children

from four to nine months old. This result, it will be observed, shows that the pulse is not so frequent during the first few days after birth, as it becomes at a somewhat later period, which, moreover, agrees with a previous statement to the same effect made by M. Valleix. This latter author is of the opinion that at seven months of age the pulse is much more frequent than some days after birth, and that it afterwards falls gradually as the child advances in years.

We are not acquainted with any observations upon the rate of the circulation during the second year of life, except those of M. Trousseau, who, according to M. Bouchut (*Manuel Prat. des Mal. des Nouv.-Nés*, p. 133, Paris, 1845), gives as the average between one year and twenty-one months, one hundred and eighteen.

M. Becquerel (*Traité Théorique et Prat. des Mal. des Enfants*, Paris, 1842), gives us the result of his observations upon thirty children, between two and six years of age, during sleep and in the waking state. During sleep the average was seventy-six; in the waking state it was ninety-two.

Between six and nine years of age, the same observer found the average during sleep to be from seventy-three to seventy-four, whilst in the waking state it was ninety. Between nine and twelve years, the average was, during sleep, seventy-two, in the waking state, eighty. Between twelve and fifteen years the rate was seventy whilst the children were asleep, and seventy-two when awake. Roger gives seventy-seven as the average between six and fourteen years.

One very striking fact attracts our attention in the above statements: the much greater difference between the rate of the circulation during sleep and during the waking state, in very young children, than in those who are somewhat older. Thus, whilst there is a difference of seventeen pulsations in the minute, in the rate of the circulation during sleep and in those who are awake, between the ages of two and six years, the difference under the two conditions mentioned, amounts to only two pulsations in the minute in children that have reached the age of between twelve and fifteen years.

The circulation is somewhat more rapid in girls than boys. This difference should be borne in mind, but as it amounts to only about five beats in the minute, it is insufficient to be of any very decided value in diagnosis or prognosis.

After these specifications as to the rate of the circulation in children, we shall pass on to some general remarks upon the method of the examination of the pulse, and upon some other of its important characters.

M. Bouchut (*loc. cit.*, p. 129) remarks that in infants at the breast "the palpation of the pulse is almost impossible. It may be counted, but its force, feebleness, size and hardness, can scarcely be appreciated; the intermittent character is the only phenomenon upon which no doubt need rest; it is, moreover, the only one of any value." These opinions of M. Bouchut, though true in some degree, are much too strongly stated, for we are quite sure that it is very easy to detect great differences in the force, size, and tension of the pulse of the same child in health and in disease, and of

different children laboring under different diseased conditions. These differences can be detected by careful observation from a very early age, and after two months may be readily recognized, when the variation from the state of health is at all considerable.

The intermittence of the pulse above alluded to, should rather be expressed by the word *irregularity*, since the pulse is not properly *intermittent*, but merely *irregular* in its rhythm. This is quite a common feature in the pulse of children, and, be it noted, is much more frequently met with during sleep than in the waking state. M. Becquerel met with irregularity of the pulse in twenty-four of one hundred and fifty children examined during the waking state, and in fifty-five of one hundred and fifty during sleep. It is clear, therefore, that mere irregularity of the circulation, independently of other symptoms, is not a sign of disease, since it was present in one-sixth of those awake, and in a little more than a third of those asleep. It should be observed, too, that the greatest irregularity exists when the pulse is lowest (in sleep). The chief practical bearing of this fact is that we should be careful not to lay too much stress upon the slowness and irregularity of the pulse, as signs of tubercular disease of the cerebral meninges, unless they are observed during the waking state, and in connection with other symptoms; particularly with vomiting, constipation, and severe headache.

Another very important characteristic of the circulation of the child, is its extreme irritability, which causes its rate to vary to an extraordinary degree, even in perfect health. This is the more marked in proportion as the child is younger. The slightest disturbance, whether moral or physical, will cause the pulse to rise in a young child from one hundred or one hundred and fifteen, to one hundred and twenty, one hundred and thirty, or even one hundred and fifty. From this circumstance may be drawn the inference also, that the pulse should always be examined, as before stated, during sleep, or during profound quiet.

There is still another reason which makes it necessary to touch the pulse during sleep or profound quiet. This is, that when the child is agitated, it becomes literally impossible, in consequence of the contractions of the flexor tendons of the arm, and of the movements of pronation and supination, to judge with accuracy the various qualities of the arterial action.

Examination of the Heart.—The examination of the heart by auscultation and percussion ought, and, to be of essential aid in diagnosis, must be performed while the child is still and quiet. It is best made during sleep, especially in infants; when this is impossible, it can be performed with great advantage during the state of quiet that follows nursing, or during that which may often be procured by soothing management, or by taking advantage of the fondness that infants show for a strong light, the view of which will generally suffice to occupy and keep them still.

The sounds of the heart present the same general characters in the child as in the adult. They are, of course, more feeble and more rapid; conditions which make it difficult, in the young infant, to perceive and appreciate any minute change from the healthful sounds. After the age of one and two years, however, when the circulation has become slower and more

steady, the signs yielded by the physical examination of the heart become much more valuable and positive; so much so, indeed, as to yield results almost as important as in the adult. The first sound is almost always duller than the second. They succeed each other commonly with perfect regularity, and have the same interval between each in the same child. The cardiac sounds are readily heard by placing the ear over the præcordial region. The extent of surface over which they may be heard will depend on several conditions: particularly the state of quiet or agitation of the child, the presence or absence of fever, the state of the lung as to its consistence (constituting it a better or a worse conducting medium of sounds), and the condition of the heart itself as to health or disease.

In a healthy child, who is undisturbed by any cause of irritation, and particularly in one sleeping, the sounds are distinctly audible over the whole præcordial region and under the left clavicle. In many subjects they can be heard over the whole front of the thorax, but become, of course, feebler in proportion as we recede from the præcordial region. Usually they are heard quite as distinctly under the right clavicle as over the nipple of that side, in consequence, no doubt, of their transmission in an upward direction by the aorta. They are never heard over the posterior walls of the chest in children in perfect health, and whose circulation is entirely undisturbed. In those who are awake and agitated, and in those who have been making severe muscular exertions, the cardiac sounds are very loudly audible over the whole front of the thorax, and even through to the back of the chest.

When the lungs are indurated by inflammation, as in pneumonia, they transmit with great distinctness, from having become better conducting media, the cardiac sounds to the back. This circumstance sometimes becomes a valuable aid in the diagnosis of pneumonia. We have been enabled to satisfy ourselves of the existence of pneumonia in the lower lobe of the right lung, in a doubtful case, from the fact that the sounds of the heart were much more clear and distinct over the right inferior, than over the left inferior dorsal region.

The præcordial region is decidedly less sonorous on percussion than the parts of the thorax directly over the lungs. This diminution of sound is distinct enough to be evident to any ordinary ear, but it rarely amounts to absolute flatness. The region exhibiting this dulness of sound is the same in position as in the older person. It occupies the space corresponding to the cartilages of the fifth, sixth, and seventh ribs, and is situated, therefore, between the left nipple and the left edge of the sternum. Its measurements, as given by MM. Rilliet and Barthez, are one and a half to three inches in a transverse, by one and a half to two and a half in a vertical direction. The region of dulness is described by those observers as being represented by a circle or ellipse, the transverse diameter of which extends from the nipple to the sternum, or more rarely, towards the xiphoid cartilage. In children over six years old, the nipple sometimes lies above the middle line of this space.

Thermometric Observations in Children.—As an indication of the intensity and character of the disease in febrile attacks, we have seen that

the frequency of the pulse is little to be depended on. Dr. Forster (*Jour. f. Kind.*, July and August, 1862, in *New Syd. Soc. Year-Book*, 1862, p. 413), who has made an extensive series of observations upon this subject asserts that variations in the temperature of the body offer far more certain indications. The instrument used was a Reaumur's thermometer, eight and a half inches long, in which slight variations are easily appreciable. The bulb was placed in the axilla.

The results given are those of observations upon healthy children, during the first few days of life.

A constant lowering of the temperature of the body takes place after birth, which reaches its maximum, 28.97° R., on an average within the first two hours after birth.

Hours after Birth.	Average Temp. (R.)	Minimum Temp. (R.)
¼— 2,	28.97	28.2
2— 6,	29.12	28.1
6—10,	29.49	28.7
10—15,	29 53	29 0
15—20,	29 31	28 8
20—25,	30.04	29.7
25—30,	29.9	29.7
30—36,	30 07	29.7
36—42,	30.04	29.4
42—48,	29.86	29.3

A subsequent elevation always occurs. The average time at which the highest temperature was observed, was from thirty to thirty-six hours after birth, at which time the average was 30.07° R.: maximum 30.4° R., minimum 29.7° R.

This elevation was noticed equally when the infant had and had not taken food.

During the first nine days of life, the temperature was observed as follows:

Days.	Maximum (R.)	Minimum (R.)	Average (R.)	No. of Observations.
1 —1½,	30.4	29.7	30 01	22
1½—2,	30.5	29.3	29.93	16
2 —2½,	30.4	29.3	29.87	28
2½—3,	30.3	29 2	29.74	16
3 —3½,	30.3	20.3	29.76	27
3½—4,	30.2	29.0	29.68	17
4 —4½,	30.4	29.2	29 68	25
4½—5,	30.3	29.2	29 72	18
5 —5½,	30.4	29.2	29.82	23
5½—6,	30.5	29.3	29 81	16
6 —6½,	30.6	29.4	29.83	23
6½—7,	30.3	29.1	29 75	17
7 —7½,	30.4	29.3	29.82	22
7½—8,	30.4	29.0	29.72	11
8 —8½,	30.0	29.4	29.70	8
8½—9,	29.9	29.6	29.75	2

We thus see that from the thirtieth to the thirty-sixth hour after birth the highest temperature is observed. Then a fall takes place, which

reaches its maximum at four days after birth (average maximum 29.68° R.). Again, between the fifth and eighth days, a new elevation of temperature occurs; but this new elevation is less in degree than that previously noted. The average maximum was 29.83° R. Some differences were found in the results, according as the children were large and heavy, or the reverse. Large and well-developed children had a slightly higher temperature than those less robust.

Thus the average temperature in the early part of the day was, in children weighing eight pounds and upwards, 29.84° R.; but, in children weighing less than this, the average was 29.65° R. The evening observations, again, gave an average for the heavy children of 29.94°; for the others, of 29.77° R. Respecting the temperature at different times of the day, observations showed that, from the second to the ninth day, there was an average elevation of temperature, from morning to evening, amounting to .11° R.; the average morning temperature being 29.75° R.; the average evening temperature, 29.86° R.

This interesting subject has been further examined in regard to older children, by Mr. Finlayson (*Proc. of Manchester Med. Soc.*, in *Brit. Med. Jour.*, Jan. 16, 1869, p. 59).

His results are based on two hundred and eighty-one observations on eighteen different children, of ages varying from twenty months to ten and a half years, and are as follows:

1. The daily range of temperature is greater in the healthy child than that recorded in healthy adults—amounting to 2° F.
2. There is invariably a fall of temperature in the evening, amounting to 1, 2, or 3 degrees.
3. This fall may take place before sleep begins.
4. The greatest fall is usually between 7 and 9 P.M. (at least under the conditions of life in hospital).
5. The minimum temperature is usually observed at or before 2 A.M.
6. Between 2 and 4 A.M. the temperature usually begins to rise, such rise being independent of food being taken.
7. The fluctuations between breakfast and tea-time, are usually trifling in amount.
8. There seems to be no very definite relationship between the frequency of the pulse and respirations, and the amount of temperature; the former being subject to many disturbing influences.

Respiration; its Rate and General Characters.—The respiration, like the pulse, to be examined with any advantage to the explorer, must be investigated whilst the child is still and quiet. In the young infant it should be done during sleep, as it is only then that we can find the breathing uninfluenced by disturbing causes other than those connected with deranged health. In the older child, the play of whose functions is more steady and regular, and less readily jarred by trivial causes, this part of the clinical exploration may be made during the waking state; but, still, it must be done whilst the patient is quiet and tranquil, else the results obtained will necessarily be less certain and reliable than under the opposite state of things.

The respiration ought always to be counted by the watch, if possible, especially by the young practitioner. This is the only mode in which a perfectly accurate idea of the frequency of the respiration is to be obtained. It sometimes happens that a greatly increased rate of the breathing will pass unnoticed by the physician, from the fact that it continues to be regular and without effort. We have known children to breathe eighty times in the minute, without presenting any appearance of labor or effort in the act; without cough, and without the least wheezing or sound to be heard at a short distance from the patient. Under these circumstances, the great rapidity of the respiration might very well pass unnoticed, especially by inexperienced practitioners; and, be it remarked, this would be particularly apt to happen were the attention of the physician addressed to some other part of the economy than the thorax, as the seat of the sickness. For instance, in latent pneumonia, when this simulates meningitis, or when it is conjoined with gastro-intestinal symptoms, the failure to note a greatly increased rate of the breathing might very well occur. In many cases of secondary pneumonia, it might also take place. In children, who have been long sick with diseases that debilitate and impoverish the health, a sudden aggravation of the symptoms dependent on collapse of the lung, might be misunderstood and falsely explained, for the want of this precaution. It is therefore a good and useful rule, for the young practitioner always to count the respiration, when he has to do with a case presenting the least obscurity of diagnosis, since this simple habit may guide him to the real seat of disease, which else he might mistake.

The rate of the respiration in children is very different at different ages, a circumstance that should always be recollected in the examination of their diseases. The average frequency of the breathing in new-born children and during the first week of life, is thirty-nine, according to M. Roger. It may rise, however, upon very slight disturbances, to fifty, sixty, or even eighty, while it is not at all unusual to find it at twenty-five or thirty in perfectly healthy infants during sleep. Between the ages of two months and two years the average is about thirty-five. Between two and six years, the average is eighteen during sleep and twenty-three during the waking state; from six to twelve years, the average during sleep is eighteen, and in the waking state twenty-three; from twelve to fifteen years, it is eighteen in the former, and in the latter twenty. It will be observed, therefore, that after the age of two years, the rate of the respiration is nearly the same throughout the remainder of the period of childhood; it changes so little, indeed, that the same average will answer for all practical purposes throughout that period.

The other characters of the respiration require some attention on the part of the practitioner. In the first place, the diaphragm plays a more important part in the process in the child than in the adult. In the young infant, indeed, the function is carried on almost wholly by the action of that muscle, so that the respiration is correctly described by the technical term of abdominal. The walls of the chest are almost motionless. On this account the rate and characters of the breathing can be best studied in young children, by examining the abdomen, the movements of which

being strong and marked, are much more easily seized by the eye than are those of the thorax.

During perfect quiescence, and especially during sleep, the breathing of a young child is soft, regular, though less so than in the adult, and perfectly noiseless; it is necessary to place the ear close to the face or chest of the child, and to listen attentively, in order to hear it. It the young child, and especially the young infant, the breathing is, in the waking state, very different from that of the adult. It is short, irregular, uneven, and marked by occasional pauses, followed by a hurry and precipitation of the movements. These peculiarities in the respiration of the infant appear to depend on the weakness and imperfect action of the muscular apparatus at that early age, which causes the various movements of the body to be hesitating and uncertain, and without that steadiness and evenness which are characteristic of matured strength. After the age of two years, these irregular and tumultuous movements cease, and the breathing becomes more regular and even, like that of adults.

In the inflammatory affections of the lungs,—pneumonia, bronchitis, and pleurisy,—the respiration is almost invariably accelerated. In extensive pneumonia, and in capillary bronchitis, it becomes very rapid, rising to eighty or one hundred in the minute. In pleurisy and simple ordinary bronchitis, it seldom becomes so frequent, not exceeding, usually, forty or fifty. In severe pneumonia, the rhythm of the movement sometimes becomes inverted: the pause occurs at the termination of the inspiration instead of the expiration. The patient makes first a violent and labored expiration, bringing into a kind of convulsive action all the expiratory muscles of respiration; instantly after the expiration follows a rapid and full inspiration; then occurs a momentary pause, and again the respiratory act begins with the labored expiratory effort. This kind of respiration is a very unfavorable symptom, as it is indicative of a most dangerous oppression. It is particularly apt to occur in infants, and very young children. It has been called *expiratory* respiration.

The respiration, though almost invariably accelerated in pulmonary inflammations, sometimes retains its normal rate, or even falls below that rate. This occurs, we believe, only under one condition of things: when the forces of the constitution have been sapped by previous disease, or exhausted by the long continuance of the thoracic inflammation. It is therefore met with in cases of secondary inflammations, and in those of the chronic form.

The respiration is very much increased in frequency as a general rule in Atelectasis Pulmonum, or collapse of the lungs. When, therefore, a young child who has been exposed to the causes of this disease (feebleness at birth, exhausting disease, or debilitating hygienic conditions), is suddenly seized with hurried respiration, slight cough, paleness or blueness, with coldness of the cutaneous surface, and in whom there are but few and unimportant physical signs of pulmonary disease, there is very good reason for supposing that some portion or portions of the lungs have become collapsed, or, in other words, have ceased to admit air.

The respiration often lends some assistance in the diagnosis of cerebral

affections. In acute meningitis, accompanied by violent febrile reaction, it is more frequent than natural, but often irregular. When the early stage passes into the stage of coma, the breathing becomes slow and irregular. In tubercular meningitis it is seldom increased in frequency except for a day or two before death, whilst in the middle period of the disorder, it is either continued at its normal rate, or becomes slower. During that period, also, it is almost always extremely irregular, and is interrupted by long and mournful sighs, which, to the ear of the experienced physician, who hears in them the almost certain prognostic of approaching death, have an inexpressibly touching sound, increased tenfold by the consciousness of his utter inability to control the fatal tendency of the malady.

There is a peculiarity of the respiration which occurs in collapse of the lung, and also in cases of membranous croup, which ought not to be passed by unnoticed. It is, that during the inspiratory effort, the ribs move inwards and backwards towards the mesial line of the trunk, instead of outwards as in normal respiration; and at the same time there may be recession of the lower part of the sternum, so that a more or less deep sulcus is produced around the base of the thorax. This peculiarity is readily explained, as shown by Rees and Jenner, by reference to the normal relation which exists between the current of inspired air, the expansion of the lungs, the descent of the diaphragm, and the firmness and resistance of the thoracic walls. If this relation be disturbed in any way, the phenomena we are now considering may be produced. Thus if the diaphragm contract suddenly and violently, the lungs cannot expand with sufficient rapidity, and in order to prevent the occurrence of a vacuum, the thoracic walls must yield to the external atmospheric pressure at their least resisting part, which is, under normal conditions, at the base of the chest. The same result must occur, also, when the diaphragm contracts with only normal force, but when the calibre of the larynx is much narrowed, or again, when a considerable portion of lung-tissue is collapsed. In the article on rickets, an affection in which the firmness of the chest-walls is much diminished, a full account will be found of the masterly manner in which Jenner has applied the above principles to the explanation of the deformities of the thorax so characteristic of that disease.

Auscultation and Percussion of the Lungs.—This portion of the examination of the sick child ought to be performed, if possible, whilst the patient is still and quiet. Unfortunately, however, it happens in a large majority of cases that the disturbance of position necessary to effect the exploration, and the presence of the physician, together with the irritability of nerves and temper occasioned by sickness, almost always cause more or less resistance on the part of the child, and produce violent screaming and struggling. In young infants we have to contend only against the instinctive resistance to any physical disturbance naturally attendant upon sickness and suffering. In older children, who have learned to distinguish between familiar and strange faces, and in whom the will has begun to act, there is added to the instinctive resistance of the infant an opposition of the most strenuous and annoying kind, founded upon the natural fear of a

stranger, and upon a mental determination not to be interfered with or incommoded by the movements and changes of position necessary for a careful examination.

For these reasons, the physical exploration of the chest in young subjects is often to be accomplished only with great difficulty, and in the midst of the most violent screaming, struggling, and contention. It is clearly important to avoid these obstacles if possible. This can only be done by the employment, on the part of the attendants and physician, of the most soothing, gentle, and patient management; and in this way, let it be remarked, it can be done in a large majority of cases. The possession by the physician of a quiet and yet decided manner, the power to interest and attract the child by entering with active sympathy into its little amusements and pursuits, the skill to engage its attention by the exhibition of some book or toy, or the mere influence he may exert to calm its terror or excited irritability, by a soothing voice and gentle persuasion, will, in many instances, overcome any resistance offered to the examination by children over two years of age. Nevertheless, in very young children, and in not a few that are older, no gentle means whatever will overcome opposition. Here the exploration must be made in the midst of struggles and cries, and though the results obtained will be less clear and positive than when the child is reasonable and obedient, a great deal of most valuable information can be acquired by a quick and dexterous practitioner. The percussion can be made in the short intervals between the cries, or even during their continuance, and by placing the ear close to the finger by which it is performed, the sounds elicited can be very well heard and judged. The auscultation is more uncertain; but, by watching intently the long and deep inspirations which immediately precede the violent cries, the presence or absence of râles, and their characters, the degree of freedom with which the air enters the lung, and the existence or non-existence of bronchial respiration, can, after some experience, be ascertained and commented upon, so as to give considerable certainty to the diagnosis.

The particular position in which to place the child, during the examination, is of some importance. After the age of three and four years the position may be the same as that selected for the adult, if only the patient be reasonable and tractable. When, on the contrary, the child resists, it should be taken on the lap of the mother or nurse, or else held in the arms, with the head inclined over one shoulder, while its back is presented to the practitioner. Infants within the year may sometimes be examined whilst engaged in the act of sucking; but this is inconvenient, both from the constrained position, and from the circumstance that the inspirations are short and imperfect during the act. The French authors recommend that the very young infant should be laid, with its face downwards, across the hand of the practitioner, who is then to approach the back of the chest to his ear. We have found either one of the three following positions most convenient, as the case may be: the infant laid across the lap of the mother, with its face downwards, and the head hanging a little over one knee; held in the arms, with the front of

its body placed against the mother's chest, and the head lying over her shoulder; or, lastly, a favorite position of ours, placed in a sitting posture upon the lap, supported by one hand in front, and by the other holding the occipital portion of the head.

Auscultation should always be performed before percussion, because the latter generally alarms or annoys the child, and occasions crying, which of course would interfere more or less with the auscultation, were this performed after percussion. The auscultation should be made with the ear rather than the stethoscope, for the reason that the instrument terrifies the child, and also because it cannot, when the child resists and struggles, be kept in contact with the chest. Moreover, the instrument is unnecessary, except for the examination of the upper portions of the thorax in front, and it had better, therefore, be dispensed with.

Percussion is best made in children by using a finger of the left hand as the pleximeter, and by striking with one finger of the right. One finger is quite sufficient to elicit all necessary sound in young subjects. The strokes should be light and distinct, consisting of short, quick, and gentle taps.

To perform auscultation and percussion with success, the surface ought to be quite uncovered. The habit of examining the thorax through one or several thicknesses of clothing, which some persons fall into, is a most careless one, and cannot but lead to uncertain and erroneous results.

As a general rule, it is sufficient, in young children, to examine the posterior portion of the thorax. Doubtless it is more accurate and artistical to explore the whole chest, and this ought to be done in all obscure cases. But when the child is sick and suffering, when it is irritated and exasperated by the presence of a stranger, or by coercion, and still more, when it is weak and exhausted by long or violent illness, it becomes of the greatest importance to shorten, as much as possible, the time occupied in the examination. For these reasons, it is well to be aware of the fact that, in nearly all inflammatory diseases of the lungs, the morbid changes affect first and most severely the posterior surfaces of those organs. This is thought to depend on the fact that the child passes so large a portion of its time in the recumbent position as to cause the fluids of the body to gravitate towards the dependent parts of the lungs, and thus to determine the beginnings of inflammatory action in that direction. Certain it is, be the explanation what it may, that it is rare to find the anterior surface of the lungs affected either with bronchitis, pneumonia, or pleurisy, the posterior surface remaining healthy. When, therefore, upon auscultation and percussion, no signs of disease are met with over the dorsum of the thorax, we may feel pretty well satisfied that the lungs are healthy. Nevertheless, in all doubtful cases, the examination ought to be extended to the whole chest, in order to make what was, before this has been done, only a strong probability, a certainty. Whenever, also, it is important to ascertain the precise amount of disease in any serious or long-continued sickness, the front as well as the back part of the chest must be examined.

The *respiratory sounds* are not of the same character precisely in the

child as in the adult, and of this the physician ought to be aware. In children the vesicular murmur is stronger than in the adult, so that it assumes somewhat of a blowing or bronchial sound. It was in consequence of this peculiarity that Laennec gave it the name of puerile respiration, which, though a mark of health in early life, is, at the period of maturity, an indication of a morbid change in some portion of the pulmonary parenchyma. It ought to be remarked, however, that in infants under two, and particularly in those under one year, the vesicular murmur is, in ordinary respiration, weaker than in adults; owing, no doubt, to the fact that the inspirations are short and imperfect, not distending the lungs to their full capacity. When, however, from any cause, a sigh, a sudden disturbance, or the act of crying, a full and complete inspiration takes place, so as to dilate thoroughly the pulmonary structure, the murmur becomes at once loud and strong, or, in other words, *puerile*, as in older children.

The murmurs of inspiration and expiration bear the same relation to each other as in the adult; the expiration being much shorter and feebler than the inspiration, though, at the same time, it, like the inspiration, is louder than in the adult. In some instances, however, and especially over the posterior, inferior, and lateral regions of the thorax, no sound whatever is heard during the accomplishment of the expiration. This absence of sound during expiration is the more apt to be met with in proportion as the child is younger.

When a young child is made to breathe forcibly and rapidly, the respiratory sounds assume certain characters, even in perfect health, which might mislead an inexperienced observer. The inspiration is short, loud, and hard, so as to assume somewhat of a blowing character, resembling not a little the sound of bronchial respiration. At the same time, the expiration becomes louder also, and longer, which two circumstances, rude or even blowing inspiration, with loud and somewhat prolonged expiration, may very well deceive a young or careless practitioner.

The respiration is most clear and characteristic over the anterior lateral, and posterior inferior regions of the thorax. Over the origin of the larger bronchia, that is to say, in the interscapular region, the respiration is very strong, so as to resemble very closely bronchial blowing. Here, also, the expiration is often very marked; it is sometimes heard as long, or even longer than the inspiration. Over the scapulas, the sound of respiration is always feebler than elsewhere, except in the præcordial region from the interposition of the scapulas and of thick muscles between the ear and the lung.

Percussion yields a much louder and more sonorous sound in children over two years of age than in adults,—a circumstance always occurring coincidently with the presence of puerile respiration, and dependent on the fact that the function of respiration is, at that age, very active, and the lungs therefore filled to their utmost capacity with air. In infants under two years of age, the sonorousness varies to a considerable extent in the same child. When the respiration is, as it usually is, gentle and easy, the inspirations being rather feeble and incomplete, the amount of air con-

tained in the lungs will be somewhat deficient in comparison with what their cells might contain, and the sound yielded upon percussion will necessarily be rather dull and insonorous. When, on the contrary, the respiratory process is quick, active, and energetic, from any cause, so as to give rise to the auscultatory phenomenon called puerile respiration, the percussion will be loudly sonorous, as it is in the later periods of childhood, owing to the thorough dilatation of all the air-cells, and the consequent presence in the thoracic cavity of a large amount of air.

The sonorousness of the thorax is different in different parts in children, as in adults. In front, the percussion is most sonorous from just beneath the clavicle on the right side down to one or two inches below the nipple, where it gradually becomes dull, owing to the position of the liver. On the left side the sonorousness is modified by the presence of the heart in the manner already mentioned. Below the præcordial region we again have pulmonary resonance down to the sixth or seventh ribs, below which is heard the tympanitic sound of the stomach.

Behind, the sound is very dull above the spine of the scapula, and considerably so over the scapula beneath its spine. Over the interscapular space it is clear and strong, and more so in the lower than in the upper half. Beneath the inferior angle of the scapula, likewise, it is clear and full, until we approach the inferior margin of the thorax, where it is dulled, even above the lower edge of the lungs, by the presence beneath of the liver on one side and of the spleen on the other. Over the right side the dulness begins a little higher than over the left, in consequence of the greater bulk of the liver than of the spleen.

The lateral regions are very resonant in their upper portions, but become dull as we approach the liver on the right side and the spleen on the left. On the left side the pulmonary sound is often entirely eclipsed by a tympanitic resonance occasioned by the presence of gas in the stomach.

In practicing percussion in children it is necessary to strike gently, because, from the great natural sonorousness of the chest in early life, any considerable force would bring out so much sound as to prevent the recognition of a degree of dulness which might readily be perceived by the use of more gentle blows. It is necessary always to compare the two sides together, as in adults, since this often leads to the detection of a degree of impaired resonance which might be otherwise inappreciable. Yet, and the physician ought to be well aware of this, the comparison of the two sides is not quite so useful in young as in mature subjects, because of the fact that the diseases in which the differential comparison is most important, pneumonia and pleurisy, are more frequently double than in adults. It becomes, for the same reason, very important to compare the upper and lower portions of the thorax behind, since we may assure ourselves of the existence of dulness below, of which we were before doubtful, by the fact that the sound is less sonorous in that region than above; which is, as already stated, the very opposite of the healthy condition.

Examination of the Abdomen.—It is often very important to ascertain, by palpation, the form, size, and degree of tension of the abdomen, the presence or absence of effusions within its cavity, and the condition of

the organs which it contains; to learn by percussion the degree of resonance which it affords; and, lastly, to find by pressure whether it be unnaturally tender to the touch or not. By a careful inquiry into these various points, and a proper comparison between them and the rational symptoms presented by the patient, we shall be able to discover the existence of tumors, of hypertrophied organs, of unusual developments of gas in the intestines, of dropsical effusions, of enlarged and hardened mesenteric glands, of gurgling, and of soreness on pressure caused by inflammation of some of the contents of the cavity. The examination should be made, if possible, whilst the child is still and composed. It is best, therefore, to perform it before auscultation and percussion, in children who are old enough or amiable enough to be willingly quiet, since the length of the examination of the thorax often wearies out their patience, and they refuse to submit to further inspection; whilst, in infants and in children who obstinately resist the examination, it matters little at what particular period it is attempted, since it must be done at last in the midst of cries and general agitation. It is, at all times, a difficult and not very useful examination, unless the patient consents to it freely and without fear. It is very necessary, therefore, to resort to every means to obtain this quiet consent. In children over a year old, this condition is to be obtained only during deep sleep, during the act of nursing, or, when the patient is awake, by so pleasing and attracting its attention by toys, by soothing voice and manners, as to cause it to forget what is passing. The reasons why the examination is useless, unless made during a state of calm, are very obvious. In the first place, the contractions of the abdominal muscles give to the walls of the abdomen such a degree of hardness and rigidity, that it is impossible to learn anything in regard to the state of the parts within, except merely what can be learned by percussion; and, in the second place, no acuteness of perception will enable us to distinguish between the cries of anger and fright, and those that may proceed from pain occasioned by pressure.

M. Valleix recommends a plan in the case of young infants, by which tenderness on pressure may very generally be recognized. It is as follows: He carries the child, carefully sustained in the arms, suddenly before a bright light, either that which pours in at a large window during daylight, or that of a bright artificial light at night. The infant, whose greatest pleasure consists in gazing at a bright light, almost always ceases to scream and becomes perfectly quiet while thus attracted. Seizing this opportunity, the physician should pass his hand under the clothes, and applying it directly over the cutaneous surface, he may first learn, by a rapid palpation, the general characters of the abdomen, and then ascertain by sudden and decided pressure whether it be abnormally sensitive. If the pressure gives pain, the infant will cry out at the moment, while, at the same time, a sudden contraction of the countenance will assist to show the perception of some painful sensation. Should the infant, on the contrary, continue to gaze fixedly at the light, without noticing the manœuvres of the physician it is fair to conclude that there is no inflammatory tenderness present.

Examination of the Mouth and Fauces.—In all obscure attacks of sickness occurring in young children, and even in those who have attained to the faculty of speech, the physician ought to be most careful to inspect the condition of the mouth and fauces, since not a few cases of fever which seem at first view inexplicable, are at once made plain by this simple exploration. We were once called to see a child three years of age, who had been sick three days with fever, thought by intelligent and educated parents to depend on gastric derangement. A single look into the throat showed it to be completely clogged up with pseudo-membranous exudation, whilst a slight hiss in the inspiration, and a husky voice, declared that the same fatal product was just entering the larynx. The time for successful action had slipped by; the patient died two days after in the agonies of slow croup. On another occasion we were called to take charge of two children in one family who had been ailing several days with feverish symptoms, loss of appetite, languor, and some complaint of sore throat. In both we found the fauces covered with plastic deposit, and both died a few days after of membranous croup. Some years ago we attended a child between five and six years old, for a period of four days, with irregular fever, some vomiting, total anorexia, languor, indisposition to play, and rare complaints of pain in the *chin and neck*, that were not mentioned to us by the attendants, so that all the time we had the idea that the attack was one of gastric embarrassment. Greatly to our amazement and consternation, the mother informed us on the fifth day that she had seen something white in the throat, and upon examination we found both tonsils covered with whitish exudation. Happily the exudation was still confined to these glands, and we were able by appropriate treatment to prevent its further extension.

In croup, also, in whatever form it may make its attack, the fauces ought to be closely watched, in order to know by the presence or absence of false membrane, the probability or improbability of the case being one of the membranous kind. In scarlatina and measles, especially in the former, the throat ought to be examined each day, to ascertain its precise condition, and particularly to learn whether there be present any disposition to membranous, ulcerative, or gangrenous angina.

In young infants, also, the mouth requires a thorough examination from time to time in all their ailments, and especially in their digestive diseases, since they are liable to thrush, to aphthæ, and, in chronic and debilitating maladies, to gangræna oris. In teething children the act of dentition requires that the mouth should be inspected occasionally in order to ascertain the state of that process, and to detect the existence of the form of stomatitis called ulcerative, which generally occurs between the ages of one and five or six years.

The mouth can be readily examined by pressing upon the chin with force sufficient to cause the child to separate the jaws. In the young infant this very generally produces crying, during which the mouth is widely opened, and the state of the cheeks, lips, gums, and tongue can be perfectly well seen. In an older child, who refuses to open the mouth, or to

keep it open, the handle of a smooth silver spoon is the best instrument to employ by which to effect our purpose.

The throat cannot be well seen at any age, except by depressing the base of the tongue, which is best done by means of a spoon-handle, as above directed. When a child refuses obstinately to open the mouth, and resists with violent struggles, it should be taken on the lap of a strong assistant, with the back of its trunk resting against the chest of the assistant, whose arms should restrain, by being crossed over the body and limbs of the child, its more vehement movements. Another assistant must hold the head of the child steady, whilst the physician obliges it to open the mouth, either by closing the nostrils with the fingers, or by slowly and gently, but firmly, insinuating the handle of the spoon between the teeth. After the spoon has once been passed over the tongue there is seldom any difficulty in obtaining a good view of the fauces.

The *introduction of the finger into the mouth* is of some use as a diagnostic means in the case of infants. It informs us of the temperature of that cavity, of the state of its secretions, and consequently, of its dryness or humidity, and of the disposition and ability of the infant to suck. When an infant is in good health, it will almost always seize the finger, when this is placed in the mouth, and suck vigorously for some instants. It will do the same when it is only ailing with some slight malady, and in the early stage of more dangerous diseases. But, in severe and threatening illness, the infant either refuses to suck upon the finger at all, or does so only for an instant. When the mouth is irritated or inflamed, as in the various forms of stomatitis, the child will open the mouth and cry, and make no attempt whatever at suction. In stupor, and especially in coma, but little attention is paid to the finger, the infant being generally unconscious of its presence.

By watching the child when put to the breast, we may acquire nearly the same information as that just referred to, except that the child would naturally make a greater effort to seize the nipple than the finger, and would therefore nurse, even though the act of so doing were painful, under circumstances in which it might refuse to grasp the finger at all. The refusal to nurse, or the nursing but little at a time, may depend on other causes, however, than sore mouth. It often depends on some anginose inflammation. When this is the case, it may be suspected from the peculiar gulping manner in which the child swallows, and from the fact that swallowing often causes fits of coughing. It is caused also by dyspnœa. An infant laboring under severe oppression from pneumonia, bronchitis, or any other cause, never sucks well and steadily, but rather by fits and starts. The nipple is seized often with avidity, and two or three swallows are made in quick succession; then follows a pause to regain the breath, and then again the effort of deglutition. In a few cases attended with very great dyspnœa that we have seen, the patients have been able to swallow only once or twice without pausing, and even then with very great difficulty.

Manner of Taking Drinks.—The remarks just made as to the inferences to be drawn from the manner in which the infant sucks, will

apply also to the mode in which both infants and older children drink. A young child drinks continuously, without stopping to breathe. If, however, it have any disorder which accelerates the respiration, it will, after drinking a few mouthfuls, cease, jerk its head away from the cup or spoon, breathe irregularly and hurriedly, and cough. These symptoms ought to call attention to the respiratory organs. So, if a child, whose breathing is not oppressed, nevertheless drinks with difficulty, slowly, at intervals, and apparently with pain, there is reason to suspect some impediment in the pharynx, and the fauces ought thereupon to be carefully examined.

We may learn also from the manner of drinking whether the child is thirsty or not. When it drinks often and with avidity, and yet has a dry mouth, it is evident that there is very great thirst.

Vomiting and the Discharges by Stool.—The physician should never think his examination of a sick child concluded until he has inquired as to the occurrence of vomiting, and as to the state of the discharges by stool. Not only, indeed, should he inquire as to these symptoms, but he ought by all means to inspect personally the appearance of the matters ejected. This is especially important in regard to the dejections, since no description of a mother or nurse, however intelligent, can impart to the physician the precise and accurate idea of the state of those discharges which even a very rapid inspection would give him.

Vomiting is of very frequent occurrence in infancy and childhood. Owing to the fact that the stomach is much less curved in its shape than in the adult, and that the œsophagus enters the organ close to its left extremity, vomiting and regurgitation take place with great readiness, and are, therefore, very common symptoms in the diseases of early life.

The young practitioner must beware lest he regard all kinds of vomiting in the infant as the result of disease. The nursing child is very apt to vomit, even when in the most perfect health, especially if it be suckled at an abundant breast. This kind of vomiting, however, may be readily distinguished from that which depends on some morbid state of the health, by the circumstance of the infant's ejecting nothing but the milk which it has swallowed, either just as it was drawn from the mother, or slightly curdled, and by the fact that it suffers no inconvenience whatever from the act,—neither any violent effort, languor, paleness, nor faintness. And yet we have known a young practitioner to prescribe antacids and absorbents to correct this kind of vomiting, which is most plainly an act of nature kindly intended to rid the infant of any excess of food it may have imbibed.

In older children also, vomiting not unfrequently occurs as a consequence of overdistension of the stomach with food. When, therefore, after vomiting, a child seems relieved and comfortable, when any unpleasant symptoms that may have existed prior to it moderate or disappear afterwards, it is fair to conclude that the act has been beneficial, and wrong to regard it as the signal of a necessity for giving medicine, or for regarding the child as a patient, except insomuch as to watch lest it

be sick as an after-consequence of having had the digestive power overtasked.

Frequently repeated vomiting, attended with retching and effort, and with paleness and exhaustion, or with fever, always indicates some considerable derangement of the health. It is impossible to ascertain the precise cause of such vomiting, except by a proper consideration and comparison of all the symptoms the child may present. The cause may be in the stomach itself, consisting of an inflamed state of the organ, or it may be a simple indigestion without any inflammatory condition whatever; it may be that the cause lies in the intestine, being some inflammation, functional disease, or obstruction of that part; it may be pneumonia or pleurisy; it may be the approach of some of the eruptive fevers; or last, and most serious of all, the cause may be some commencing lesion of the brain, which, though as yet determining no proper cerebral symptoms, shall perhaps be destined, by its inevitable progress, to end the patient's life. The detection of the particular causative condition, in any of these forms of vomiting, can be arrived at only by a careful study of the whole constitution of the patient, both through the rational symptoms that may be present, and by a thorough inspection of the different systems of the body by means of the physical methods of diagnosis.

The rule to examine with his own eyes the napkins or cloths of the child, ought never to be forgotten by the practitioner, when there is any reason to suppose that the alimentary functions are at all deranged. The number of the stools in the twenty-four hours ought also to be ascertained, not loosely and carelessly, but precisely and with certainty. Without a close attention to these two precautions, it is impossible for the physician to obtain really useful and exact notions in regard to the nature of the disorder he is called upon to treat, or to judge of the degree of severity of the attack.

We shall not attempt to consider in this place either the various unnatural appearances of the matters vomited, or ejected by stool, the amount of those substances, or the frequency with which the discharges take place, since these various circumstances can be treated of in the manner they require, only when we come to study separately the diseases of which they form a part.

We shall here conclude our remarks upon the methods to be pursued in the clinical exploration of the diseases of children. We have only to add the wish that those who shall honor them with their perusal, may find them of some real assistance in their subsequent studies of the affections of early life. They are intended, of course, chiefly for the student and young practitioner; but we cannot help hoping that they may possibly prove useful to some who have spent a longer time in the profession, but who have never, perchance, given any particular attention to the best modes of investigating the diseases of infants and children.

CLASS I.

DISEASES OF THE RESPIRATORY ORGANS.

CHAPTER I.

DISEASES OF THE UPPER AIR-PASSAGES.

SECTION I.

DISEASES OF THE NASAL PASSAGES.

ARTICLE I.

CORYZA.

Definition; Synonyms; Forms; Frequency.—Coryza is inflammation of the mucous membrane lining the nasal passages. It is called in common language, cold in the head, or snuffles.

We shall describe three forms of the disease,—the simple or mild, the severe, and the chronic. The severe form includes purulent and pseudo-membranous coryza. Simple coryza is very common at all ages; it occurs frequently as a distinct disorder, but still more frequently in connection with laryngitis, bronchitis, pneumonia, measles, scarlet fever, etc. The severe form of coryza is that which was called by Underwood coryza maligna, or morbid snuffles, and which, as he stated, is very different from and far more serious than what is usually called snuffles. Purulent and pseudo-membranous coryza rarely occur idiopathically, but are almost invariably connected with angina or other diseases.

The affections upon which they are most frequently dependent are diphtheria, measles, and scarlet fever. A full account of this complication will be found in the chapters devoted to these various affections.

Chronic coryzà occurs most frequently in connection with scrofula or hereditary syphilis. It also results from the persistence of the purulent form which has originated in the course of some specific fever.

Causes.—The only clearly evident cause of simple primary coryza, in most cases, is chilling of the body. Insufficient dress,—a very common error in this country,—too low a temperature of the nursery, and exposure to bad weather, may often be discovered to have been the causes of the attack.

As already stated, acute purulent coryza usually occurs in connection with some general disorder, though we have occasionally met with it as an independent affection, for which no satisfactory cause could be assigned. The cases of MM. Rilliet and Barthez coincided generally with primary or secondary purulent or pseudo-membranous angina. From the account given by Underwood of coryza maligna, there can be little doubt that it was epidemic when observed by himself and Denman. The latter author states that in connection with the coryza there was a general fulness of the throat and neck externally; that the tonsils were tumefied, and of a dark-red color, with ash-colored specks, and in some cases, with extensive ulcerations; and that some of the children swallowed with difficulty: all of which symptoms clearly point to severe concomitant angina. There can therefore be little doubt but that in reality these were cases of nasal diphtheria.

Anatomical Lesions.—The Schneiderian mucous membrane is found reddened uniformly, or in points, rough, thickened, and sometimes softened. When pseudo-membrane is present, it exists either in fragments, or lines the whole extent of the nasal passages, and is mixed with mucus or muco-purulent fluid, in greater or less quantity.

Symptoms.—The symptoms of simple coryza are sneezing, dryness of the nose at first, soon followed by discharge, which is very small in quantity in the beginning, and more abundant afterwards, and more or less disturbance of the respiration. It is only in young infants that this form of coryza is a disorder of any consequence in itself. In older children it never injures the health by its own action; it is of importance merely as the sign that a cold has been taken, and ought to be regarded as a hint given by nature of the necessity of guarding the child more carefully in future. But, in infants at the breast, and very young children, it assumes much greater importance from the very considerable obstacle it opposes to the act of respiration. At this early age, in fact, coryza becomes a serious and even dangerous disease. If primary, it causes great distress and disturbance to the child, interrupting its sleep, interfering with the act of nursing, and, in some instances, so impeding the function of respiration, as to bring on slight, and more rarely, dangerous asphyctic symptoms. It may, undoubtedly, occasion in weak and debilitated children, more or less extensive collapse of the lungs, an accident which will explain the imperfect performance of the hematosic function in some cases, where the only evident disease is this apparently insignificant one of coryza.

When simple coryza exists in connection with bronchitis and pneumonia, it adds to the severity of those diseases. In children over three or four years old, and particularly in those who are vigorous, it seldom gives any serious trouble. But in young infants, and in weakly children of any age, its influence upon the symptoms is often very marked. The effort to breathe through the nasal passages, when they are partially or wholly occluded by the inflammatory swelling of their lining mucous membrane, or by abundant and viscid secretions, fatigues, and wears away the strength of the child, exhausts its energies, and renders it less able to resist the pressure of the sickness. But not only this;—as in

primary coryza, the entrance of air into the lungs is impeded, and the hematosic function is thereby interfered with, while at the same time, the existence of an obstacle to the full inspiratory movement, in addition to that which exists in the lungs themselves from bronchial or pneumonic disease, cannot but assist in the production of that collapse of the pulmonary tissue, which has been found of late years to coincide so often with the bronchitis and pneumonia of young children, and especially with the former.

The reason why coryza causes so much difficulty in young children is, that they persist in the effort to breathe through the nose in spite of the obstruction of the nasal passages. They seem to do this instinctively, not, apparently, having the power to carry on the act of respiration through the mouth, or but for short periods only at a time. The constant struggle to force the air through the nose, and the necessarily smaller quantity that reaches the lungs, are undoubtedly the two chief causes of the symptoms above described as occurring in the coryza of children.

Severe Coryza begins with sneezing and stoppage of the nostrils, soon after which the discharge, which is the pathognomonic symptom of the disease, makes its appearance. This consists of serous or mucous fluid in greater or less abundance, usually of a yellowish color, and which, at first thin and without odor, becomes afterwards thicker and often purulent, with a peculiar, unpleasant, but not fetid odor. In other cases, on the contrary, and especially when the pseudo-membranous exudation is present, the discharge is thin, and often contains small granular particles, which seem to be the detritus of the false membrane, while at other times it is ichorous or even bloody. When false membrane is present, it can often be seen, upon examination of the nostrils in a strong light, to cover the mucous membrane in the form of thin adherent layers of a yellowish-white color. The alæ nasi, and sometimes the whole extremity of the nose, are red and swelled, and the skin, which is tense and shining, presents an erysipelatous appearance. The upper lip is generally reddened, irritated, swelled, and sometimes excoriated, by the nasal secretion.

The *respiration* is generally difficult, nasal, and snoring. When the nasal passages are nearly or quite filled with the secretions, the child being no longer able to breathe through them as in health, is compelled to keep the mouth open. This is exceedingly inconvenient to children of all ages, as it causes great dryness and stiffness of that cavity, and of the tongue and throat, and in very young infants, who instinctively respire almost exclusively through the nostrils, it is attended with such violent efforts as to be a chief or perhaps sole cause of the fatal termination of some cases. In one instance that we saw, the child was seized with attacks of suffocative breathing, which threatened fatal asphyxia, whenever the passages became much impeded. Under these circumstances the cleansing of the passages with a brush would afford complete relief, and, for a time, the little thing would appear to be quite well. Finally, however, death occurred in one of the attacks of dyspnœa, from sudden serous effusion into the lungs. The difficulty of respiration is greater, as we have stated, in proportion as the child is younger, and depends on the physiological fact already referred

to, that at a very early age, respiration is performed almost solely through the nostrils, and that the child seems incapable of keeping the mouth open, in order to compensate for their closure. We have never observed *cough* except in cases accompanied by angina. *Epistaxis* occurred in two cases of the pseudo-membranous form, in children between three and five years of age. The bleeding recurred on several occasions, but ceased so soon as the coryza was cured. Infants refuse the breast when the passages are much clogged, or suckle with great difficulty and at long intervals.

The character of the *general symptoms* depends much more upon the accompanying disease, in older children, than on the coryza itself, and it is unnecessary therefore to dwell upon them. In the cases observed by ourselves, the principal symptoms have been unaccompanied by angina, restlessness, weakness, emaciation, dry, harsh, and wrinkled skin, and violent attacks of dyspnœa; and in the other cases, in which angina was present, there were added to these, fever and somnolence. The *duration*, as observed by ourselves, in cases occurring in infants, has been between two and three weeks. In other cases, which occurred in older children, the duration of the attack depended on the form and degree of the attendant angina. In some cases it became chronic, and was accompanied by ulceration of the nasal passages. MM. Rilliet and Barthez state that they saw a child two years old die in three days, and another of three years in the same time; but as one of these cases was complicated with angina and croup, and the other with pseudo-membranous angina, it is clear that the rapid death depended rather on the accompanying disease, than on the coryza itself.

The *prognosis* must depend on the age of the child, and the form of the attack. Simple coryza is never dangerous except in very young infants, and rarely in them. When, however, it occurs in a delicate infant, and is accompanied with either sufficient turgescence of the nasal mucous membrane, or with enough viscid secretion, to cause a nearly complete occlusion of the nasal passages, the effort to breathe through the nose, and the diminished quantity of air that reaches the lungs, will sometimes give rise to great and dangerous exhaustion, or to partial or fatal asphyxia. In older children this form of the disease is never scarcely more than an annoyance.

When simple coryza occurs in connection with other diseases, whether thoracic inflammations, angina, or measles, it always adds, and sometimes most seriously, to the difficulties of the patient, since the effort to breathe through the obstructed air-passages must assist to exhaust the life-forces, while at the same time a certain amount of the blood in the lungs, which ought to be exposed at each inhalation to the inspired air, is deprived of this necessary contact by the fact that less than the natural quantity of air is drawn through the nasal passages at each expansion of the chest.

The purulent and pseudo-membranous forms of coryza are always dangerous, whether they occur alone or as a part of other diseases. The two cases of idiopathic membranous coryza in infants that came under our observation, both proved fatal. The four cases in older children recovered without any difficulty. When they occur in connection with pseudo-mem-

branous angina, or in the course of scarlet fever, the prognosis will of course depend very much on that of those diseases.

Chronic Coryza.—Under this title we shall describe as succinctly as possible a form of inflammation of the Schneiderian membrane, of which we see a good many examples. It is characterized rather by swelling and thickening of the mucous membrane, as far as this can be seen, and by an accumulation of scabs and crusts, causing obstruction to the passage of the air, than by a discharge. The secretions are, in fact, not much increased in quantity beyond their natural amount, but they consist of very thick mucus, or they are purulent in character.

This form of the disease may be met with at any age, from a few weeks old up to puberty. Its principal *cause* has always seemed to be some faulty state of the general health, some constitutional dyscrasia. Like the keratitis and chronic otorrhœa of children, it makes its appearance without any evident exciting cause whatever, or it follows an acute attack of catarrhal inflammation from cold, or an attack of measles, scarlatina, or epidemic angina. On one occasion, we met with it in three out of a family of four children. Though it is unquestionably very apt to occur in scrofulous children, its presence is not necessarily a sign that the patient is of scrofulous habit, since we have seen it in families in which there was no taint of that disease, and have known a good many of those affected by it to recover perfectly, and show no subsequent symptoms of the scrofulous or tuberculous cachexia. Its chief efficient cause appears to be a low state of the general health, the blood being more or less markedly anemical, and the nutrition of the body imperfect. In addition to the above conditions, it must also be borne in mind, as a fact of the utmost importance, that this form of coryza occurs frequently as a symptom of constitutional syphilis.

The chief *symptoms* of this form of disease are of a local character. The breathing is at all times more or less nasal and embarrassed. Even in the waking state, the child will sometimes attract attention by the noisy and slightly oppressed character of its respiration, while when asleep the obstruction to the passage of air through the nasal passages will be so great as to give rise to symptoms which, though not alarming, are most annoying to those around. The obstruction to the passage of air through the nasal passages produces snoring or hissing sounds, which are sometimes so noisy as seriously to disturb those sleeping in the same apartment. This obstruction also obliges the child to make much greater muscular efforts than in the healthy state, to supply the thorax fully with air, so that the sleep, instead of being quiet and easy as in health, is broken and disturbed by the unusual play of the muscles, and by the disordered internal sensations caused by the reaction upon the nervous centres of a circulating fluid less thoroughly decarbonized than it should be. The child tosses and rolls, sighs and moans, or it cries out in its sleep, or it wakes suddenly and frequently.

When the nasal passages are examined by a full light, they will be seen to be obstructed in two ways: by a thickened and injected state of the mucous membrane, and by the presence in them of scabs, or of more or

less inspissated masses of mucus or muco-pus. The mucous membrane is also redder and more highly vascular than natural, and sometimes exhibits an appearance in some points as though excoriated or slightly eroded. There is seldom, indeed rarely, any considerable amount of fluid secretion, as in acute coryza; the secretions are so much more viscid than usual that they desiccate in the passages and form scabs and crusts. Not unfrequently the surfaces become so irritable as to bleed very easily. The act of blowing the nose, a rude touch, or a blow, will cause a considerable discharge of blood, and this is often the symptom for which the practitioner is particularly consulted. The voice of the child is usually characteristic: it is nasal; and when the obstruction is considerable this becomes a marked symptom.

The general appearance of the patient almost always shows a deteriorated state of the general health; his color is too pale; the skin is muddy; the expression is languid; the tissues are more flabby and flaccid than they ought to be; and the movements are less brisk and prompt than in full health. Such patients wake from their sleep less refreshed than is natural; their appetite is often capricious and poor; and the digestive and nutritive functions are impaired. The tongue is often flabby in its texture, pale, and more or less furred, the bowels are irregular, and the discharges often scanty, and of an unhealthy color and smell, or there are alternations of diarrhœa and constipation.

In addition, when the case is connected with constitutional syphilis, some of the other evidences of this disease may usually be detected; though we have, like West, met with cases where the coryza has been the only sign of the constitutional taint.

The *duration* of this form of coryza is very indefinite. Under the most patient treatment, it often lasts for many months, and even when cured is very apt to return with or without apparent exciting causes, so that we have known it to last for several years.

Treatment.—Simple coryza requires no treatment in children over two years of age, except attention to hygienic conditions. Young children may often be preserved from attacks of spasmodic laryngitis and bronchitis, by calling the attention of the mother to the strong tendency which exists during infancy and childhood to the extension of disease, and advising, in cases of coryza, that the child should be secluded in the house, or else very warmly clothed if sent out.

In young infants, even the mildest coryza gives trouble, by obstructing the full freedom of the respiratory act, by interfering with the suckling, and by the restless and broken sleep which it induces. In such cases, all the treatment required is to keep the child warm, and to clear the nasal passages, and at the same time lubricate them by the occasional introduction of a camel's-hair pencil, charged with glycerin or sweet oil.

When the coryza is more severe, so as to interfere a good deal with the respiration, it is necessary to make use of the brush frequently, to administer a warm foot-bath once or twice a day, and to give a few drops of syrup of ipecacuanha, with sweet spirits of nitre, every two, three, or four hours. In such cases, the late Dr. Charles D. Meigs was in the habit, for many

years past, of directing a flannel cap to be put upon the child, and kept there for two or three days;—a simple, and often most effectual mode of treatment. The cap should be removed after two or three days, so soon as the coryza is relieved, as otherwise the child is apt to become so much accustomed to it as to take fresh cold when it is removed.

In infants laboring under purulent or pseudo-membranous coryza, the indications of treatment are to remove the secretions as they collect, and to subdue the inflammation of the mucous membrane by which they are produced. It must never be forgotten, moreover, that this form of the disease is very frequently dependent upon some general specific disorder, of which it may indeed be one of the earliest symptoms, as in diphtheria. It need not be said that in such cases the general treatment is of even more importance than the local. The first indication may be fulfilled by means of a brush made of long camel's-hair, by throwing water or lime-water from a small syringe into the nasal passages, or, when the discharges are thin and fluid, by blowing strongly into the nostrils, whilst the tongue is depressed by a finger introduced into the mouth, so as to allow the secretions to pass out of the posterior nares into the fauces.

The second indication is to be fulfilled chiefly by the application of solutions of alum, nitrate of silver, sulphate of zinc or copper, and by insufflations of different substances in powder. The best application is probably the solution of nitrate of silver, which may be made of the strength of five or ten grains to the ounce, or stronger, to be made use of several times a day, with a brush. We have also employed injections consisting of solutions of alum, of from three to six grains to the ounce. It is recommended by MM. Rilliet and Barthez to make insufflations of powdered gum and alum, or of gum and calomel in equal parts, several times a day. There is, however, it seems to us, an objection to this method of treatment, especially in infants,—which is, that the powders would necessarily tend to increase the obstruction which already exists, to breathing through the nose. It has been proposed also to apply a few leeches to the mastoid process, or over the frontal sinuses; but it seems to us that this could scarcely ever be advisable.

In the form of the disease accompanied with angina, an essential part of the treatment must be that of the throat affection. This will be considered in another place.

The treatment of chronic coryza must be twofold: *general* and *local*. The most important points to be attended to in connection with the general treatment are the clothing, the diet, and the administration of tonics and alteratives. The *clothing* ought to be warm during the cold seasons of the year. Flannel, as a general rule, ought to be insisted upon. The arms and neck must be covered, and the legs should never be exposed, after the very mistaken fashion amongst many persons of the present day. The diet ought to be strengthening and nutritious. Fresh meats, milk, bread, and good butter, and the plainer vegetables, ought to be urged upon the child. If necessary, some authority must be made use of by the parents to induce the patient to take a sufficient quantity of these plain, but nutritious articles of food. Pastry, cakes, candies, nuts, hot bread, sweet-

meats, and all such rich, but not really substantial diet, should be forbidden to as great an extent as possible.

Of the tonics to be given, the best are the preparations of iron and cod-liver oil. Of the former, we prefer commonly the syrup of the iodide of iron, from three to five drops, at four or five years of age, three times a day, in half a teaspoonful or a teaspoonful of sarsaparilla syrup. Or the Pulv. Ferri of the Pharmacopœia may be given, either in the form of powder, mixed with dry sugar, in pill, or in the shape of the chocolate lozenge. From half a grain to a grain, three times a day, is the proper dose from three or four years to six or seven. The carbonate of iron may be given, if it is preferred, for any cause. Either of these preparations of iron, or any other that may be chosen, should be combined with a grain of quinine, three times a day, whenever the appetite is poor, and when the digestive process seems to be slow and feeble. Or the child may be made to take half a teaspoonful of the fluid extract of cinchona, mixed with an equal quantity of syrup of ginger, half an hour before the meals, while the iron is given alone soon after the meals. When the attack is particularly obstinate, and when, also, it occurs in a subject who either inherits or exhibits signs of the tuberculous or scrofulous diathesis, the best remedy is cod-liver oil, which should be given in doses of from half a teaspoonful to a teaspoonful two hours after each meal. In cases of syphilitic nature, in addition to the above regimen and tonic remedies, we should administer the iodide of potassium, associated in obstinate cases with minute doses of bichloride of mercury.

The *local treatment* must consist in the use of means intended to keep the passages clean and free from scabs and incrustations, and in the employment of astringent and alterative applications. When the patient will submit, the nasal passages should be cleansed by means of a syringe once or twice a day, with tepid water, or milk and water, or with a weak solution of alum in water. The latter may be made in the proportion of from two to four grains to the ounce. If the discharges are offensive, the lotion used for injection should consist of the solution of chlorinated soda, one, two, or three drachms in two ounces of water. After the use of the syringe, and more or less frequently through the day, according to the disposition to dryness of the surfaces, these should be lubricated with some oleaginous application. One of the best is glycerin, or glycerin rubbed up with cold cream (f℥j of the former to ℥j of the latter); or sweet oil, or oil of sweet almonds, may be used. These applications are best made by means of a camel's-hair brush.

Amongst the astringent applications, the best are weak solutions (gr. v to x to water f℥j) of the nitrate of silver, which should be used only once a day, or solutions of the sulphate or acetate of zinc with wine of opium. From two to five grains of either preparation, with a drachm of wine of opium, to an ounce of water, make a proper application. This may be applied twice a day. One of the best means that we know of, however, after the use of the alum or soda injection through the day, is to apply the following ointment at night: R. Ungt. Hydrarg. Nitrat., ℥ss.; Ext. Belladonnæ, gr. x; Axungiæ, ℥ss.—M. This has succeeded admirably well in

several cases in which we have used it. It should be applied, after being completely softened by a gentle heat, on a camel's-hair pencil, care being taken to apply it thoroughly to the surface of the mucous membrane itself, and not merely to the outside of the hardened scabs.

The following case well illustrates the chronic severe form of coryza. It was in all probability of syphilitic nature, though circumstances rendered it impossible to determine this question.

Case.—The subject of this case, a male, was born after an easy, natural labor, and appeared strong and well, with the exception of a little discharge of blood from the nose soon after birth and slight coryza, the latter of which continued until the child was five weeks old, when it became aggravated, and one of us was requested to visit the infant. It was small and puny; the skin was harsh, dry, and wrinkled, so that the child looked like a little old woman. It was very weak, and had constant secretions from the nostrils of thick, dark-colored pus. When the discharge collected in sufficient quantity to obstruct the passages, the respiration became exceedingly difficult, as the infant seemed incapable of breathing through the mouth. At such moments it seemed as though the child must die of asphyxia. If the nostrils were cleared by any means, by syringing, by the use of a brush, or by blowing into them in the manner already described, the respiration would become easy and natural, until the discharge collected again, when the same scene recurred. During the paroxysms arising from the closure of the nasal passages, the child was entirely unable to take the breast, but after being relieved, had no difficulty whatever; the mouth was either kept shut, or if open, the tongue was observed to be pressed spasmodically against the roof of the mouth, so that it was impossible for more than a very small amount of air to pass over it; the respiration was labored, and accompanied by a loud snoring or nasal sound. There was no other marked symptom, except a nearly constant flatulent distension of the epigastric region. On the day before death, the infant seemed better, appeared to have gained flesh, and looked more intelligent, so that the mother was greatly encouraged; but the next day it was seized during one of the paroxysms of suffocation, which did not seem to be worse than many preceding ones, with copious discharges of bloody and frothy serum from the mouth and nose, and died in about three-quarters of an hour.

At the post-mortem examination we were not allowed to examine the nasal passages or throat. The stomach and bowels were healthy, but much distended with gas. The peritoneum was healthy, but contained a considerable amount of clear yellowish serum. There was serous effusion in both pleural cavities, but no traces of inflammation. The lungs were healthy, with the exception of some ecchymosed points, and general infiltration with sanguineous frothy serum. The trachea and bronchia were natural. The heart was larger than usual, but healthy in other respects.

SECTION II.

DISEASES OF THE LARYNX.

GENERAL REMARKS.

There has been much confusion amongst writers on the diseases of children, until within a few years past, in regard to the diseases of the larynx, each one differing from the other in his opinions as to the nature

of the several disorders of that organ, and of course as to their classification and symptoms. From later and more rigid observation it has become clear, however, it appears to us, that there are but three diseases of the larynx which deserve to be considered as separate and distinct affections: these are simple erythematous or catarrhal inflammation of the larynx, unattended with spasm of the glottis, or, as that symptom has been emphatically named, laryngismus; simple catarrhal inflammation of the larynx, attended with laryngismus, and called most properly spasmodic simple laryngitis, or more commonly simple, false, spasmodic, or catarrhal croup; and lastly, pseudo-membranous inflammation of the larynx, properly named pseudo-membranous laryngitis, and more commonly called true or membranous croup. There is, moreover, another disease, of which one of the most marked symptoms is spasm of the glottis, or laryngismus, attended with a hoop or stridor, which is now known by the name of laryngismus stridulus, but which is called also Kopp's or thymic asthma, spasm of the glottis, and croup-like convulsion. This disease has often been confounded with the above-named affections of the larynx under the common title of croup, or has been supposed to constitute a distinct disease of the larynx; whereas now it is well known that the laryngismus whence its name was taken, is but one of many symptoms that mark the dependence of the disease upon disordered action of the reflex portion of the general nervous system.

We are well aware, also, that some most competent observers describe a purely spasmodic affection of the larynx, under the title of spasmodic croup, which they believe to be entirely independent of laryngeal inflammation, and to consist in a mere momentary contraction of the sphincter muscle of the larynx, produced by the sympathies which that part holds with other parts of the body, and especially with the digestive apparatus. As we have never, however, in what has now become a very considerable experience in the diseases of children, met with a case of spasmodic croup unconnected with more or less evident catarrhal inflammation of the larynx, we are not disposed to risk increasing the confusion already attending this subject, by making additional and more minute varieties of these affections than those above named. We are quite willing to acknowledge that, in some cases of simple spasmodic croup, the amount of catarrhal inflammation of the larynx is slight, and that the symptoms of digestive disorder are very strongly marked, but in not a single instance of croup that has come under our notice, have we ever had reason to suppose that the croupal symptoms were dependent solely on simple spasm of the glottis (caused by some distant irritation), unattended with inflammation of the laryngeal mucous membrane. In all such cases that we have met with, it has seemed to us that the condition of gastric, intestinal, or bilious disorders, might be explained in one of two ways. Either the disorder of the digestive function has rendered the child unusually susceptible to cold, by having diminished its power of resistance to the weather; or, the derangement of the bodily functions caused by the cold has weakened, amongst others, the digestive system, and thus brought about

various symptoms of gastric or intestinal disturbance, or more commonly of indigestion.

ARTICLE I.

SIMPLE LARYNGITIS WITHOUT SPASM.

Definition; Frequency.—This disease consists of simple erythematous or catarrhal inflammation of the mucous membrane of the larynx, unattended with spasmodic closure of the organ. It is sometimes attended with ulceration, but is unaccompanied by exudation of false membrane. The frequency of the disease, during infancy and childhood, is very considerable; so much so, that not a winter passes without our meeting with a good many well-marked cases.

Predisposing Causes.—The disease occurs at all periods of childhood, but seems to be more frequent under than over five years of age. Of sixty-two well-marked primary cases that we have met with in which the age was noted, fifty occurred in children under, and only twelve in those over that age. Of the former class, twelve were under one year, seventeen between one and two, nine between two and three, five between three and four, and five between four and five. Of sixty-four cases in which the sex was noted, thirty-six occurred in boys, and twenty-eight in girls. As to the influence of the seasons, it may be stated that it is by far the most common in the fall, winter, and spring months.

The only *exciting* causes of the disease which appear to have been ascertained with any certainty, are the action of cold, the positive influence of which cannot be questioned; the inspiration of irritating substances, such as gases, smoke, powders floating in the air, etc.; and violent efforts of crying. MM. Rilliet and Barthez state that they have twice known erythematous and ulcerative laryngitis to follow long-continued and violent crying; and M. Billard also cites this as a cause. We are acquainted with one case in which a slight attack of the disease appeared to have been brought on solely by loud and obstinate screaming.

The disease is very apt to occur in the course of other maladies, and particularly of measles, small-pox, scarlet fever, bronchitis, and pneumonia.

Anatomical Lesions.—The anatomical alterations may consist of simple inflammation of the mucous membrane, with its various effects, or of the same changes in connection with ulceration. The latter class of lesions is almost always confined to secondary cases. In the former class, the mucous membrane varies in color between a deep rose and violet red, which may be either uniform or only in patches. In severer cases, the tissue is at the same time softened or roughened, and sometimes thickened. When redness, softening, and thickening are present, the disease is generally confined to certain parts, and commonly to the epiglottis, and internal portions of the vocal cords; but when redness alone exists, it usually affects the whole of the larynx, and sometimes extends to the

trachea. In cases attended with ulcerations, these alterations exist in connection with those already described. The ulcerations are generally small, few in number, very superficial, linear in shape, and are almost always found upon the vocal cords. They are so slight often as to escape observation, unless a very careful examination be made; and this, perhaps, explains the circumstance of so few persons having met with them in the simple acute disease.

Symptoms; Course; Duration.—The attack generally begins with an alteration of the *voice or cry*. In infants the change in the cry alone exists, so that to detect the disease, it is necessary to hear the child cry. In older children the same alteration of the cry is present, but there is in addition a change of the voice, consisting of various degrees of hoarseness. These symptoms may be so slight as to be observed in the cry only when it is strong and forcible, and in the voice so as to strike only the ear of one accustomed to be with the child; or they may be so marked as to be heard in the faintest cry that is uttered, and to be evident in the voice in a moment to the most careless observer; or there may be complete aphonia. They are often intermittent in this form, and are generally most marked in the after part of the day and during the night. Simultaneously with this symptom, or very soon after, *cough* occurs. This is generally hoarse and rough, and early in the attack, dry; at a later period it usually becomes loose, and as this change occurs loses its character of hoarseness. The frequency of the cough is variable, but usually moderate; as a general rule it is most frequent in the evening, and early in the morning, particularly in infants and young children. The disease is almost always preceded and attended with some coryza, which, in the early stage, is marked by sneezing and slight incrustations about the nostrils, and at a later period, by mucous and sero-mucous discharges. The *respiration* remains natural, except that it is sometimes nasal, and sometimes a little accelerated. There is rarely any fever, or it is slight, and occurs only at night. There is no pain in the larynx. In some cases, the hoarseness of the cry, voice, or cough scarcely exists, or is but slightly marked, and the only symptom is a dry, hard, teasing, and paroxysmal cough, which, from its sound, evidently proceeds from the larynx, and resembles very much that produced by the tickling of a foreign body in the throat.

The symptoms of this disease, instead of being of the mild character just described, may be much more severe. The cough is more frequent, hoarse, troublesome, and painful, from the scraping and tearing sensations it occasions in the larynx. The voice is more affected, becoming from husky more and more hoarse, though it is very unusual for it to become weak and whispering, as in membranous and severe spasmodic croup. The respiration is decidedly accelerated, giving rise to slight dyspnœa, and there is more or less fever, which is most marked usually in the after part of the day and in the night. The pulse is more frequent than in health, rising to 120 or 130 in the minute; the skin is hot and dry; the child is thirsty, restless, and uncomfortable. After a few days usually, the cough becomes loose and easy, and ceases to be painful; the voice

loses its hoarse tone gradually, the fever disappears, the appetite and gayety return, and the child regains its usual health.

When the laryngeal inflammation becomes violent in this disorder so as to be attended with considerable swelling of the mucous membrane, the case always, according to our experience, assumes the shape of grave spasmodic laryngitis. To our article upon this latter affection, spasmodic croup, we must refer the reader for further information on this point.

In nearly all the cases of this form of laryngitis that have come under our observation, we have found, upon examining the fauces, more or less decided inflammation of the tonsils, soft palate, and pharynx. In cases following a rather chronic course, from two to four or six weeks, which are rarely accompanied by fever or hoarseness, except at the invasion, and sometimes in the evening, the pharyngeal mucous membrane presented a roughened, thickened appearance, and the tonsils and uvula were more or less enlarged and tumefied.

There is a form of obstinate, troublesome cough, to which children are subject, and of which we have met with a good many examples, that must be noticed here. It depends evidently upon chronic inflammation, with thickening of the mucous membrane lining the upper portion of the larynx. Of this we feel assured, not from any post-mortem examination, since we have never known a child to die of, or while laboring under the affection, but from the tone and character of the cough, from its occasional association with hoarseness of the voice, from its being almost invariably coincident with thickening and granulation of the pharyngeal mucous membrane, and from the fact that the most careful physical examination of the chest fails to reveal any disease whatever of the lungs. The cough is harsh, rough, and, so to speak, tearing in its character. It often sounds, especially towards evening and in the early part of the night, croupal in its tone. It is usually very frequent, not so much, however, during the day, as in the evening and night. It is very generally increased by the horizontal position, so that when the child is put to bed, he will begin to cough violently and almost incessantly, and will continue to do so for one, two, and even three or four hours. The cough is so constant and so severe as to cause the greatest disturbance not only to the patient, who will toss and turn in bed in the most restless manner, but to the mother or attendants, who are excessively annoyed, and sometimes alarmed, by its constancy and obstinacy. Children who become subject to this species of cough, often have repeated attacks during the cold seasons of the year, the slightest exposure sometimes bringing them on. Each attack may last from a few days to several weeks. In one case we knew it to last, without once entirely ceasing, three months, and in another it lasted, with imperfect suspensions of a few days, during the same length of time. Both these cases occurred in hearty boys, one in the second, and the other in the third year of life, and yet both were vigorous and healthy children, as time has shown. In many other instances, we have known it last two, three, and four weeks, proving all that time most troublesome and rebellious to treatment. During the day, the child generally seems perfectly well, or at most merely a little pale and languid, and he coughs but moderately, but

as soon as night comes on and especially when he is put to bed, the cough begins and goes on for hours, as stated above, unless some remedy, and particularly some opiate, be given to check it. It is most annoying to the practitioner, for he finds that his usual remedies act merely as palliatives. They check and modify, perhaps overcome it for a time, but the next change in the weather, and especially the least exposure to cold and damp, start it afresh, and he has to resort again to the same round of treatment to subdue it. To the members of the family also it gives great anxiety. At first, they fear it must run into croup, which, however, it very seldom does, and then, finding how difficult it is of cure, and how often it recurs, they can scarcely be persuaded that it does not depend on some serious disease of the lungs.

The principal *cause* of this form of chronic laryngeal irritation is, so far as we have been able to ascertain, an unusual susceptibility of the laryngeal mucous membrane, sometimes the result of a congenital idiosyncrasy, and at other times the result of influences coming into action after birth, and especially of improper dress. We have generally met with it in children dressed upon the hardening system so much in vogue with many of our most highly educated citizens. The low frock, leaving the neck and upper half of the chest exposed to the air, the bare arms and bare legs, persevered in through our cold autumns, winters, and springs, have certainly, in most cases, been the cause of this troublesome and chronic cough.

Our experience since the publication of the last edition fully confirms the truth of these remarks upon the style of clothing just referred to. We certainly do not see so many cases of obstinate laryngeal cough as we formerly did, for the simple reason that but few of the families we take care of, adhere to the old-fashioned system of leaving their children half naked.

The *duration* of the disease varies according to its form and the circumstances under which it occurs. When primary, it lasts usually from a few days to one or two weeks, but when it becomes chronic, as we have known to happen in a good many instances, it has lasted from two to four or six weeks, and even two or three months. The duration of secondary cases depends, of course, upon that of the disease during which they occur.

Diagnosis.—The diagnosis of simple laryngitis is very easy. The hoarseness of the cry, voice, and cough, the redness of the mucous membrane of the pharynx, and the absence of general symptoms, will distinguish it from any other affection. In somewhat severer cases of this form, in which the cough is more frequent and harassing, the general symptoms more strongly marked, and the respiration somewhat hurried and oppressed, the attack may at first view present the appearances of bronchitis or pneumonia. The absence of the physical signs of these affections will show at once, by negative evidence, the true nature of the case.

In some cases in which there is little or no hoarseness of the voice or cough, the symptoms strongly resemble the early stage of hooping-cough. We have met with five instances in which it was difficult not to believe, for two and three weeks, that the attack was really one of that disease. In one of these the resemblance was so close, that for several days there

was a distinct hoop during the fit of coughing, with vomiting at the close of the paroxysm. The grounds for deciding that the case alluded to was not one of pertussis, were, that the attacks came on like laryngitis, after measles, and that the paroxysms occurred only at night. In the other cases a correct diagnosis was arrived at only by attention to the state of the fauces, which are almost always more or less inflamed and thickened in laryngitis, whilst they are not so in pertussis, and by watching the progress of the sickness.

PROGNOSIS.—The prognosis is always favorable in the mild form of the disease. We have never met with a fatal case.

TREATMENT.—The treatment of the milder cases of this form of laryngitis ought to be very simple. Children under four or five years old ought to be confined for the first few days to the house, unless the weather be dry and not intensely cold. In mild weather they may be sent out for a short time in the middle of the day. When the patient is five or over, he may continue to go out through the day, unless the weather be very bad. Much must depend upon the peculiarities of the child's own constitution. These can only be learned by observation on the part of the mother. Some children bear going out with such attacks perfectly well; others, if sent out with this simple laryngitis, are almost certain to have spasmodic croup or bronchitis more or less severely. When there is any febrile movement in the case, no matter how slight, the child ought to be kept quiet, and confined to the house. Attention to this point, therefore, careful management of the clothing, slight reduction of the diet if there be any fever, a warm foot-bath at night of simple water, or of water containing a little mustard, the application of some slightly stimulating liniment to the front of the neck and throat twice a day, and the occasional internal administration of some gentle expectorant and anodyne dose, constitute all that is necessary in the great majority of cases of this kind. The best internal remedies are a few drops of syrup of ipecacuanha, with paregoric, laudanum, or solution of morphia given every evening as the child is put to bed, or occasionally through the day also, if the cough is troublesome. A combination of syrup of seneka with that of ipecacuanha, will often be found very serviceable.

The treatment of the chronic laryngeal cough, unattended by fever or any severe constitutional symptoms, described above, requires some special remarks. In the first place, we have to state we have seldom succeeded in curing it until we had obtained from the parents their consent (often obtained with great difficulty) to a proper dress for the child. Expectorants, nauseants, opiates, antispasmodics, counter-irritants, and local applications, have nearly always failed to procure more than temporary alleviation, until the child has been dressed warmly. We have cured, on several occasions, this kind of cough, after many ineffectual trials with the above remedies, only by insisting upon a mode of dress which covers the neck, arms, and lower extremities. A merino or soft flannel shirt, with long sleeves and high neck, long merino stockings, and thick muslin or canton-flannel drawers, have done more in such cases to effect a cure than all other means. This style of dress has removed the cause, the constant

chilling of the body, and then the usual therapeutic measures will, no doubt, assist in overcoming the local changes which constitute the disease.

The best therapeutic measures to be adopted in such cases are the application, once a day, of a solution of nitrate of silver, of from five to twenty grains to the ounce, low down into the pharynx and chink of the glottis, by means of a small sponge-mop on a bent whalebone. After several applications have been made daily, they should be made only once in two or three days. The strength of the solution is to be determined by the condition of the pharyngeal mucous membrane, as we may assume this to mark, in some measure, the state of the contiguous tissue of the glottis. When the mucous membrane of the fauces is covered with large, protuberant follicles, when the tissue between the follicles is thickened, relaxed, spongy-looking, and when the color of the membrane is dark-red, the stronger solutions are the best; when, on the contrary, the mucous membrane is not roughened or thickened materially, when the follicles are small, when the color of the tissues is bright-red, it is best to use only the five-grain, or even a weaker solution. The most useful internal treatment in our hands has been the exhibition, three times a day, of one of the following mixtures, preferring that with antimony for a vigorous child, and that without antimony for one less robust.

℞.—Potass. Carbonat., ... ℈j.
Vin. Antimon., ... fʒss. vel j.
Tinct. Opii, ... gtt. xxiv, vel xlviij.
Syrup. Simp., ... fʒj.
Aq. Cinnamom., ... fʒij.—M.
Ft. Mistura.

℞.—Potass. Carbonat., ... ℈j.
Tinct. Opii, ... gtt. xxiv, vel xlviij.
Syrup. Senegæ, ... fʒij.
Syrup. Tolutani, ... fʒvj.
Aq. Fluvial, ... fʒij.—M.
Ft. Mistura.

One of the most troublesome cases of cough we ever met with, occurred a few years since in a fine, intelligent, but not robust boy, four years old. He was seized with a hard, obstinate cough, which, in a few days, became really terrible from its almost incessant repetition for many hours at a time. The cough was dry, tickling, choking, repeated with nearly every breath, and so incessant as to drive the parents—and we may add the doctor—almost frantic. The little fellow at last found out, instinctively, that, by placing himself on the front of the body on two pillows, with the chin hanging over the edge of the upper one, he coughed less frequently, and with less violence, than in any other position. Discovering that the uvula was very much lengthened from relaxation and elongation of its mucous membrane, we touched the lower, sharp extremity with the lunar caustic stick twice a day. At the same time the following mixture, which we had often used to control general nervous irritability in children, was pre-

scribed; and this, with the lunar caustic application, finally controlled the cough. It was as follows:

R.—Vin. Antimonii, ... gtt. xlviij.
Ext. Valerianæ Fl.,
Tr. Opii Camph., āā, ... fʒij.
Syrup. Simp., ... fʒss.
Aquæ, ... fʒj.—M.

S. A teaspoonful every hour or two when the fits of coughing set in.

After a few days, when the irritability of the fauces was somewhat subdued, the elongated portion of the mucous membrane of the uvula was cut off close to the muscle, and there was no renewal of the cough afterwards.

When the cough is very harassing at night, from two to four drops of laudanum, with from ten to twenty drops of syrup of ipecacuanha, or two grains of Dover's powder, given once or twice in the evening, have answered better than any other means. When the patient presents an anemical appearance, or other symptoms marking a general deterioration of the health, iron, and especially the syrup of the iodide of iron, given three times a day, has assisted in removing the cough, and especially in lessening the extreme susceptibility of the system to changes of the weather. The diet ought to be light, but strengthening. Good fresh meat, with simple nutritious vegetables for dinner, and bread and milk morning and evening, constitute the most proper diet. In bad weather, during the cold seasons of the year, the child should be confined to the house.

ARTICLE II.

SPASMODIC SIMPLE LARYNGITIS, OR SPASMODIC OR FALSE CROUP.

Definition; Synonyms; Frequency; Forms.—Spasmodic laryngitis is a disease of the larynx almost peculiar to children, consisting of simple catarrhal inflammation, without pseudo-membranous exudation, of the mucous membrane of that organ, attended with spasmodic contraction of the glottis, or laryngismus, occasioning violent attacks of threatened suffocation.

It is the disease commonly called in this country croup, or, by those who make the distinction between it and pseudo-membranous laryngitis or true croup, spasmodic croup. It is known also by the names of false or pseudo-croup. We prefer the term spasmodic laryngitis, because it is expressive of the essential characters of the disease. It is the stridulous laryngitis of MM. Guersent and Valleix; the stridulous angina of M. Bretonneau; the acute asthma of infancy of Millar; and the spasmodic croup of Wichmann, Michaelis, and Double. It is not the laryngismus stridulus described by

the English authors, Kerr, Ley, and Marsh, which is the same as the thymic or Kopp's asthma of the Germans, and spasm of the glottis of the French. It is called by Dr. Wood, in his work on the practice of medicine, catarrhal croup.

Spasmodic laryngitis is one of the most *frequent* of the diseases which occur during childhood in this country. It is so common in this city, that almost all mothers who have had any experience in sickness, keep some remedy for it in their houses, which they are in the habit of resorting to upon their own judgment.

During the last 20 years we have had under our charge 109 cases of the disease, of which we have kept an accurate record, and at least 100 other cases, of which we have no written account. Of the 109 cases, 86 were of the mild, and 23 of the severe form.

We shall describe two *forms* or degrees of this disease, the *mild* and the *severe*. Without this distinction it would be impossible to give an accurate account of the disorder, since the two forms differ so much in aspect as to render them almost as much unlike as though they were two distinct affections. Moreover, the mild form differs so widely from membranous or true croup in its course and symptomatology, that the distinction between the two is readily made out, whilst the severe form, on the contrary, resembles true croup so much as to demand often very nice powers of observation to distinguish them, and yet the distinction is one of vast consequence to the patient, since the prognosis and treatment are widely different in the two diseases.

Predisposing Causes.—The disease is much more common at some *ages* than others. It occurs most frequently during the period of the first dentition, being more common in the second year of life, which is the time of greatest activity of the first dentition, than at any other age, though it is often met with also in the third and fourth years. In the fifth year it still occurs occasionally, in the sixth and seventh it becomes rare, and after the seventh we have seen it but a few times. Of 106 cases of the disease that we have attended, in which the age was noted, 8 occurred in the first year of life, 33 in the second, 22 in the third, 26 in the fourth, 12 in the fifth, 2 in the sixth, 2 in the seventh, and 1 in the eighth.

It is said to be more frequent in boys than girls, and this seems borne out by our own experience, since of 106 cases, 62 occurred in boys, and 44 in girls.

Spasmodic croup occurs usually as a *sporadic* disease, but is said by some authors to prevail at times as an *epidemic*. We have never had any reason to suppose that it was strictly an epidemic like membranous croup, which appears to a considerable extent in some years, and in others is scarcely seen. We believe rather that the unusual prevalence of spasmodic laryngitis at certain periods, in comparison with others, depends on the fact that certain states of the weather or season predispose or excite to it in a greater degree than usual, and thus occasion a large number of children to be attacked with it.

It is generally believed to be hereditary in certain families, and of this

we ourselves have no doubt. We are acquainted with one family in this city, in which the children for three generations were extremely liable to it; with another, in which the grandmother and grandchildren were frequently attacked; and with a third, in which the father and children showed the same predisposition in the most marked manner. The idea is, moreover, entertained by many people in this community.

The natural constitution of the child does not seem to have much influence upon the liability to the disease; it occurs indifferently in the weak and strong. We have no doubt, however, that there are certain transient conditions of the health which do affect the liability to it, since it has long been remarked that disturbances of the digestive functions frequently invite it, and since we have often ourselves found it most apt to attack those who are liable to it, when they happen to be laboring under bilious disorders or indigestions. It is most common during cold weather.

Exciting Causes; Cold.—By far the most frequent exciting cause is the action of cold; either the passage from a warm into a cold atmosphere, or prolonged exposure to cold and damp. It has been known on several occasions to follow long-continued crying, doubtless from inflammatory action set up in the larynx, as a consequence of the excessive determination of blood to that part during the act of crying. We were assured, some time since, by a very intelligent woman, that her little daughter had, at the age of two years, a well-marked attack of croup, after a severe and long-continued fit of crying from some contrariety.

Anatomical Lesions.—Mild cases of spasmodic laryngitis are so rarely fatal, as to leave us in some doubt as to the character of the anatomical lesions, or whether there are indeed any perceptible alterations of the tissues. We have never ourselves met with a fatal case of this form, and are therefore unable to give any personal account of the condition of the larynx, though we have never doubted, from the nature of the symptoms, the hoarseness, the dry cough, which afterwards becomes loose, and the whole aspect of the disease, that the anatomical condition of the affected organ must be one of slight inflammatory hyperæmia. In some cases, however, that have been examined, a little mucus in the larynx, and slight redness have been found, while in others no change has been detected. Dr. Wood (*Treat. on the Prac. of Med.*, vol. i, p. 779) accounts for this absence of morbid appearances in the following plausible manner: "In some rare instances, no signs of disease are discovered in the mucous membrane, and the patient has probably died of spasm, consequent upon high vascular irritation or congestion, the marks of which disappear with life."

Cases of severe spasmodic croup have not unfrequently proved fatal, and the anatomical alterations of this form of the disease have therefore been well ascertained. These alterations consist of either simple catarrhal inflammation of the laryngeal mucous membrane, or of inflammation attended with ulceration. When the inflammation is simple, the membrane is changed in color, either uniformly or in spots, to a deep rose or dark-red tint. This may be the only alteration, or the tissues may be found also softened, or roughened and thickened. When the redness, thickening, and softening, are all present, these appearances are usually confined

to certain parts, and particularly to the epiglottis and vocal cords, but when redness alone is present, it generally affects the whole of the larynx, and may extend to the trachea. To the alterations just described are sometimes added, as was stated above, ulcerations. These are commonly small, few in number, of a linear shape, and are usually seated upon the vocal cords. They are so slight as to escape observation, unless carefully looked for.

Symptoms; Duration.—The invasion of the *mild form* of spasmodic croup is generally very sudden, for though it is often, probably in a large majority of cases, preceded for a few hours or a day or two by slight coryza, hoarseness, and cough, these symptoms are seldom noticed at the time, and the child is not supposed to be sick until seized with the paroxysm of suffocation, which is pathognomonic of the disease. This occurs in much the larger number of cases during the night, and very generally wakes the child from sleep. Of sixty-four cases observed by ourselves, in which the time of the attack was noted, it occurred in the night in sixty-two, whilst in two it came on in the afternooon. The period of the night at which it takes place is very irregular, but it is much more apt to be before than after midnight, as is shown by the fact that of forty-two cases in which this circumstance was ascertained, the attack was before midnight in thirty, and after in twelve. This agrees very closely with the statement of MM. Rilliet and Barthez, that it has been observed most frequently at eleven in the evening. The duration of the paroxysms varies considerably, and depends a good deal upon the treatment employed. They may last from a few minutes to several hours, but are seldom shorter than from half an hour to an hour. The number of the attacks also varies. In some cases there is but one, though very generally there are several. When the attack occurs early in the night, it is very apt to recur again towards morning, and, unless means of prevention are used, on the following night also, and even, though this happens much more rarely, on the third night. As a general rule, the first attack is the most severe.

When the paroxysm comes on, the child is wakened from sleep by the sudden occurrence of symptoms apparently of the most alarming and dangerous character. These consist of loud, sonorous, and barking cough; of prolonged and labored inspiration, accompanied by a shrill and piercing sound, to which the term stridulous is applied; of rapid and irregular respiration, amounting often to violent dyspnœa, or seemingly impending suffocation; the child, alarmed and terrified at its condition, and at the fright of those around, its countenance expressive of the utmost anxiety, cries violently between the attacks of coughing, and begs to be taken on the lap, or sits up or tosses itself upon the bed, struggling apparently with the disease, which seems for the moment to threaten its very existence. The voice and cry are hoarse, and sometimes almost extinguished during the height of the paroxysms, but become distinctly audible, and often nearly natural, in the intervals between them; differing in this respect from pseudo-membranous croup, in which they remain permanently hoarse or whispering. We have never heard, in this disease, the whispering voice and the short smothered cough of true croup. The face, head, and neck, are at

first deeply flushed, and as the paroxysm becomes more violent, assume a dark livid tint, which afterwards passes into a deadly paleness, if the attack be long continued. These changes in the coloration depend upon the arrest of the respiratory function and a consequent partial asphyxia. The pulse is frequent during the paroxysm, and the skin sometimes heated. After a longer or shorter period, generally from half an hour to an hour, the respiration becomes more tranquil; the stridulous sound disappears entirely, unless the child be disturbed and made to cry, when it again becomes distinct; the cough is less frequent and less boisterous, and the child generally falls asleep. The attack is very apt to recur towards morning, as has been stated, and if not then, the following night. The patient often seems perfectly well the day after the first paroxysm, with the exception, perhaps, of slight cough. This is no reason, however, for supposing that the disease will not return in the course of the second night, which is almost sure to happen, unless measures be taken to prevent it. The cough generally continues for a day or two, but soon loses the peculiar character expressed by the term croupal; it becomes less frequent and more loose, and the child is commonly well again in two or three days. Sometimes, however, the cough lasts for several days, becoming gradually less frequent, until at last it ceases entirely.

There is very little fever in mild cases, for though the pulse is accelerated and the skin warm during the paroxysm, these symptoms disappear very soon after that is over. In more severe cases, on the contrary, there may be considerable fever, the pulse becoming frequent and full, and the skin hot. The febrile movement is most apt to occur after the first paroxysm, as a consequence, apparently, of the slight catarrh which remains after the attack.

In the few fatal cases on record, the paroxysms have generally become more frequent and more violent by degrees, and death has occurred from suffocation. In other instances, death has been the result of prostration, which itself has probably depended on imperfect hematosis.

Recurrences of the disease are very common, children sometimes having several attacks in a single winter. This is not the case in true croup. We have known but two children to have a second attack of that disease.

The *severe form* of spasmodic laryngitis may begin as such or result from an aggravation of the mild form; or the case may commence as one of simple laryngitis without spasm of the glottis, and as the intensity and extent of the laryngeal inflammation increase, it may assume all the features of the form under consideration. Whatever be the mode of onset of the case, this form of the disease sets in with hoarse, frequent cough, difficult respiration, restlessness, and more or less violent fever, symptoms which almost always become severe for the first time at night, and usually between early evening and midnight; though, in some few cases, they make their first appearance during daylight, and this is very much more apt to happen in this than in the mild form of spasmodic croup. During the night the symptoms increase in severity; the respiration is frequent and difficult, and, after a time, attended with the stridulous sound in inspiration and expiration caused by narrowing of the glottis; the cough is

hoarse, dry, and croupal, and unattended with expectoration; the voice becomes hoarse, and fever sets in, the pulse becoming full and frequent, the skin hot and dry, and the face flushed. These symptoms persist, with greater or less severity, throughout the night, while from time to time, they increase to such an extent as to seem to threaten suffocation, resembling then exactly the paroxysms described as occurring in the mild form of the disease. They usually subside, however, very decidedly towards morning, the breathing becoming easier, the stridulous sound less loud, or ceasing altogether, the fever diminishing, and the patient becoming in all respects much more comfortable. This amelioration of the child's condition often continues until the after-part of the day or till evening, when the same train of symptoms reappears. In other cases the disease scarcely subsides at all for two, three, or four days, but continues throughout the day and night to exhibit the same symptoms as have been described above. In cases of this kind, which are not rare, the disease assumes many of the alarming and dangerous characters of pseudo-membranous laryngitis or true croup, and it becomes very difficult often to distinguish between the two. If no favorable change take place, the dyspnœa becomes so violent as to threaten suffocation; the cough is rare and short; the voice is reduced to a mere whisper; the pulse becomes small, extremely rapid and thready; the countenance, at first livid and congested, assumes a pale, cadaveric appearance; the features are contracted; the child becomes comatose or delirious, and death occurs from slow asphyxia, or sometimes in an attack of general convulsions.

In favorable cases, on the contrary, the dyspnœa, and especially the stridulous sound, diminish; the cough becomes loose, less hoarse, and loses its croupal character; expectoration of mucous sputa takes place in older children, whilst in younger, the loose gurgling sound produced by the discharge of the sputa into the fauces, is heard at the termination of each cough; the voice becomes clearer and stronger; the fever diminishes; the child regains its spirits and disposition to be amused; and soon all dangerous symptoms have disappeared, and the recovery is established.

In nearly all the cases that have come under our observation, we have found, upon examining the fauces, more or less decided inflammation of the tonsils, soft palate, and pharynx.

The *duration* of the *severe form* of spasmodic croup depends on the violence of the attack, and on the mode of treatment. When the treatment is begun with from an early period, the disease is much sooner overcome than when allowed to run on for some time without remedies. In cases of moderate severity, the violence of the symptoms usually subsides after thirty-six or forty-eight hours. In more violent cases, on the contrary, the symptoms seldom subside definitively before the third, fourth, and not unfrequently the fifth day. In no case that has come under our observation, has the disease continued to present dangerous symptoms after the fifth day, unless, as not unfrequently happens, the inflammation spreads to the bronchia or tissue of the lungs, producing bronchitis or pneumonia. But even after the signs of severe laryngeal inflammation have disappeared, there almost always remains for several days longer, some cough

and huskiness of the voice, marking that the mucous membrane of the larynx has not yet regained completely its healthy condition. The disease is said to have proved fatal in twenty-four hours.

Nature of the Disease.—Authors hold very different opinions as to the nature of spasmodic laryngitis. By Underwood, Dewees, and Eberle, it is confounded with membranous laryngitis, they making no distinction between false or catarrhal, and true or membranous croup. Dr. Cheyne (*Cyclop. Pract. Med.*, Art. Croup) treats of the two affections as one and the same disease, differing only in their degree of violence. Dr. Copland (*Dict. of Pract. Med.*, Art. Croup) describes spasmodic croup as a variety or modification of true or membranous croup. He supposes that the modifications of true croup are attributable to "the particular part of the air-passages chiefly affected, to the temperament and habit of body of the patient, and the intensity of the causes." It seems to us, however, that these views as to the nature of the two diseases are not correct, and we are induced by personal observation to regard them as distinct affections, which may, in the great majority of cases, be distinguished from each other at a very early stage, by a careful observer. The comparative fatality of the two diseases alone is sufficient to establish a wide difference between them. Thus, of 35 cases of the pseudo-membranous form that we have seen, 16 died; while of considerably more than 200 cases of the spasmodic form that we have seen, not one has been fatal. M. Guersent states that of ten cases of the former disease, scarcely two escape; while of upwards of a hundred of the latter that he has seen, not a single one was fatal. (*Dict. de Med.*, t. ix, p. 365.)

The different effects of treatment in the two affections also point to a wide difference in their nature. True croup is almost inevitably fatal, unless attacked at an early period by energetic remedies, while the mild spasmodic form seldom resists the exhibition of an emetic, a warm bath, or of nauseating doses of ipecacuanha or antimony; and the severe form, though of a most threatening appearance, almost always yields to the proper employment of very moderate local depletion, aided by the use of expectorants, emetics, opiates, and correct hygienic means. When we add to these circumstances, the differences in the anatomical alterations in the two diseases, the difference in the mode of invasion, in the cough, voice, cry, fever, duration of the attack, and state of the constitution, all of which will be carefully described in the remarks on diagnosis, we do not see how we can resist the conclusion that they are two distinct disorders, and not, as was formerly generally asserted by English writers, degrees or modifications of the same.

We believe, therefore, that mild spasmodic laryngitis is a disease consisting in slight catarrhal inflammation of the mucous membrane of the larynx, attended with violent spasmodic contraction of that organ, or, as that condition has been called of late, laryngismus. The spasm of the laryngeal sphincter seems to be the result of a disordered action of the excito-motor innervation of the part, the irritant, which is productive of the morbid innervation, being, in all probability, the inflammation of the laryngeal mucous membrane, which has been already stated to constitute

one element of the malady. The nervous element predominates in the early part of the attack, but towards the conclusion, the spasmodic symptoms disappear entirely, and we have left only those which depend on the local tissue-changes.

In severe cases of the disease we have the same element of laryngeal spasm, or laryngismus, coincident with, and produced by, a much more intense and dangerous inflammation of the mucous membrane of the part than exists in the mild form.

Diagnosis.—Unquestionably the disease with which spasmodic laryngitis is most likely to be confounded is pseudo-membranous laryngitis, or true croup. There is very little difficulty, however, in distinguishing the mild form of spasmodic croup from true croup, whilst in regard to the severe form, it may be safely stated, that the distinction cannot, in some cases, be made with positive certainty, except by watching the course of the sickness.

Mild cases of spasmodic croup may be distinguished from membranous croup by a comparison of the different symptoms as they arise. The most important of these are: the invasion, in one sudden and almost invariably in the evening or night, in the other slow and creeping, the paroxysm first occurring indifferently day or night; the cough, in one hoarse and boisterous, in the other hoarse and frequent at first, but rare and smothered towards the end; the voice, in one hoarse, but never scarcely whispering, and if so, only during the height of the paroxysm, in the other hoarse at first, and soon permanently whispering or entirely lost; the cry, in one hoarse and stridulous only at the moment of the paroxysm, in the other permanently so; the respiration, in one stridulous and difficult only during the paroxysm, and in the interval perfectly natural, in the other, at first natural, becoming by degrees permanently stridulous, and attended by the most violent dyspnœa, with remarkable prolongation of the expiration, and even with recession of the base of the thorax in inspiration; the fever, in one very slight and generally observed only during the nocturnal paroxysm, in the other much more considerable and permanent; and lastly, the duration, in one seldom more than two or three days, in the other rarely less than six, and very often eight or ten days. M. Trousseau states that the *hoarse-sounding croupal* cough is not a sign of the presence of exudation in the larynx, but rather of its absence; but, "when the cough, croupal at first, becomes less and less frequent, and ends with being nearly insonorous with suffocation, there is true croup, that is to say, with plastic exudation in the larynx." This is precisely our own experience. The rare, insonorous cough of M. Trousseau is the condition which we have expressed by the term smothered.

In order to render the diagnosis still clearer, we add the following table, which is altered from one given by MM. Rilliet and Barthez:

MILD SPASMODIC LARYNGITIS.	PSEUDO-MEMBRANOUS LARYNGITIS.
Begins with coryza and hoarse cough, or more frequently with a sudden attack of suffocation in the night. Fauces natu-	In epidemic form, begins as pseudo-membranous angina. In sporadic form, invasion of slight hoarseness for a day

MILD SPASMODIC LARYNGITIS.	PSEUDO-MEMBRANOUS LARYNGITIS.
ral, or merely slight redness, as in simple angina.	or two. There is fever, increase of the hoarseness, with hoarse, croupal cough; in most of the cases, pharyngeal exudation, and a little later, paroxysms of suffocation.
After the paroxysm, the child seems well, the fever disappears, or is very slight. Voice natural, or only slightly hoarse; not whispering.	The fever continues; stridulous respiration; prolonged and difficult expiration; recession of base of thorax during inspiration; cough hoarse and smothered; voice hoarse and whispering.
If the paroxysm returns, it is during the following night, and it is less severe; the hoarseness disappears; the cough becomes loose and catarrhal.	The dyspnœa and suffocation increase; the voice and cough are smothered or extinguished; stridulous respiration persists.
Duration seldom more than three days.	Duration seldom less than five or six days. The hoarseness continues for several weeks.
Very rarely fatal.	Fatal in the majority of the cases.

The only real difficulty in the diagnosis is the distinction between the grave form and pseudo-membranous laryngitis or true croup unconnected with angina; and this, it would appear from all evidence, cannot in some cases be made with absolute certainty. The only certain and indubitable sign by which to distinguish them is the presence of false membranes in the expectoration. The existence of this symptom is proof positive of pseudo-membranous disease, but its absence is no proof that the case must be one of simple inflammation; for, even though the membrane has been exuded in large quantities within the larynx, it is not always thrown off by the effort of coughing or vomiting. To show the difficulty of the diagnosis, we will cite the case quoted by M. Valleix (*loc. cit.*, t. i, p. 211) from M. Hache, of a child supposed to be laboring under true croup, who was sent to the Children's Hospital in Paris, in order to have the operation of tracheotomy performed. The absence of false membrane in the expectoration, and a slight remainder of clearness in the voice, occasioned the suspension of the operation. The child died, and no pseudo-membrane whatever was found in the larynx. The only lesions were moderate redness of the mucous membrane, without tumefaction, and without narrowing of the glottis; so that the fatal termination must be ascribed to spasmodic constriction of the glottis, or to tumefaction of that part, which had disappeared after death.

Nevertheless, though the diagnosis is difficult, it can almost always be made out with certainty by attention to the following points. The pseudo-membranous form of the disease is usually preceded or accompanied by the presence of false membranes in the fauces, which is not the case in spasmodic simple laryngitis; the symptoms of invasion of the former disease are less acute than those of the latter, the fever being less violent, and the restlessness and irritability less marked, than is usual in the simple affection, in which the general symptoms are decided from the first. The hoarseness of the voice and cough follow a different course in the two dis-

eases; the progress of these symptoms being slow and gradual in the membranous, and much more rapid in the severe spasmodic form. The fever is marked throughout the attack in the severe spasmodic disease, whilst in the other form it seldom reaches a high degree of intensity. Lastly, the presence of portions of false membrane in the expectoration, in connection with the laryngeal symptoms, affords positive evidence of the existence of true croup.

Of the characters just enumerated as likely to aid us in distinguishing between severe spasmodic and true or membranous croup, we wish to call the reader's attention in greater detail to two,—the condition of the voice, and the stridulous respiration. The former is, we have no doubt, much the most important single symptom. In membranous croup, the voice begins by being hoarse, but soon becomes weak, so that after the disease has lasted three or four days, it changes from hoarse to whispering; it becomes, in fact, suppressed. In severe spasmodic croup, the voice is hoarse at first, and becomes more so as the disease goes on, but it very rarely becomes whispering as in true croup, but almost always retains a good volume, so that when urged the child can speak out loudly. Now this is never the case in the membranous disease, for, as the fibrinous exudation is deposited on the vocal cords and in the ventricles of the larynx, it suspends almost entirely the functions of those parts, and the voice is more or less completely suppressed. The remarks just made in regard to the voice will apply also to the *cry*, which should be carefully studied in young infants.

The second very important symptom is the stridor. This is, as might be expected, more marked in all its features in true than in false croup, since in the former it depends on a permanent and considerable obstacle to the passage of the air through the larynx. That tube is, in fact, completely coated over upon its internal surface, with a more or less thick false membrane, which reduces materially its calibre, and impedes to a greater extent the passage of air, than does the mere inflammatory turgescence and swelling of the mucous membrane of the organ in severe spasmodic croup. On this account, therefore, the stridor in the respiration is louder, shriller, more persistent, more marked in the expiration, and attended with greater effort of the respiratory muscles to overcome the obstacle to the passage of the air in membranous than in severe spasmodic croup. We may add that there is something very peculiar in the cough in true croup. When the membrane has come to cover the interior of the larynx, the cough is very distinctive; it has a sound which we can describe only by saying that it always reminds us of the sneezing of a young kitten. This we have never heard in catarrhal croup, no matter how severe.

To conclude, there is in membranous croup a slow, steady, and unrelenting progression of the symptoms, which is not observed in the spasmodic disease. From hour to hour, from day to day, we can perceive, so to speak, from the gradual and steady march of the disease, that a foreign body in the form of a fibrinous moulding is being spread slowly over the cavity of the larynx. In severe spasmodic croup, on the contrary, the

course of the symptoms is less regular; paroxysms of suffocation occur as in true croup, but when these are over, the child is often quite comfortable; the symptoms indicating a much less considerable permanent mechanical obstruction than in the other affection.

Spasmodic laryngitis has been mistaken also for laryngismus stridulus. The manner in which it is to be distinguished, will be described in the article on that disease.

Prognosis.—Spasmodic catarrhal laryngitis is very rarely a fatal disease. Of its two forms, there can be no doubt that the severe is much more dangerous than the mild, since in the former the patient labors under acute inflammation of the larynx, as well as under spasm of that organ; whilst, in the latter, the amount of inflammation is so very slight as to be of little or no consequence, were it not associated with the laryngismus, which gives to the disorder its most characteristic features.

Of 109 cases of the disease of which we have kept an accurate record, none proved fatal, though 23 of these were of the grave form. We may state, also, that we have seen at least 100 more cases, of which we have no written account, in none of which was there a fatal termination. We have, therefore, never seen a case of croup without false membrane prove fatal. That it does sometimes end unfavorably, however, cannot for a moment be questioned. There are various examples of the kind scattered through the medical journals. MM. Rilliet and Barthez quote, in proof of this, two cases from the work of Jurine, in one of which an autopsy was made, and no false membrane discovered. Copland (*loc. cit.*) remarks, that in the few cases of the more purely spasmodic forms that he has had an opportunity of examining, an adhesive glairy fluid, with patches of vascularity on the epiglottis and larynx, and a similar fluid in the large bronchi, were the only alterations observed.

Great imminence of danger in any case is shown by a high intensity of the stridulous sound, especially as heard in the expiration; by great severity of the dyspnœa or suffocation; by permanently whispering voice; by lividity or extreme paleness of the face; by smallness and rapidity of the pulse; by coldness of the extremities; and by delirium or convulsions.

Treatment.—M. Guersent (*loc. cit.*, pp. 367, 368) states that demulcent and mucilaginous drinks, with stimulating hand-baths and foot-baths, are the principal means that ought to be employed in the treatment of spasmodic laryngitis, or pseudo-croup. He proscribes the use of emetics and leeches as unnecessary in most cases, and is of opinion that they have come into general use, in the management of the disease, in consequence of its having been generally confounded with true croup. In a paper on croup, by the late Dr. Charles D. Meigs (*Med. Exam.*, vol. i, p. 398), may be found the following statement in regard to the spasmodic variety: "The croup sound often ceases entirely, and never returns after the exhibition of a small quantity of ipecacuanha, or any other emetic substance, even when no emesis is produced." He says in another place, that "a foot-bath with mustard, and an emetic of ipecacuanha, is in general all that is necessary for the cure."

In giving our own experience in regard to the treatment of this disease, we shall speak first exclusively of the mild, and then of the severe form, since the measures proper and necessary in the one, are very different from those called for in the other.

Treatment of the Mild Form—*Emetics.*—The great majority of cases will recover perfectly well under the use of emetics employed alone, or in combination with warm baths and revulsives. Of late years we have often succeeded in warding off the slight attack, where there has been good reason to expect it, by the administration of an opiate with syrup of ipecacuanha, at bedtime (early in the evening). At two years of age, three or four drops of laudanum, with ten to twenty drops (according to the gastric susceptibility) of syrup of ipecacuanha; at three or four years, five drops of laudanum with twenty of the ipecacuanha, are about the proper doses. Even when the child has had one attack early in the night, the use of the opiate is most successful, after vomiting, in preventing the usual return towards morning. If the physician is not called until the day after the first attack, this treatment is excellent in the evening of the second day. In cases attended with violent dyspnœa, hoarse cough, and loud stridulous respiration, the emetic should be given until it produces a full effect. In milder cases, in which there is merely loud croupal cough, with an occasional stridulous sound, nauseating doses alone will generally suffice. The most suitable emetic is, as a general rule, ipecacuanha. The best preparation for children is the syrup, of which from twenty to thirty drops may be given to those two years of age, to be repeated every ten or twenty minutes until vomiting is produced, or until the paroxysm is relieved. In very sudden cases, the Syrupus Scillæ Compositus, which is more active in its effects in consequence of the tartar emetic which it contains, might be preferable; about twenty drops of this may be given, and repeated every ten or fifteen minutes, until vomiting or the resolution of the paroxysm is obtained; but, in its employment, care should always be observed not to continue it for too long a time, lest it produce the injurious effects of tartar emetic. Of late years we have almost entirely abandoned the use of this latter emetic, as we succeed perfectly well with the ipecacuanha, and dislike more and more the antimonial preparation in children. When the dyspnœa is very urgent, or when other means fail to produce emesis, we have found nothing so effectual as powdered alum, in doses of a teaspoonful mixed with honey or molasses. (See *Treatment of Pseudo-membranous Laryngitis.*)

A simple and good method of treating the paroxysm is that recommended by Dr. Charles D. Meigs, in the paper referred to. It is to direct a small teaspoonful of powdered ipecacuanha to be diffused in a wineglassful of water, of which mixture doses of a teaspoonful are to be given every ten, fifteen, or twenty minutes, according to the urgency of the symptoms. This is a plan of treatment often resorted to by parents in this community, where the disease is so common and so well understood, that there are few mothers who have several children, and who have had some little experience, who do not know how to treat a nocturnal attack of mild spasmodic laryngitis.

A very simple and efficient mode of treating the paroxysm, which was first recommended by Graves, consists in gently pressing a sponge soaked in warm water under the chin and to the front of the neck. This may be repeated every ten or fifteen minutes, and under its influence the croupy symptoms will often promptly subside without the use of an emetic.

After the paroxysm is relieved, it is a good plan to direct five or ten drops of the ipecacuanha syrup to be given every two or three hours during the following day; or, if the child seems perfectly well in the morning, we may begin with these doses in the middle of the day, and continue them until bedtime. By this method, the recurrence of the paroxysm during the second night may, we think, often be prevented, and the cough is rendered free and loose much sooner than when the disorder is left to pursue its natural course. Moreover, the child ought to be kept in the house during the next two or three days, or until the cough is thoroughly loose and easy. If the child be at all a delicate one, or one in whom the disorder is prone to be obstinate, there is no plan so good as to make it sit or lie quietly in bed, sufficiently covered, with a large abundance of playthings, or with a kind nurse to read to and amuse it for two or three days.

Baths.—The warm bath is a very prompt and useful remedy in the disease. In all very violent cases, it ought to be resorted to immediately. It should be used also whenever the emetic fails to relieve the urgency of the symptoms, and in cases attendant with much disturbance of the circulation. The temperature of the water ought to be about 95° Fahrenheit, when the child is first immersed, to be raised gradually by the addition of hot water, to 100° or 102°. The child may remain in the bath from ten to twenty minutes.

Revulsives.—The only revulsives that it can be necessary to employ are mustard foot-baths or mustard poultices applied to the interscapular space; and even these are often needless if the emetic be given. Blisters, which are recommended by some of the French writers, can only be proper in rare cases of the grave form.

Purgatives are required when constipation is present, or when there is so much fever on the second or third day, as to show a considerable amount of laryngeal inflammation. Under the latter circumstances some mild remedy of this class may be resorted to with a view to its evacuant effect. We have never had occasion to employ any of the *mercurials*, and believe them to be unnecessary.

Opium is exceedingly beneficial when the emetic, nauseant, or warm bath has failed to relieve entirely, and when a troublesome croupal cough continues after the spasm has been overcome. Laudanum, paregoric, or solution of morphia, in combination with syrup of ipecacuanha or Dover's powder alone, are the most suitable preparations. It is a very good plan to give the child a moderately full dose of the opiate, with ipecacuanha, after the violence of the paroxysm has subsided. It puts the child to sleep, promotes perspiration, softens the cough, and tends to prevent the return of the spasm. Repeated once or twice early in the second night after the first attack, we believe it often assists materially to avert the recurring nocturnal paroxysm.

Treatment of the Severe Form.—This form of spasmodic laryngitis requires more active measures than the mild form of the disease.

In some of the former editions of this work, *bloodletting* was recommended when the disorder occurred in robust and vigorous children, and a record was given of the employment of venesection in seven out of twenty-three cases, all of which recovered. Since that report we have learned that depletion is less necessary than we formerly supposed, and, as we can still say that we have never yet seen a fatal case of spasmodic croup, either simple or severe, it is fair to conclude that the disease can be safely managed without a resort to this more violent measure. Still, it is but proper to state, that should a case occur to us in a strong and healthy child, in which the breathing should become so much obstructed as to cause deep and alarming venous stasis, and in which these symptoms resisted the more simple means we now employ, we should not hesitate again, as in former years, to employ a venesection to the extent of four ounces at the age of four or five years, or a leeching to the same amount.

Our favorite remedies of late years have been *emetics*, *opiates*, *salines*, and the *sulphurated antimony* of the recent Pharmacopœia. When the patient is a vigorous child, and over a year old, we generally employ the following combination:

℞.—Antimon. Sulphurat., ... gr. j.
Pulv. Doveri, ... gr. iij.
Sacch. Alb., ... gr. xij.
M. et div. in chart. xij.

Of these powders one may be given every two, three, or four hours, care being taken to suspend the antimony when it produces any of the peculiar distress or general prostration to be described in the article on pneumonia. In such a case, we use one of the following combinations:

℞.—Potass. Citrat., ... ʒj.
Syrup Ipecacuanhæ, ... fʒij.
Tr. Opii Deodorat., ... gtt. xij.
Syrup Simp., ... fʒij.
Aq., ... fʒiss.—M.
Dose for a child two years old, a teaspoonful every two hours.

Or:

℞.—Ammoniæ Muriatis, ... gr. xxiv.
Ammonii Bromidi, ... ʒj.
Syrup Ipecacuanhæ, ... fʒiss.
Syrup Zingiberis, ... fʒijss.
Aquæ, ... fʒiss.
Ft. sol. Dose for a child two years old, a teaspoonful every four hours.

In older children, both the potash and opiate may be doubled. In all these cases an emetic ought to be given once, or two or three times in twenty-four hours, when the dyspnœa and stridor become very severe; and in about an hour after its operation, the saline dose should be resumed. Of course, if decided drowsiness supervene from the opiate, the doses must

be given at longer intervals. The emetic treatment is not so essential as in true croup, where it is so useful in causing the rejection of the false membrane which obstructs the larynx. Yet it is exceedingly useful, and often indispensable, in assisting to expel the viscid mucus secreted within the larynx, and in relaxing, for a time at least, the spasmodic constriction of the glottis, which plays a most important part in the production of the distressing dyspnœa and suffocation of the disease. They act probably also by lessening immediately, or through their action on the circulatory and nervous systems, the inflammation of the larynx. For their choice and mode of administration, the reader is referred to the article on true croup.

Purgatives are required merely to keep the bowels soluble; they should be repeated as may be necessary throughout the disease. If the bowels are moved every day or every other day spontaneously, there is no use in giving them at all. The most suitable are castor oil, rhubarb, or magnesia, in small doses; or an enema may be given from time to time if the child does not resist its application.

Expectorants are useful after the violence of the disease has been moderated by more energetic remedies. They may consist of small doses of ipecacuanha, of antimonial wine and sweet spirits of nitre, of decoction of seneka, snakeroot, or of the citrate or carbonate of potash.

Opiates are necessary, and are serviceable, as has already been stated, in calming excessive restlessness, and in allaying the violence of the suffocative attacks, which depend, in good part, on spasm of the glottis. The most suitable are Dover's powder or some other preparation of opium, or small doses of belladonna, or hyoscyamus.

Belladonna would seem, from its power to relax the sphincters, and from its excellent effects in hooping-cough, to be indicated in this disease, but we have succeeded so well with opium that we have not often used belladonna. Probably a combination of the two would be found beneficial.

A warm *bath* at 97° or 98°, employed once or twice a day, and continued for a period of ten or fifteen minutes, often assists greatly in lessening the sufferings of the child, in calming restlessness, and in moderating the heat of skin, and violence of the circulation, when the latter symptoms are strongly marked. The same effects may often be obtained by the use of *counter-irritants*, as sinapisms, mustard poultices, mustard foot-baths, etc. *Blisters* are of doubtful propriety in any cases.

Hygienic Treatment.—In either form of the disease the child should be placed for the time in a warm room, and warmly clothed. If old enough, it ought to be kept as much as possible in bed during the paroxysm. If so young as to prefer the lap of the nurse, it should be clothed in a long loose wrapper in addition to its usual night-dress. It is very important to confine the child during the whole term of the acute period in the bed, if it is over three or four years old, and in the crib or lap if it be younger. Even after the cessation of the acute condition, it ought to be kept in the house for a few days, in order to make sure of the convalescence. The diet must be simple and of easy digestion, so long as there is any disposition to recurrence of the disease. It may consist of preparations of milk,

of bread, rice, or of thin chicken or mutton water. Meat and most vegetables had better be avoided until the convalescence is fairly established.

Prophylactic Treatment.—It is certain that much may be done by a wise attention to physical education, to prevent attacks of the disease in children who show a liability to it. We would strongly recommend, with this view, attention to the following advice given by M. Guersent, who says (*loc. cit.*, p. 381): "It is possible, to a certain extent, to prevent attacks of pseudo-croup, if we fortify the constitutions of children, by exposing them well-clothed to a dry and elastic atmosphere, particularly if they can be kept in constant movement. But of all the precautions which have been found unquestionably advantageous, that which seems most useful is to make them sleep in well-ventilated, dry, carefully closed chambers, having a southern exposure, and always without fire. We have several times been convinced of the utility of this habit in families the children of which were subject to this kind of catarrh."

There can be no doubt that the style of dress used for children in this country, must occasion many and repeated attacks of croup which might just as well have been avoided. The custom is to dress children between the ages of one and four or five years, in such a way as to expose to the air the whole of the neck and the upper half of the thorax (for the dresses are made so low and loose at the shoulders, as to leave the upper part of the chest virtually uncovered). The arms are left bare, as are also the legs from the knee, or above the knee, to the ankle, so that very nearly half of the cutaneous surface is without covering, and this too, in the very same rooms and temperature in which sit the parents with the body and limbs warmly clothed to resist our climate, at all seasons changeable and uncertain, and, in the winter, very cold. We are perfectly well convinced that this faulty and unreasonable system of dress, which is chosen because it is the fashion, or in order to *harden* the child, who, however, invariably puts on warm clothing when it comes to years of discretion, will explain in part the enormously greater frequency in children than in adults, of the various diseases of the air-passages and lungs produced by cold.

One of the most important means of prevention, therefore, is the adoption of a suitable dress. In winter this should consist of one that shall cover the body completely. If the child be at all delicate, it ought to wear next to the skin a woollen jacket with long sleeves, and covering the chest to the neck. Over this should be put a long-sleeved stout muslin dress, or one of some light woollen material, made in the same style. In young children, the stockings ought to be of wool, and should reach to the knees; in older ones, they may be shorter, but the legs should be covered with drawers made of canton flannel, of thick cotton stuff, or of light woollen flannel. To show the influence of dress, Dr. Eberle mentions the fact that in the country, and especially amongst the Germans, who cover the neck and breast, croup is a very rare disease. During a practice of six years amongst that class of people, he met with only one case of the disease.

When the liability to the disease continues after the completion of the first dentition, we have found the daily use of the cold bath, in connection

always with warm clothing, most useful in preventing the attacks. The bath must be commenced with in the summer, and persevered in through the following winter. The water, after the cold weather begins, should be drawn in the evening, allowed to stand all night in a room in which there is a fire through the day, and made use of on the following day. Prepared in this way, we have found the water in the morning at a temperature of between 50° and 60° F. The child ought to be kept in the water only half a minute or a minute, then well rubbed, and dressed immediately.

When the child is pale, weak, and feeble, and unable to bear exposure to the outer air, it may generally be restored to much better health by careful attention to diet, and by the steady and long-continued use of some tonic remedy. The diet ought to consist of bread and milk, and of meat and the simpler vegetables, as potatoes and rice. The tonics most generally suitable are quinine or iron. Of the quinine a grain may be given in pill or solution, twice or three times a day; while at dinner or lunch, or at both, the child should be made to drink from a dessert to a tablespoonful of port wine, mixed with water. This method ought to be steadily persevered in for from three to six weeks or longer. If quinine be objectionable for any reason, iron must be substituted. The best preparations are the iodide or the metallic iron.

ARTICLE III.

PSEUDO-MEMBRANOUS LARYNGITIS, OR MEMBRANOUS OR TRUE CROUP.

Definition and Synonyms.—Pseudo-membranous laryngitis is an acute inflammation of the mucous membrane of the larynx, attended with the exudation of false membrane.

It is the croup of the French writers, while, in this country, it is called by the various names of slow, creeping, true, membranous or inflammatory. The term given above seems most suitable, as expressive of the real nature and seat of the disease, and we shall, therefore, make use of it in contradistinction to that of spasmodic laryngitis or spasmodic or false croup, which is a much more common and less dangerous affection.

Nature and Relations.—Since the publication of our last edition, the questions of the essential nature of membranous croup and its relations with diphtheria have been actively discussed, and it has appeared that there are marked differences in the opinions held by the best authorities. In the present state of the discussion, it is improper to attempt any dogmatic assertions on the points at issue, but it seems desirable to restate fully the views we have long held and the considerations on which they are based. By many authorities, true croup is regarded as an idiopathic primary inflammation, presenting the unusual result of pseudo-membranous exudation, and differing thus from diphtheritic croup, which is a

mere complication in the course of a constitutional disease, depending upon the extension of the false membrane from the fauces into the larynx.

The considerations upon which this distinction is based may be briefly stated as follows: that true croup is a disease peculiar to childhood, and that many of its peculiarities are to be explained by reference to the development of the larynx at that period; that it is a local disease and not connected with any special alteration of the blood crasis; that it is not contagious; that it nearly always commences in the larynx, and, though it may pass downwards into the trachea, never passes upwards into the pharynx; and finally, that it does not present the complications of diphtheria, such as albuminuria and pseudo-membranous exudation on abraded surfaces, nor its characteristic paralytic sequelæ.

So far as the mere anatomical conditions are concerned, it is generally conceded that there is no essential difference between primary croup and pseudo-membranous croup occurring in the course of diphtheria. The attempt was made by M. Isambert to base a distinction between the two affections upon the ulcerated condition of the mucous membrane of the larynx in diphtheritic croup, but West has met with similar ulceration in cases of primary croup, though somewhat less frequently than in the secondary diphtheritic form.

It has also been attempted to establish a distinction between the morbid process in croup and in diphtheria upon the greater intensity of the lesion in the latter case, associated with more swelling, a more intense congestion of the mucous membrane; but from careful observation of the numerous grades of severity of the diphtheritic process, we are convinced that this difference in degree is not constant, and cannot be made the basis of a radical division of the two affections. It appears moreover that there is no essential chemical or histological difference between the pseudo-membranes formed in the two conditions.

But further, our personal experience constrains us to state that the differences between the two forms of membranous croup above enumerated, have not seemed to us sufficiently marked and constant to positively establish their essential diversity; and that it is our decided opinion that the vast majority, of the cases usually termed pseudo-membranous laryngitis are in reality instances of primary laryngeal diphtheria, in which the constitutional symptoms are not grave, and where the faucial deposit has been very slight and perhaps even overlooked.

We are led to this conviction especially by the repeated observation of cases in private practice, where we have been summoned upon the first symptoms of indisposition, and have found a trifling amount of membranous exudation on the fauces, which, in a day or two, had disappeared, while the symptoms of croup supervened. In one of the most recent works on *General Pathology*, Wagner, who inclines to believe in the distinction between the two affections, says (p. 266), "in the greater number of fatal cases of laryngeal croup, diphtheritic exudation is found on the soft palate."

Apart from their sporadic occurrence, we confess that we are altogether unable to detect any difference between such cases and the cases of so-called

primary laryngeal diphtheria, frequently met with in epidemics of diphtheria, where the angina is but trifling, and is rapidly followed by pseudo-membranous formation in the larynx.

It is true that the primary sporadic form of croup we are now discussing occurs more exclusively in children than does the more fully developed form of diphtheria; but it must be remembered that in childhood there seems to be a peculiar tendency for the larynx to become involved in the course of diphtheria, and also that a comparatively trifling amount of membranous exudation in a child's larynx will produce grave symptoms of obstruction.

It is true that in membranous croup there is but little enlargement of the lymphatic glands, but when the anatomical conditions of the larynx is borne in mind it will be understood why there should be but little lymphatic implication, while, when the pharynx with its very rich lymphatic supply is affected, enlargement of the glands is a prominent symptom from an early date. We may here merely allude to the query whether this latter fact may be concerned at all in more frequent constitutional infection which follows pharyngeal diphtheria.

It is also true that these sporadic cases are rarely attended with albuminuria or followed by paralytic sequelæ; but when we consider the remarkable variations in the frequency of these conditions in different epidemics of diphtheria, it is not inconsistent that they should be usually absent in mild sporadic cases.

In regard to the difference in the contagiousness of croup and diphtheria we would merely remark, that it is undoubted that in cases where the virulence of the disease is marked, and where its infectious or contagious character is most pronounced, the pseudo-membrane is most likely to appear first in the pharynx, and to be extensive and persistent. On the other hand, in cases where the infectious character is but slightly developed, and the symptoms mild, the membrane either remains limited to the pharynx where it speedily disappears, constituting the mild cases of diphtheria which we frequently meet with, usually in a sporadic form. Or, in a certain proportion of these cases, the pharyngeal deposit having been slight and often overlooked, the larynx is invaded and the symptoms of membranous croup appear. It is but natural, if this suggestion be entitled to any weight, that there should be found a considerable difference in the degree of contagiousness of croup and of grave infectious diphtheria. However, we have recently met with two separate instances where among children of a family, one was seized with membranous croup presenting the symptoms and course described in the sporadic idiopathic form, while one or more of the others were affected with pharyngeal diphtheria.

As we have above stated this question must be regarded as still under discussion and unsettled. We are by no means prepared to assert the identity of croup and diphtheria in all cases, but have merely desired to state the considerations which incline us to regard them as closely allied, and as probably being different forms of one great pathological process.

As it is not our intention, therefore, to deny the possibility of pseudo-membranous laryngitis occurring as a purely primary idiopathic affection,

we have consequently treated of it as a special disease, apart from the brief notice of it we have given in the article on diphtheria.

But the considerations which we wish to impress deeply upon the mind of the reader are, that in the vast majority of cases of true croup careful examination of the throat at an early period of the attack will show the presence of exudation on the tonsils or pharynx; and that, consequently, whenever a child is taken sick with even the most trifling croupy symptoms, the throat should be immediately and repeatedly examined, and, if any membranous exudation be detected, the case should be regarded as probably one of membranous croup, a most guarded prognosis accordingly given, and the most careful treatment immediately instituted.

Frequency.—The mortality from this disease is in all years considerable, as will be seen from the subjoined table:

Years.	Mortality from Croup.	Mortality from Diphtheria.	Total Mortality less Stillborn.
1846,	111	0	5,944
1847,	121	0	6,881
1848,	177	0	7,268
1849,	130	0	8,989
1850,	151	0	8,034
1851,	180	0	8,374
1852,	208	0	9,745
1853,	303	0	9,184
1854,	304	0	11,280
1855,	265	0	9,906
1856,	268	0	11,720
1857,	256	0	10,331
1858,	292	0	10,162
1859,	312	0	9,084
1860,	354	307	10,849
1861,	304	502	13,838
1862,	258	325	14,386
1863,	443	434	15,045
1864,	455	357	16,794
1865,	350	260	16,453
1866,	239	192	16,005
1867,	185	118	13,153
1868,	206	118	13,949
1869,	237	182	13,428
1870,	316	172	15,317
1871,	264	145	15,485
1872,	296	150	18,987
1873,	200	110	15,224
1874,	199	179	16,238
1875,	428	656	17,805

It is difficult to estimate the number of deaths due to this affection since diphtheria has made its appearance in the mortality lists of the city, as many cases of diphtheritic croup have unquestionably been returned as mere pseudo-membranous laryngitis.

True croup is, however, rare in comparison with false croup, since while we have seen but 35 cases of pseudo-membranous laryngitis, we have met

with upwards of 200 of the catarrhal form. In the following remarks, and in those on the causes of croup, we refer the reader also to the table in the article on diphtheria, showing the comparative monthly and annual mortalities from these two diseases.

From a glance at the accompanying table, it will be seen that since the prevalence of diphtheria, the mortality from croup has not increased disproportionately to the increase in general mortality. Moreover, no change whatever has occurred in the type of this disease during the past ten years, for the experience of one of us for a number of years before the term diphtheria came into use and appeared in the mortality returns of this city, enables us to attest the fact that pseudo-membranous laryngitis, both of the primary and of the more grave diphtheritic form, occurred then precisely as it does now.

Predisposing Causes—Age.—The disease is far most frequent between the close of the first and fifth years. Thus of 2136 fatal cases reported in this city during the seven years from 1862–68, 301 were under 1 year of age; 571 between 1 and 2 years; 951 between 2 and 5 years; or 1522 between 1 and 5 years; and 236 between 5 and 10 years; leaving but 77 cases as occurring after the latter period of life.

Of the 35 cases that we have seen, 28 occurred between 2 and 7 years of age, while of the remaining 7, 1 occurred at the age of 18 months, 1 at that of 19 months, 1 at $7\frac{1}{2}$ years, 2 at 11 years, and 1 each at $11\frac{1}{2}$ and $12\frac{1}{2}$ years.

Sex cannot be said to exercise any decided influence upon the frequency of the disease. Thus of the above 2136 cases, 1115 occurred in males, 1021 in females.

Constitution.—A feeble and delicate constitution is thought by some to be a powerful predisposing cause, but this is at least very doubtful.

Of the 35 cases referred to, of which we have preserved notes, 26 occurred in healthy vigorous children, while the remaining 9 occurred in children who, though neither very weak nor very sickly, presented a rather delicate appearance.

Season exerts a very powerful influence upon the development of croup. Thus the mortality from it attains its maximum during the months of November, December, and January, during which quarter about four times as many deaths occur from croup as during the months of June, July, and August. It is, however, comparatively frequent from October to March inclusive.

The relation between the mortality from croup and the temperature appears to be a definite and quite constant one, since, as will be seen by referring to the table in the article on diphtheria, with the single exception of February, the mean monthly temperature and the mean monthly mortality from croup rise and fall together throughout the entire year.

The *exciting causes* are but little understood. The only ones which seem to have been ascertained with any certainty, are the application of irritating agents to the laryngeal mucous membrane, and exposure to cold, and even these are questioned by the most accurate observers. In none of the cases that we have seen could the exciting cause be even suspected.

It seems probable, therefore, that the existence of at least some predisposing constitutional condition may be assumed.

Second Attacks of membranous croup, though rare, are mentioned as occurring by several authors; and, in our remarks on tracheotomy, we quote from Millard an allusion to five cases, in each of which the operation was twice successfully performed for successive attacks of this disease.

We have ourselves met with two instances in which second attacks occurred. One was a girl, who had her first attack at the age of $11\frac{1}{2}$ years, and her second at the age of $12\frac{1}{2}$, and recovered from both without the operation. The second patient was a boy, who had his first attack, a very severe one, but from which he recovered without tracheotomy, at the age of $5\frac{1}{2}$ years; and his second attack, which is fully detailed at the end of the article on tracheotomy (Case 1), at the age of $7\frac{1}{2}$ years.

Anatomical Lesions.—The false membrane may cover the whole mucous membrane of the larynx, and extend into the pharynx, trachea, and bronchia; or it may be confined to the larynx, either forming a complete lining to the cavity of that organ, or consisting merely of patches of various sizes, with intervals of mucous membrane destitute of exudation.

It is, in the first place, important, to ascertain the proportion of cases in which the deposit extends into the bronchia, and those in which it remains limited to the larynx, or larynx and trachea, as the determination of this point has some bearing upon the question of the propriety of the operation of tracheotomy. It appears from a table given by M. Guersent (*Dict. de Médecine*, t. ix, p. 346), containing the results of cases collected by M. Hussenot from various sources, and of autopsies made by M. Bretonneau, numbering in all 171, that in 78 the membrane did not extend beyond the trachea, and that in 42 it invaded the bronchia, and in 30 the condition of the bronchia was not mentioned; and in 21 there were no false membranes; so that of 120 cases, in which the extent of the false membrane was accurately noted, it was confined to the larynx and trachea in 78, and extended into the bronchia only in 42; or in about one-third of the cases. This proportion is the same that Millard gives (*De la Trachéotomie dans le cas de Croup, Thèse de Paris*, 1858), in his masterly memoir upon croup, after an analysis of a large series of cases. Our own experience, based upon 15 cases in which we ascertained with exactitude (by autopsy or by tracheotomy) the extent of the membrane, would indicate that it passed into the bronchia in a larger proportion of cases; since in 7 of these 15 cases the exudation extended beyond the trachea. It is to be borne in mind, however, that the cases upon which these calculations are based have very frequently resulted fatally, and presented extensive formation of pseudo-membrane in the bronchia; and it is probable that it really exists there in other instances, but to a much less extent, so that recovery takes place, and renders it impossible to determine accurately the extent of the exudation.

The proportion of cases in which the pharynx is implicated is also important, since it affects the diagnosis of the disease, and indeed bears upon

the question of the identity or non-identity of pseudo-membranous laryngitis and diphtheritic croup.

In considering the statements of authors upon this subject it is evident that much of the diversity in their opinions depends upon the fact, that they are not in reality all referring exclusively to this particular affection. Thus the assertion of M. Guersent (*Dict. de Méd.*, t. ix, p. 339), that in nineteen-twentieths of the cases the exudation begins in the pharynx, is evidently to be explained on the supposition that this distinguished practitioner had been observing a series of cases of diphtheria in which the exudation had extended into the larynx. MM. Rilliet and Barthez, on the other hand, state that a majority of the cases observed by themselves, and of those of M. Hache also, commenced in the larynx. Dr. West also reports 11 cases of idiopathic croup, in only two of which was there any formation of false membrane upon the velum and tonsils.

In 31 cases observed by ourselves, in which the condition of the throat was recorded, the croup followed membranous angina in 21 cases; in 5 the disease began in the larynx, but was attended later with small deposits upon the tonsils; and in 5 only was there no deposit on the throat at any time.

The fauces and pharynx do not present any constant alterations in cases of croup. Frequently, however, the mucous membrane is red and swollen, and there may be patches of membranous exudation upon the tonsils, velum, half-arches, or on the pharynx. These patches are usually thin, whitish, and may not persist more than 24 to 48 hours, disappearing and being succeeded by similar formations in some other part of the throat.

We believe indeed that such patches of exudation will be found in a large proportion of cases during the first two or three days of the attack; and that they are not more frequently observed, chiefly because the symptoms are usually so slight during this stage, that either no medical attendant is summoned, or his attention is not attracted to the throat.

The most important and characteristic morbid appearances are, however, to be found below the glottis, and consist in the presence of pseudo-membranous exudation, and of certain alterations in the respiratory mucous membrane.

The false membrane may be limited to the larynx, or to the larynx and trachea; or it may extend over these parts and into the branches of the bronchi, even to the third and fourth division. In the larynx, trachea, and even the primitive bronchi, it may appear merely as patches of various sizes, with intervening spaces of vascular mucous membrane; but in the smaller air-passages it usually takes the form of complete tubes lining the bronchus. In some cases, such tubular casts may be formed continuously from the larynx down to the minute bronchioles, completely lining the air-passages. It is undoubted, that in the more sthenic idiopathic form of membranous laryngitis, the membrane is more apt to extend deeply into the ramifications of the bronchi, than when it occurs as a complication of diphtheria.

The false membrane is commonly of a yellowish-white color, and from a fifth of a line to a line in thickness. Its consistence is generally con-

siderable, and it is usually somewhat elastic; indeed the more white and fibrous varieties possess a degree of firmness and toughness that renders it difficult to tear the membrane, or teaze it out with needles. It is an almost invariable rule, that the membrane lining the upper part of the air-passages is more white and firm than that found in the smaller bronchi; so that it frequently happens, that, on drawing out the firm white tubular membrane lining the larynx, trachea, and primary bronchi, it is seen to terminate in branches which grow progressively softer, more yellow and purulent, as they become smaller and smaller.

The free surface of the pseudo-membrane is usually covered with puriform mucus, while the attached surface is adherent with various degrees of force to the mucous membrane beneath. The strength and closeness of these adhesions are often proportionate to the firmness and toughness of the false membrane itself. In the larynx and trachea it is often necessary to employ a good deal of force to separate the exudation from the mucous membrane, and innumerable little fibres are seen passing from one to the other, as though they were processes of exudation dipping into the minute orifices of the mucous follicles. On the other hand, the adhesion between the exudation and mucous membrane is rarely close in the smaller bronchi, or in cases where the pseudo-membrane in the larynx and trachea is less firm and consistent.

These false membranes consist, according to Hasse, mainly of fibrin blended with mucus in various proportions. (*Path Anat.*, Syden. Soc. ed., p. 278.) On microscopic examination, they present a more or less close fibrous basis, consisting of interwoven fine fibrils, with imbedded cells in varying number; these cells presenting the ordinary appearances of exudation-corpuscles, being round, granular, and containing from one to three small nuclei. The action of various chemical reagents upon them will be found detailed in the article on diphtheria.

The mucous membrane beneath the exudation presents various shades of redness, or it is purplish, or even ecchymosed and blackish. It is also swollen, and may be slightly softened or friable, and has a dull excoriated appearance, though actual ulceration very rarely exists. West mentions the occurrence of small aphthous ulcers about the edges of the rimi glottidis and the arytenoid cartilages, as a frequent lesion in idiopathic croup; but the same lesion has been observed in the diphtheritic form of the disease.

There is also vascularity, though usually to a less marked degree, of the bronchial mucous membrane at the points where no exudation exists.

The lungs present some abnormal condition in the great majority of cases. Bronchitis and pneumonia are frequent complications of the disease; and in addition there is often collapse of larger or smaller portions of lung-tissue from occlusion of some bronchus by the pseudo-membrane. In other instances, or frequently in conjunction with collapse of portions of the lungs, the violent respiratory efforts induce either vesicular or even interstitial emphysema, especially of the anterior borders of the lungs.

The morbid appearances found in cases where the croup has followed

diphtheritic angina, will be fully described under the head of this latter disease.

In the secondary croup of measles, the appearances are very similar to those observed in primary cases, while in that of scarlet fever the exudation differs in being less consistent and less uniformly spread over the diseased part. In the last-named malady, the membrane is thinner and less adherent, and, in some cases, puriform, soft, and of a grayish color. It is usually poor in fibrin, and prone to decomposition. The mucous membrane is generally discolored and softened.

Symptoms.—In the majority of cases, the development of the symptoms characteristic of croup, is preceded for a few days by the ordinary symptoms of catarrh and slight sore throat. The child is feverish and drowsy; there is cough, which may possess a slight croupy character at some period of the twenty-four hours, but more frequently seems like an ordinary catarrhal cough; coryza is very rarely present, but there is slight soreness behind the angles of the jaws, and the fauces are seen to be reddened, and probably small, thin patches of pseudo-membrane may be visible on the tonsils or fauces. This early stage lasts a variable time, usually from one to three or four days, and is more or less gradually succeeded by the symptoms indicative of laryngeal obstruction.

When, on the other hand, the disease begins in the larynx, the invasion is marked by hoarseness of the voice, and hoarse, croupal cough, which often continue for one, two, or three days, until the disease has made considerable progress, before the parents deem it necessary to send for a physician. In a case that came under the observation of one of ourselves, the child was playing about the room at a time when he had hoarse, whispering voice, and cough, and stridulous respiration. In another we were not called until the evening of the third day, though the child had had stridulous cough and respiration for two nights; but, as he always seemed better in the morning, it was not thought necessary to send for a physician until after he had become violently ill. In a third case there was hoarseness of the voice and slight croupal cough during the afternoon of one day and the ensuing night, and the next morning fully developed croup, with fibrinous patches on each tonsil. These symptoms are not generally accompanied by fever at first. The appetite is usually unimpaired, the thirst scarcely augmented, and the child, though somewhat dull and languid, is disposed to be amused at times. In other and severer cases, on the contrary, the disease becomes aggravated much more rapidly, and may soon lead to a fatal termination.

The change of the *voice* is the first symptom observed in the cases which begin in the larynx. It has always been described to us as hoarse, like that which is heard in an ordinary cold. As the disease progresses, the voice becomes more and more hoarse and difficult, until at length it is reduced to a mere whisper. The degree of the hoarseness varies, however, to a very great degree in the same case, the diversities depending probably upon the amount of the spasm of the larynx at the moment, and upon the state of the exudation. We have several times observed the voice to become much stronger and clearer after the operation of an emetic, in con-

sequence, no doubt, of its relaxing effect upon the glottis. The *cough* is peculiar. At first slightly hoarse, it becomes, as the case goes on, very hoarse and hollow, and then short and smothered. It is variable in frequency, and is apt to occur in paroxysms, which are often very troublesome from their frequent recurrence. Towards the termination of the disease in fatal cases, or whenever the case is very severe, it is altogether different in character from what it was at the beginning, becoming short, instantaneous, and smothered, so that it might very well be called whispering. As the disease progresses, it is accompanied by stridulous respiration, in which a hoarse, rough, hissing, or crowing sound is produced by the rush of the air through the constricted larynx. This sound is usually heard at first only during forced inspirations, and is therefore noticed first during the long inspiration which precedes coughing. Next it is heard during the violent respiratory movements which accompany the act of crying; and as the larynx becomes more and more clogged with the exudation, it occurs during both inspiration and expiration, in every act of respiration, and is so loud as to be heard over the whole room, or even in adjoining rooms.

The *respiration* is natural in the early part of the attack, but as the voice and cough assume their characteristic features, and the stridulous sound is established, it becomes more frequent, rising to 28, 32, 40, and 48 in the minute. At first easy and natural, it becomes, during the height of the symptoms, and especially in fatal cases, the most frightful dyspnœa we have seen in any disease. Every movement of inspiration requires the whole force of the inspiratory muscles to lift the walls of the chest, and enable the air to find its way through the narrow and obstructed glottis; each expiration, instead of being short and easy, as in health, and in nearly all other diseased conditions, requires a slow and laborious contraction of the expiratory muscles to expel from the lungs the air which they contain, and which hisses through the larynx with a sound nearly as loud as that produced during inspiration. The dyspnœa just described is for the most part constant, but exhibits paroxysmal aggravations from time to time.

When a paroxysm of dyspnœa occurs, the expression of the child is that of the most terrible anxiety, or of the wildest terror. In some instances, the face becomes deeply red, then blue, livid, and finally pale and white, and for a moment life may seem extinct. In other cases, in which the dyspnœa is constant, the face is of a dusky red color, the expression anxious and haggard, and the child either lies on its side with the head thrown far backwards in a state of somnolence, or constantly changes its position from restlessness without noticing anything around it.

Jacobi (*Amer. Jour. of Obstet.*, May, 1868, pp. 13–65) lays particular stress upon the fact that in membranous croup the dyspnœa exists both in inspiration and expiration, whereas in spasmodic catarrhal croup it is chiefly present in inspiration, and is due, he thinks, to paralysis of the crico-arytenoid muscles from œdema and infiltration, so that the vocal cords are brought into contact during inspiration.

There is one further peculiarity about the dyspnœa in membranous croup

to which we would direct especial notice, since we regard it as of the utmost importance. This consists in the occurrence, in certain cases, of a deep sulcus around the base of the chest, and of recession of the lower part of the sternum and the epigastrium during the act of inspiration.

These phenomena are, perhaps, partly due to the violent action of the diaphragm, but undoubtedly their chief cause is the atmospheric pressure, which acts here, as it has been clearly shown by Jenner to act also in rickets to produce the deformities of the thorax characteristic of that disease. The normal relation which exists between the firmness and resistance of the thoracic walls, the power and rapidity of contraction of the diaphragm, the elasticity of the lungs, and the size of the orifice of the larynx, is here disturbed by the greater or less degree of occlusion of the larynx by membranous exudation. The calibre of the larynx being thus diminished, so that air enters the lungs but slowly, and the diaphragm contracting violently, there will necessarily be recession of the softer parts of the chest-walls at each inspiration.

The persistence of these phenomena during inspiration for even a short time is, we believe, in the highest degree characteristic of the presence of false membranes in the larynx; and when, despite the use of emetics, this form of respiration continues, it constitutes one of the strongest indications for the performance of tracheotomy.

There is no *expectoration* early in the disease, or it consists of yellowish viscous mucus. At a later period there is usually expectoration of false membrane, sometimes in the form of a complete tube, or, much more frequently, of small, irregular fragments, mixed with mucus, or with the matters ejected from the stomach by vomiting. To detect the membrane, the substances expectorated or vomited ought to be placed in water, when the former detaches itself from the mucus and other matters, and is easily recognized. It is not voided in all cases in which it is known to be present in the larynx.

Thus of the 35 cases observed by ourselves, it was expelled by vomiting or coughing in 12; in 21 none was rejected, though its presence in each case was proved by the character of the symptoms and by its existence in the fauces, by autopsy, or by the operation of tracheotomy; in one there was expectoration of masses of viscid, yellowish fibrin, though none of membrane; and in one there was no positive evidence of its existence. M. Valleix (*Guide du Méd. Prat.*, t. i, p. 330) states that of 51 cases, in which the symptoms were very carefully observed, no traces of the exudation could be discovered either in the expectoration or in the matters rejected by vomiting in 26, though its existence was proved by post-mortem examination.

Auscultation.—In the severe cases of true croup that have come under our notice, auscultation has been of little or no aid. In fact, the chest-sounds have been, in most cases, so completely masked by the loud shrillness of the laryngeal stridor, that we have been unable to judge with any satisfaction to ourselves of the condition of the lungs. It has been impossible to determine whether the inability to detect natural respiratory murmur depended on the small volume of air that found its way through

the obstructed larynx, or on the fact that all sound was masked by the stridor. This is particularly unfortunate, since, were it not for this circumstance, we might be able to judge by auscultation of the extent to which the bronchia have been invaded by the false membrane,—a matter very important to determine when the question of tracheotomy comes to be mooted in any case.

In cases in which the laryngeal obstruction is not very great, and the stridulous sound consequently less loud, we may auscult the chest to some profit. The vesicular murmur is then either natural, or altered according to the state of the lung.

But though such has been our own experience in regard to auscultation in croup, MM. Barth and Roger (*Trait. Prat. d'Auscultation*, 2ème ed., pp. 255 and 261) describe, as a sign of croup with floating false membrane, a kind of vibrating murmur, or *tremblotement*, as though a movable membranous veil were agitated by the respired air, and which can be heard when the stethoscope is applied over the larynx or trachea. If this sound be heard only in the larynx, and not in the trachea and bronchia, it indicates the plastic exudation to be of small extent, and likely to be rejected by expectoration, and the prognosis is favorable. In the other case, on the contrary, it shows the disease to be of considerable extent, and the prognosis becomes much more serious.

This question will be found referred to more fully in our remarks on the indications for the operation of tracheotomy.

There is a slight *febrile movement* at the onset, or a day or two after the appearance of the earliest symptoms. When the disease is fully established, the fever becomes violent. The pulse rises to 130, 140, 160, or even higher; it is generally regular and strong at first, but as the case progresses, becomes small, feeble, and very rapid. In one of the paroxysms that we witnessed, it became so rapid that it could not be counted, and at last ceased to beat at either wrist for a few instants. The heat and dryness of the skin are very moderate at first, but increase as the disease reaches its maximum, to diminish afterwards gradually, and in fatal cases, to be replaced by coldness, with copious clammy perspirations. The strength is not diminished at first, but as the disease progresses, becomes more or less so in proportion to the violence and duration of the case. The *digestive organs* are but little disturbed by the influence of the disease, with the exception of diminution or loss of appetite, and moderate thirst, during the violent period. Spontaneous vomiting or diarrhœa are rare, though both sometimes occur. The tongue is moist, and generally covered with yellowish-white fur. Pain in front of the larynx has been noticed by several authors. We have ourselves observed it in but one case.

Tumefaction of the submaxillary glands, which is a frequent symptom of pseudo-membranous angina, ought always to be sought for, and when present lends additional support to the diagnosis.

The *mode of recovery* in favorable cases is different in different instances. In some it is sudden, taking place rapidly and steadily after the expectoration of a tubular-shaped membrane. The rejection of the deposit in

this form is, however, a rare event, and is not always followed by recovery. We have seen in this city three distinct tubules of false membrane, which were thrown from the larynx of the same child at intervals of two days each. The first was the largest, and came evidently from the whole length of the larynx and trachea; the second was somewhat shorter, and the third not more than half so long as the first. The child was greatly relieved for some hours on each occasion of the rejection of a tubule, but then became more oppressed as the exudation again collected. It sank from exhaustion after the third came away.

As a general rule, the recovery is slow and gradual. After free vomiting, after the expectoration of fragments of false membrane mixed with mucus, or, as happened to ourselves in two cases, after the expectoration of masses of tough yellowish fibrin, or, lastly, after the rejection of mucoid and frothy sputa only, the symptoms gradually ameliorate; the stridulous respiration slowly subsides, and at last disappears; the cough, which was short, hoarse, and smothered, becomes louder, stronger, less hoarse, and what is still more favorable, loose; the aphonia moderates, but very slowly; the fever disappears; appetite and gayety return; and, after a variable length of time, the child enters into full convalescence. The hoarseness of voice very generally continues for several days after all the other symptoms have lost their dangerous character, and sometimes lasts for weeks. In one case the voice was still weak and hoarse on the tenth day, and in another during the seventh week. (*See a paper on Croup, by J. F. Meigs, M.D., Am. Med. Jour. Med. Sci.*, April, 1847.)

Duration.—Death has been known to occur on the first, second, and third days, but such cases are rare. The duration of the disease may be stated at from three to thirteen days, as its most common term. The cases seen by ourselves lasted from five to fourteen days.

Diagnosis.—There can be no difficulty in recognizing the presence of pseudo-membranous laryngitis, when the development of the symptoms of laryngeal obstruction has been preceded for several days by angina, with or without membranous exudation, and hoarseness of voice and cough. For the relation which exists between such cases and diphtheritic croup, the reader is referred to the remarks at the beginning of this article on the nature of croup, and to the remarks made under the head of diagnosis in the article on diphtheria.

When, however, the disease begins in the larynx, and especially when there is no exudation whatever in the fauces, the diagnosis becomes more embarrassing, since under these circumstances there are two other laryngeal affections with which true croup may be confounded, to wit: false croup or spasmodic catarrhal laryngitis, and laryngismus stridulus. The mode of distinguishing between these different disorders has been carefully described in the remarks on diagnosis, under the head of the former disease. We wish in this place merely to call the attention of the reader, and particularly of the young practitioner, to the extreme importance of the differential diagnosis between the disease now under consideration, and false or spasmodic croup, since the former is one of the most dangerous and frightful disorders to which children are subject, demanding vigorous

and active treatment from the start, at which period only is medical treatment likely to be successful; whilst the latter, though of a much more threatentng aspect at the beginning, is in fact a mild and safe disease in comparison, and one rarely requiring other than very simple treatment.

In this connection we would urge again the extreme importance of a careful examination of the throat in every case where there are even the most trifling croupy symptoms present, since if membranous exudation be present either on the pharynx or tonsils, there is great danger that the laryngeal symptoms are due to an extension of the false membrane.

Prognosis.—Pseudo-membranous laryngitis is a very fatal disease. In its sporadic form it is decidedly less dangerous than when it occurs in the course of epidemic diphtheria, owing to an extension of the exudation from the fauces into the larynx; but it still ought, at all times and in all shapes, to arouse the utmost caution of the practitioner.

MM. Rilliet and Barthez state that its common termination is in death. M. Valleix says that, "to speak in general terms, it is fatal when not treated energetically." M. Guersent (*loc. cit.*, p. 365), after a careful consideration of the statements of various authors, says: "In fact, true croup is one of the most dangerous of all diseases; it is generally fatal." He adds that he has seen at least 100 cases of spasmodic croup without a single death, while of 10 children attacked with true croup, it is scarcely possible to save two.

We have ourselves seen upwards of 200 cases of spasmodic or false croup, all of which without exception recovered, while of the 35 cases of true croup, of which we have preserved careful notes, 16 died.

The danger is great in proportion as the child is younger and more feeble, and in proportion to the rapidity of the case and the degree of the dyspnœa. The most unfavorable symptoms are: loud stridulous sound, heard both in the inspiration and expiration; laborious and prolonged expiration; recession of the base of the thorax during inspiration; whispering voice or complete aphonia; congestion of the face and neck; somnolence; weak, rapid, and irregular pulse; cold extremities; and cold, clammy perspirations. The favorable symptoms are: expectoration of false membranes; diminution of the stridulous respiration; the change from whispering to hoarseness or to clearness of the voice; looseness of the cough; moderation of the fever; improvement of the temper and moral state; and amelioration of the general condition.

The case should not, however, be abandoned as hopeless until life is actually extinct. An instance has been elsewhere put on record by one of us (*see paper by Dr. J. F. Meigs, loc. cit.*) of the recovery of a child after momentary suspension of animation from asphyxia on two occasions, though these attacks were followed by a dreadful illness of two days.

Treatment.—We are desirous, at the beginning of our remarks upon the treatment of this disease, to express the opinion, that none is *likely* to succeed, unless it be applied early in the case, and by this we mean, in the course of the first, or at the latest, second day. And not only should it be commenced early, but the most active remedies ought to be applied at this period, in their full force. The very moment there is good reason

to suppose that a case will prove to be one of membranous croup, the most energetic means ought to be brought to bear upon it, and if this be done from the first, or even second day, we cannot but hope that a considerably larger proportion of recoveries may take place than has heretofore been thought possible.

In the study of the treatment, it will be necessary to rely chiefly upon the works that have been published since the distinction between the two forms of croup has been correctly drawn, for it is impossible to place much dependence on the assertions of previous writers, inasmuch as their opinions in regard to the effects of treatment must have been formed from indiscriminate experience in two very opposite maladies. It is only necessary to recollect the enormous difference in the mortality of the two affections, as shown by our own experience and the statistics quoted from Guersent, to be convinced that the success of any plan of treatment in the one, is no fair argument for its probable success in the other. The most important objects to be held in view in the treatment, are the following: to prevent, if this be at all possible, the formation of false membrane; after its production, to cause its dissolution, or render it less adherent; to provoke its expectoration; to prevent its reproduction after it is once expelled; to subdue the inflammatory diathesis which exists; to allay the painful symptoms; and in every way to support the system.

Bloodletting.—Some authors still award to bloodletting a high place in importance amongst the medical means in our possession, and it was formerly regarded by many in this country as an indispensable agent in the cure. Moreover, there are not a few who believe that, when promptly and boldly resorted to, it will seldom fail in arresting the disease.

The more careful and extended study which this question has received during the past few years, however, has led many observers to doubt the efficacy of venesection in arresting the course of this inflammation, or preventing the formation of membranous exudation.

In those cases where croup supervenes in the course of epidemic diphtheria, there can be no doubt that bloodletting is entirely contraindicated; and the same remark may be made of those sporadic cases of pseudo-membranous laryngitis, where the onset of the disease is slow, and its course gradual, and unattended by high febrile reaction. Indeed, the more wide experience we have ourselves had in the treatment of this disease during late years, has convinced us that bloodletting is, to say the least, unnecessary, excepting perhaps in cases where the disease occurs suddenly in vigorous children, and is attended at an early period of the attack by violent febrile action and especially marked suffocative symptoms. Under such circumstances, and such only, it may be advisable to resort to a moderate general venesection, principally for the mechanical relief thus afforded to the acute and intense venous stasis caused by the obstructed respiration.

For all the other indications, however, for which bleeding was formerly recommended in croup, namely, for the reduction of the fever and inflammation, and for the arrest of the exudative process, we prefer resorting to the other remedies hereafter mentioned.

Emetics.—Emetics are recommended by all writers, and are generally acknowledged to be amongst the most, if not the most, efficient of all the means employed. M. Valleix (*op. cit.*, t. i, p. 358) has demonstrated their importance more fully than any other writer. He states that of fifty-three cases of the disease, tartar emetic and ipecacuanha were chiefly relied on in thirty-one, of which fifteen were cured; whilst of the twenty-two others, in which they were parsimoniously given, but a single one recovered. He gives other facts in regard to these cases which are highly interesting and important. Thus, of the thirty-one cases treated with powerful emetics, false membrane was rejected during the efforts of vomiting in twenty-six; and of these, fifteen, or nearly three-fifths, recovered. In the five others of the thirty-one, on the contrary, no membrane was expelled, and they all terminated fatally. Again, of the twenty-two cases in which emetics formed but a secondary part of the treatment, two rejected false membrane, and of these one recovered; while of the twenty others in which no false membrane was expelled, not one escaped.

Our own experience in regard to emetics has been as follows: They were administered frequently and in full doses in thirteen of the twenty-one cases which began with angina, of which we have preserved notes; in six they were employed to a moderate extent, and in two not at all. Of the thirteen cases in which they were freely administered, eleven recovered; but, as in one of these life was saved only by tracheotomy, the success cannot be attributed to the emetics. Of the eight cases in which the emetic plan was not pushed, all but one ended fatally. False membrane was rejected in eight out of the thirteen cases above referred to. In one of the eight cases the quantity rejected was very small, and this was the case in which the child was ultimately saved only by operation.

Of thirteen cases in which the disease began in the larynx, emetics were energetically used, and frequently employed, in eight. Of the eight, five recovered. In four of the eight cases, fragments of false membrane were rejected, and in a fifth, a mass of viscid, yellowish fibrin (this case was marked as one of unquestionable membranous croup by patches of false membrane on the tonsils). Of these five, four recovered. In three of the eight, no false membrane was rejected, and of these two died. In five of the thirteen cases they were not freely used, being employed in two only as a secondary means; in one other only at the very termination of the attack, as we were not called to the case until the tenth day, the patient having been under homœopathic treatment before; and in the remaining two cases they were not employed at all. Tracheotomy was performed in four of these five cases, but in only one was a successful result obtained.

It is indeed true that there were peculiarities about the age and the type of the disease in the above groups of cases which may modify to some extent the conclusions which seem inevitable; but the statements and facts above given are quite sufficient to show that emetics exert a most powerful and beneficial influence on the disease, and that they ought, therefore, to form a principal and essential part of the treatment.

The emetics generally employed in Europe and this country are tartar emetic and ipecacuanha, which are given in the usual doses to produce

full vomiting. We would, however, strongly discountenance the employment of tartar emetic as an emetic, under any circumstances, in children; and, at least in the disease under consideration, we do not like ipecacuanha as an emetic so well as one which, so far as we know, was first recommended by the late Dr. Charles D. Meigs. We refer to the Alumen of the Pharmacopœia.

In an article published by him in the *Medical Examiner* (vol. i, p. 414, 1838), he says he has been "accustomed to make use of an emetic, which, so far as I can learn, is very little employed, but which, from the certainty and the speediness of its operation, ought to be more generally admitted into the list of available medicines for this particular case at least. I have been familiar with its effects for more than twenty years, and my confidence in them increases rather than diminishes by time." He adds, "I think that I have never given more than two doses without causing very full vomiting; but I have often given large quantities of antimonial wine and ipecacuanha, without succeeding in exciting the efforts of the stomach."

The alum is given in powder, in the dose of a teaspoonful, mixed in honey or syrup, or in syrup of ipecacuanha, to be repeated every ten or fifteen minutes until it operates. It is not generally necessary to give a second dose, as one operates in the majority of cases very soon after being taken. We have known it to fail to produce vomiting only in two instances, both of which were fatal cases. In one the disease had gone so far before we were called, that no remedy had any effect upon the stomach. In the other, it was administered several times with full success, but lost its effect at last, as had happened also in regard to antimony and ipecacuanha. The reasons for which we prefer alum to antimony, or ipecacuanha alone, are the following: Antimony, when resorted to as frequently in the disease as we are of opinion that emetics ought to be, is too violent in its action; it prostrates many children to a dangerous degree, and is, we fear, in some cases, itself one cause of death. It acts injuriously upon the gastro-intestinal mucous membrane when used in large quantities and for any considerable length of time. Again, it is very apt to lose its effect, and to fail to produce sickness. Ipecacuanha is a much safer remedy than tartar emetic, but its operation is often too mild, and it not unfrequently fails to produce any effect after it has been used several times. The advantages of the alum are that it is certain and rapid in its action, and that it operates without producing exhaustion or prostration beyond that which always follows the mere act of vomiting. It does not tend like antimony, and in a less degree ipecacuanha, to produce adynamia of the nervous system; an effect which, in some constitutions or states of the constitution, or when it has been exhibited frequently, is often attended with injurious or even dangerous consequences. We have given alum in the dose above mentioned every four or five hours, for two and three days, without observing any bad effects to result from it. The alum was given in all the cases that we have seen, in which emetics were used, and was usually the only one employed when it was found to produce full vomiting. In one of the cases accompanied by violent angina, ipecacuanha

was substituted because of its smaller bulk. We have already said that it failed to produce vomiting only in two instances. It was the emetic employed in the nine cases in which fragments of false membrane were rejected, and in that in which the yellow viscid fibrin was expelled. Although it did not occasion the rejection of membrane in the other cases, it operated most speedily and efficiently.

Sulphate of copper has been highly recommended by several writers for its emetic operation, and, by some of the German physicians, as exerting a specific influence upon the disease in addition to its emetic effect. As an emetic, it may be given to a child two or three years old, in the dose of from half a grain to a grain every fifteen minutes, until it operates. To obtain its specific action it is continued afterwards in doses of a quarter of a grain every two hours.

We have also employed, with very good results, sulphate of zinc dissolved in syrup of ipecacuanha, in the proportion of 2 or 4 grains to the fluid ounce. Of this, a teaspoonful may be given to a child two or three years old, and repeated every fifteen minutes until it operates. This combination appears, like that of alum and ipecacuanha, to possess the double advantage of mild action without the production of any subsequent depression.

In the third edition of this work we referred to the use of the yellow sulphate of mercury (Hydrargyri Sulphas Flava) as an emetic in croup, as recommended by Dr. Hubbard, of Maine. Our own experience with this remedy has been limited, and not very decided. In the *American Journal of Obstetrics*, for May, 1870, Dr. Fordyce Barker, of New York, speaks in the highest terms of praise of its emetic effects in this disease. He always commences the treatment by a dose of from three to five grains, according to the age of the child, which may be repeated if it do not act, which he states very rarely occurs, in fifteen minutes. This he follows up with the use of veratrum viride, and states that the treatment has been successful in every case of true croup in which he has employed it. Undoubtedly this high testimony in its behalf justifies a further trial of turpeth mineral in croup, though we confess to a suspicion that not a few of the cases in whose *incipient* stage he has administered this drug so successfully would have proved to be instances of the severe catarrhal and not of the true membranous form.

We conclude these protracted remarks upon emetics with the statement that from what we have read, and from personal experience, we are induced to regard them as the most important remedies we have to oppose to this fearful malady. The emetic, whatever it may be, ought to be given three or four times in the twenty-four hours, and in severe cases, once in every four or five hours. The exact periods and frequency of the administration must be determined by the stage and urgency of the symptoms, and by the constitution and present strength of the patient.

Mercury.—This powerful drug was first employed freely in the treatment of membranous croup in America, and has subsequently been extensively used by English and European physicians. Calomel is the preparation almost always preferred, and many authors still recommend the

administration of this remedy, in larger or smaller doses, in the earliest stage of the attack.

During late years, our increased dislike of the administration of mercury to children in large and frequently repeated doses, and the constant observation that even its free use does not appear to arrest the course of true croup, or prevent the formation of membranous exudation, have led us to abandon entirely its employment in this disease.

At the same time we believe there has been found, in the free administration of the alkalies, an agency far less injurious than mercury, and equally powerful, if not more so, in promoting the separation and discharge of the exudation, and preventing its reproduction.

The internal remedies, then, upon which, after emetics, we rely most surely, are various alkaline salts, the use of which in large doses, has been of late years highly recommended, both at home and abroad. Those which we are most in the habit of employing are the chlorate and citrate of potash, which should be given in full and frequently repeated doses, as, for example, two or three grains every two hours to a child of four years old. We are also in the habit of combining with the chlorate of potash, tincture of the chloride of iron, in doses of three to five drops, at the same age.

Antispasmodics are undoubtedly useful in some cases, when there is much laryngeal spasm.

Opium is, however, the best remedy that can be employed for this condition, since it constitutes an important element in the treatment, by alleviating pain and restlessness, at the same time that it relieves the laryngismus, and thus diminishes the asphyctic symptoms. We would consequently recommend the use of some of the preparations of opium, as the tinct. opii deodorata, in such doses and at such intervals as will maintain a gentle opiate impression. In this, as in many other diseases of children, it is better not to prescribe the opium in combination with the other remedies that may be administered, but to either give it separately, or better still, to add it to the dose of the other medicines at the time of administration, so that the amount of the dose of opium and the frequency of its repetition may be modified constantly in accordance with the condition of the child.

Revulsives often prove useful in allaying restlessness, and moderating the violence of the suffocative attacks. Sinapisms and mustard poultices, applied upon various parts of the cutaneous surface, and mustard foot-baths, are amongst the best. The warm bath is often highly beneficial in the same way.

We do not think it desirable ever to employ blisters in this disease.

Local Treatment.—In those cases, and, as we have seen, they constitute the large majority of all cases of true croup, where the exudation appears in the fauces or on the tonsils before it involves the larynx, local applications to the throat are undoubtedly of importance.

The objects of such applications are here, as in diphtheritic angina, to promote the separation of the false membrane, and to prevent its reproduction. To fulfil the first of these indications, many authorities recom-

mend astringent and caustic applications, which cause the pseudo-membrane to contract and shrink, and thus tend to promote its separation; while others direct the use of those agents which exert a solvent action upon the exudation.

In the former class, the most advisable are, alum; tannic acid; solutions of nitrate of silver; the astringent salts of iron, especially the tincture of the chloride and the perchloride; dilute mineral acids and carbolic acid.

Of these applications, those which we prefer are a solution of nitrate of silver, in the proportion of 5 to 20 grains to f℥j of distilled water; and tincture of the chloride of iron, in the proportion of f℥ss. to f℥ij, to the f℥j of water.

The second group comprises chiefly solutions of various salines, as the carbonate of potash, bicarbonate of soda, chlorate of potash; and lime-water.

If any of the astringent or caustic solutions are employed, we would recommend their application only to the patches of exudation in the fauces, since we regard it as highly doubtful whether they actually possess the power of preventing the formation of membranous exudation when applied to the surrounding mucous membrane. Still more should we doubt the efficacy or advantage of introducing such solutions, and especially the more powerful ones, into the larynx; either by pressing a soft sponge saturated with the solution upon the chink of the glottis, or by passing the sponge directly into the cavity of the larynx, as recommended by Dr. Horace Green. (*Observ. on the Path. of Croup, etc.*, New York, 1852.) The practicability of this proceeding is undoubted, and a certain number of cases are on record in which it seems to have been used with success; but we have never resorted to the treatment ourselves.

In cases occurring in older children, who can be induced to inhale the vapor from an atomizer, or to allow a hand-ball atomizer to be used, the various astringent and solvent solutions above mentioned can be applied most satisfactorily in this manner; and, when this is practicable, we would prefer the use of lime-water or one of the alkaline solutions.

We attach so much importance to this remedy, and have found it to be followed by so much relief and comfort that we are in the habit of directing the inhalation of vapor of lime-water for five or ten minutes at least every two hours.

In order to obtain the advantage which undoubtedly follows the inhalation merely of the watery vapor, we are in the habit of causing the child to inhale the vapor from slaking lime for a few minutes in every hour, by covering the patient's body with a thick cloth, and holding a vessel containing the slaking lime a short distance below his mouth under the covering. It is doubtful, however, whether any appreciable amount of lime is carried up by the vapor so as to give the additional advantage of its solvent action upon the exudation.

The reader is referred for more detailed discussion of this question of local applications in the treatment of croup, to the remarks upon treatment in the article on diphtheria.

HYGIENIC TREATMENT.—The child ought to be warmly clothed, and confined to bed. The temperature of the room should be kept equable, and about 70° F.; the air should also be frequently changed, so as to preserve it constantly pure and fresh.

Owing to the loss of appetite and the pain caused by deglutition, it is often very difficult to induce the little patients to take food, so that this important element in the management of the case requires the utmost tact and attention. During the early part of the attack, the food should consist of light animal broths, beef tea, and preparations of milk. Later in the case, when the violence of the febrile action subsides, or if any symptoms of exhaustion and prostration appear, a small amount of wine and water, of wine whey, or of weak milk punch, should be given.

Ice, given in small pieces to be held in the mouth, should be used very freely, as it relieves the parching thirst and at the same time appears to act favorably upon the inflamed mucous membrane.

SUMMARY OF THE TREATMENT.—The general plan of treating this disease should, therefore, in our opinion, be somewhat as follows: The child should be confined strictly to bed. The food should be light, digestible, but nourishing, and, upon the earliest approach of exhaustion, a stimulus should be administered. In the early part of the attack, we should advise the use of revulsives, with mild counter-irritants; topical applications to the fauces if there is any membranous exudation visible, and the internal administration of citrate of potash, with ipecac and small doses of opium, or of chlorate of potash with tr. ferri chloridi. So soon as the symptoms positively indicate the presence of false membrane in the larynx, we should resort to emetics, as directed in our remarks upon those remedies. During the whole treatment we should also recommend frequent inhalations of the vapor of lime-water or some other alkaline solution. And finally, after employing these means faithfully but without securing the discharge of the false membrane, while, on the other hand, the symptoms of laryngeal obstruction steadily progress, and the respiration grows more and more difficult, we must consider the propriety of resorting to the operation of tracheotomy, a proceeding which, as will be seen from the ensuing remarks, we approve of under the above circumstances.

TRACHEOTOMY.—The operation of tracheotomy would be apt to suggest itself to a medical man, on his witnessing the closing symptoms of croup, as the very means most likely to afford to the patient relief from the dreadful sufferings under which he labors, and as a possible rescue from impending death. It has accordingly been often resorted to in different parts of the world, at various stages of the disease, but with results that have led to very different conclusions.

In England, for example, the operation was almost universally condemned and abandoned about ten years ago; and in a former edition of this work, we presented the unfavorable opinions of the most eminent English authorities.

It was a matter of very great surprise, at that time, that the results of the operation in the hands of English surgeons should differ so widely from those obtained by the French physicians in similar cases. And, as

there was no good ground for believing that sufficient difference existed between the croup of Paris and London, to explain the difference of success in the two cities, it is probable that the great disparity resulted, in part, from the operation being performed in France at an earlier stage of the disease, and in part also from the more careful after-treatment which the patients received.

Within the past few years, however, the operation has been more favorably regarded by English surgeons, and the statistics published show that the proportion of success now obtained does not fall far short of that claimed by French operators.

Thus in a paper read before the Royal Med.-Chir. Soc., in 1857, by Dr. Fuller, it is stated that up to that time 22 cases of tracheotomy in croup had been recorded in England, and that life had been saved in 8 of these, or in 1 out of every $2\frac{3}{4}$ cases.

In the statistical report of English Hospitals from 1854–59, it appears that the operation had been performed in 15 cases with 4 recoveries, or 1 in every $3\frac{3}{4}$ cases. Still further, from the statistics published by individual operators in England, since 1858, though it is not to be presumed that we have met with all the cases recorded, it appears that tracheotomy has been resorted to in 63 cases, with successful results in 24, showing a success of 1 in $2\frac{5}{8}$.

When it is borne in mind also, that in each of these instances the operation was postponed to the last suffocative stage, and that without exception the operators believe that the proportion of success would have been increased by its somewhat earlier performance, it becomes evident that tracheotomy has acquired a fair position in England among the legitimate operations of surgery.

It is thus advocated by Fergusson in the last edition of his *Practical Surgery;* and Dr. West, in 1859, speaks of it in these terms: "In spite of the unfavorable issue of the few cases in which I have either directed or sanctioned the performance of tracheotomy in croup, I am so far from being opposed to the operation, that my chief anxiety is to make out the indications which may justify me in having more timely recourse to it in future."

In Germany, also, the operation, if not generally practiced, is regarded as fully justifiable, and recommended and successfully performed by many of the most eminent authorities.

The statistics of the results there obtained, borrowed from Fock[1] and Voss,[2] show that of 50 cases operated on in the last stage, 24 terminated favorably, giving a success of 1 in $2\frac{1}{12}$, or 48 per cent. Steiner has also recently published (*Jahrb. f. Kinderheilk.*, No. 1, 1868) the results of the operation in 52 cases (33 boys and 19 girls), which show a recovery of 18, or 34.6 per cent. of those operated upon; and in an article upon diphtheria and tracheotomy by Güterbock (*Arch. d. Heilkunde*, 1867, No. 6) 100 cases, operated on in Berlin, are reported, with 33 cures.

[1] Report on Tracheotomy. Brit. and For. Med.-Chir. Rev., July, 1860, from Deutsche Klinik, 1860.

[2] New York Journal of Medicine, January, 1860.

It is, however, in France that the operation first obtained, and has since firmly held, the position of a proper and legitimate method of treatment under certain circumstances of the disease. M. Bretonneau, of Tours, was the first who practiced it with sufficient success in France to give it some vogue. Since that time, it has been recommended and performed by many different surgeons and physicians in that country, and particularly, as is well known, by M. Trousseau, who has been undoubtedly the most ardent and persevering, as well as the most experienced advocate of the operation. In one of his later publications upon this subject (*Arch. Gen. de Med.*, Mars, 1855, p. 259), he thus boldly advocates it: "For my part, I am quite determined not to allow myself to be discouraged, but to preach tracheotomy with the greater conviction in proportion as its success increases, and did this proportion remain what it was ten years since, I should still proclaim the necessity of the operation, nor cease to say that it becomes *a duty*, a duty as imperative as the ligature of the carotid artery after a wound of that vessel, though death follows the operation as often, certainly, as recovery."

M. Guersent (*Dict. de Med.*, t. ix, p. 376) recommends the operation when the usual therapeutical methods have failed, "as the only means that offers a remaining chance." He adds (p. 377) that he is certain it does not add to the danger of the disease. MM. Rilliet and Barthez (*Mal. des Enfants*, 2ème ed., t. i, p. 337) say that "the utility of tracheotomy in the treatment of croup cannot at this day be denied; numerous cases of children snatched from a certain and imminent death, reply victoriously to any doubts that may be raised as to the truth of this assertion." The authors of the *Comp. de Med. Prat.* (t. ii, p. 587) remark that of late years, "the successful operations have been numerous enough to dispel the unfortunate prejudices which tracheotomy has hitherto inspired." M. Valleix (*Guide du Méd. Prat.*, t. i, p. 388) says that the number of recoveries are "now too numerous to allow any one to think of opposing the operation except by statistics." MM. Hardy and Behier (*Trait. de Path. Int.*, 1850, t. ii, p. 496), in speaking of the contest in regard to the propriety of the operation, say, "But the question seems now to be definitely settled; the operation has succeeded in fact in a little more than one-fourth of the cases in which it has been performed, and, in presence of these results, it may be said to become the duty of the physician to have recourse to it whenever, notwithstanding an appropriate treatment, the general and local symptoms indicate the extension of the false membrane."

M. Bouchut (*Trait. des Mal. des Nouv.-nés*, 2ème ed., p. 316) says, that when medical means have failed, and the disease has produced a "state tending towards asphyxia, in which an attack of suffocation might cause the death of the child, there should be no hesitation; a new route must be artificially opened to the external air; tracheotomy must be performed."

At the time most of the above expressions were writen, a comparatively small number of operations had been placed upon record in France, but they were quite sufficiently numerous to show conclusively that, if the operation were carefully performed, and the after-treatment skilfully conducted, from 25 to 33 per cent. of the cases would recover. This excellent

result is to be in great part attributed to the improvements introduced by Trousseau, and subsequently by other operators, both in the mode of performing the operation, and in the after-treatment of the cases.

Since the publication of the last edition of this work the operation has continued to be so frequently performed in France, that we cannot find space to quote the results obtained by individual operators. The aggregate of their reports, however, as collected by Roger and Sée, Chaillou, Barthez, etc., yield a result of about one recovery in four in a series of over 500 cases.

The proportion of recoveries has varied considerably in different years in accordance with the type of the epidemic; in some years, as 1858, falling as low as 1 in 6.9 (124 operations, and but 18 recoveries), while in other years it has risen even higher than 1 in 3.

It is further to be remembered that these French statistics are chiefly derived from the reports of the Hôpital des Enfants in Paris, and refer, therefore, to a poor class of patients, who have in many instances been subjected to improper and debilitating treatment before reaching the hospital, and who are exposed to unfavorable hygienic conditions while in the institution. When these unfavorable circumstances are allowed their full weight, it must be conceded that the operation of tracheotomy has achieved a considerable share of success in France, and has fully justified the eloquent and enthusiastic advocacy of Trousseau.

In America, tracheotomy has been resorted to but rarely until within the past few years. The statistics which have been lately published, however, fully suffice to show that, in the hands of American physicians, it has been very nearly, if not altogether, as successful as it has abroad. Dr. H. H. Smith (*Oper. Surg.*, 2d ed., vol. i, p. 473) gives the results of 26 operations performed in this country, of which 9 recovered. Dr. Gay (*Boston Med. and Surg. Jour.*, Jan. 27, 1859, et al.) reports 13 operations, with 7 cures and 6 deaths; and other operators in Boston have performed the operation in all 15 times, with 7 cures and 8 deaths. But by far the most extensive statistics have recently been published by Dr. A. Jacobi, of New York (*Amer. Jour. of Obstet.*, May, 1868, pp. 13 to 65), derived exclusively from the practice of physicians in that city.

The following table shows the results obtained:

Operator.	No. of cases.	No. of cures.	Percentage of success.
Jacobi,	67	13	19½
L. Voss,	43	10	23¼
E. Krackowizer,	55	16	29
W. Von Roth,	48	11	23
Total,	213	50	23½

In this city the operation has been as yet but seldom resorted to, and with but moderate success, owing to the fact that in nearly every instance it has been postponed until the child was almost moribund. The following table embraces certainly the great majority of the operations that have been performed; for a knowledge of which we are to a great extent in-

debted to the courtesy of the operators, since but few of them have as yet been placed on record:

Name of operator.	No. of cases.	No. of cures.
Physick,	2	0
Goddard,	2	0
Page,	1	0
J. Pancoast,	6	3
R. J. Levis,	14	2
T. H. Bache,	1	0
A. Hewson,	1	0
H. Lenox Hodge,	9	2
J. H. Packard,	3	0
T. J Morton,	3	2
Goodman,	3	1
Drysdale,	9	3
Total,	54	13 or 24.07 per cent.

Finally, to sum up the statistics given above, although even this aggregate does not include by any means all recorded cases, Jacobi states (*loc. cit.*), that out of 1024 operations of tracheotomy, performed in various parts of the world, but principally in Europe, 220 or 21.48 per cent. recovered.

It is evident, therefore, that wherever this operation has been practiced in true croup, a considerable proportion of cures has been effected; but in order to form a clear opinion as to the real merits of the operation, it is necessary to have some idea as to the number of subjects that might have recovered without a resort to it.

This is very easily arrived at in this country, since we believe that it is never performed here except as a last resort, when the patient is manifestly in great danger of death, or absolutely moribund.

In regard to the French operations, it is not so clear whether some of the patients, who recovered after the operation, might not have been so fortunate without it, particularly as M. Trousseau formerly recommended that it should be performed so soon as we can be certain that the larynx contains false membranes. But then it is generally understood that he was not called to many of the cases upon which he operated until all other means had failed, and the child had fallen into an apparently hopeless condition. To elucidate this matter, we shall quote the statements made by M. Valleix, one of the most accurate and impartial of writers. M. Valleix (*loc. cit.*, p. 388–9) tells us that he collected together 54 cases of undeniable, well-marked true croup, treated without the operation, and found that 17 had been cured. Then, examining what had occurred in regard to the operation, he found, as M. Bricheteau had done before, that nearly 1 in 3 had recovered, a success almost precisely the same as had taken place in the cases treated by medical means alone. "But," he goes on to remark, "there is a consideration of very great importance, one which gives an altogether different value to tracheotomy, to wit, that in the immense majority of instances, the operation was performed under the most discouraging circumstances, and only when all other methods of treatment

had proved useless, and the severity of the symptoms, and the near approach of asphyxia, indicated impending death. . . . . So that it follows that tracheotomy should be regarded, in connection with croup, as a genuine medical victory, the honor of which belongs to M. Bretonneau, and all preconceived views should fall before the actual facts." We have here the evidence of a most competent witness, living on the spot, to convince us that the operation is not resorted to in France, at least generally, early in the disease, but is performed only as a last resource, when the chance for the patient from the efforts of nature, or from medical means, is almost null. How, then, can we resist the conviction that tracheotomy does afford a sufficient probability of success, after other means have failed and death is fast approaching, to render a recourse to it at least justifiable, if not almost compulsory?

The second point to be examined in discussing the propriety of the operation is, whether it be in itself dangerous.

From the opinions expressed by authors upon this subject, it appears that the only serious danger attendant upon the operation is the occurrence of hæmorrhage. When performed for the removal of foreign bodies from the air-passages, the patients almost always recover if the foreign body do but escape. M. Ollivier (Art. *Larynx, Corps Etrangers, Dict. de Méd.*) says that the success of the operation is, so to speak, certain, when it is performed early. Liston disapproves of the operation in croup, but states that it is not attended with much danger. Skey regards it as an operation of some difficulty and danger, from the irregularity in the distribution of the vessels, and the existence of numerous veins which may bleed profusely. M. Boyer does not regard it as dangerous, and states that the only danger is from the occurrence of venous hæmorrhage into the trachea, and not from the amount of blood lost. Chelius says that it is dangerous below the cricoid cartilage from anastomosis of the thyroidean arteries, from the presence of venous plexuses, and sometimes from a deep thyroidean artery. Velpeau speaks of the venous hæmorrhage as alone dangerous. Trousseau states that he has performed it more than 200 times, and has met with but a single fatal accident in all of these. Dr. Pancoast, of this city, who has operated in more than 6 cases of croup, and a number of times for the removal of foreign bodies in the air-passages, has never met with any serious difficulty in the performance of the operation, nor with any accident which he could suppose might have affected the life of the patient. Dr. H. H. Smith (*op. cit.*, p. 474), when commenting upon the great disparity of the mortality after tracheotomy, when performed for removal of foreign bodies, and when for the relief of croup, remarks that it is very evident that the dangers which ensue upon incising a healthy trachea are comparatively slight, and that the great mortality which has attended the operation when performed for the relief of croup, must be due to some other cause than the mere incision of the windpipe.

If, then, it is the uniform testimony of those experienced in the matter that the operation is in itself alone but slightly dangerous to life, so that its performance adds but little to the danger of the patient; if it affords immediate relief to the suffocation which threatens to be soon fatal, and at

least gives additional time, during which the gravity of the disease may subside; if, further, as we think has been most conclusively shown by the statistics quoted, it has unquestionably saved the lives of a considerable number of those upon whom it has been performed, it is difficult to avoid the conclusion that it is our imperative duty to resort to the operation under certain circumstances.

That some who have been operated upon might have recovered without it, is highly probable; but the uncertainty as to the absolute necessity of resorting to it in any individual case is not even so great, probably, as that which exists in regard to many other surgical operations, and to many medical applications.

Our own plan, then, is to try faithfully all medical means; and, being satisfied of their powerlessness and of the certainty of a fatal issue to the case without the performance of tracheotomy, to inform the parents of the inability of mere medical means to afford relief, and to propose the operation to them, setting before them the great probability of its not averting death, but still strongly pointing out the fact that it does not add to the danger of the case, but gives so much additional chance for life that about 1 in every 4 operated upon recovers.

Should they throw the whole responsibility upon us, we should, without hesitation, advise the operation. Our grounds for so doing are very simple, and have been before indicated. The operation does assuredly frequently save life. It is not in itself attended with any great danger. It cannot increase the danger of the patient's position, but certainly gives an additional chance of escape from the disease; and, lastly, it mitigates, in a remarkable manner, the sufferings of the patient. On several occasions, indeed, we have been told by the parents, after the death of their child, that they were very glad it had been performed, since, at all events, it had removed the frightful gaspings and strugglings for breath which had previously convulsed the whole frame of the poor little sufferer, and had rendered his last hours easy and tranquil.

If we decide that tracheotomy is justifiable, it becomes all-important to determine the period of the disease at which we should have recourse to it.

M. Trousseau formerly laid down the rule that it was to be performed so soon as it was certain that false membranes had formed in the larynx. He fixed upon this as the proper moment, because he believed that death was, under these circumstances, almost inevitable without the operation.

This opinion is, however, readily proved to be untenable. We have already learned from M. Valleix that of 54 perfectly well-marked cases collected by himself, treated medically (without the operation), 17, or about a third, recovered. If we add to this that, of 35 cases seen by ourselves 15 recovered without the operation, it becomes very clear that the mere presence of the exudation in the larynx is not sufficient warrant for a resort to the operation.

Accordingly, most authorities advise that we should wait until medical means have been fairly tried. Thus, MM. Rilliet and Barthez (*op. cit.*, t. i, p. 340), in discussing the period at which the operation ought to be performed, conclude that it should not be resorted to until the means that have

succeeded in other cases have been fairly tried, and it has become evident that they must fail. They advise the practitioner not to wait, however, too long a time, but to operate even early should the patient suffer a paroxysm of suffocation so severe as to make it probable that another might prove fatal. So, too, Mr. James Spence, in a valuable paper on tracheotomy (*Edin. Med. Jour.*, Feb. 1860), states, as the result of his large experience, "that if, in a case of croup, all measures have been actively tried, if the hard, ringing cough has become suppressed, and the respiration is evidently imperfect, as shown by the contracted and depressed appearance of the cartilages of the ribs, and the occasional severe paroxysms of dyspnœa, the operation is fully warranted. When the paroxysms become more and more frequent, and when the dyspnœa is rather persistent than paroxysmal, with turgid or pale lividity, the operation is the little sufferer's only chance for life."

The same course is, we believe, universally pursued in this country, and, as the reader will recollect, corresponds precisely with the advice given in our remarks on the medical treatment of true croup.

The prime indication for the performance of the operation is, then, the degree of laryngeal obstruction as shown by the characters of the respiration, the cry, and cough.

It should, however, be carefully borne in mind that great dyspnœa, or even asphyxia, when intermitting, do not so imperatively claim operative interference, since cases where the dyspnœa is of this character may recover without the operation.

When, however, despite the use of all medical means, and especially the repeated administration of emetics, the dyspnœa grows steadily and progressively greater; when there is marked hissing laryngeal stridor, and, at each inspiratory effort, recession of the base of the thorax; when, in addition, the voice is whispering or suppressed, and the cough short, smothered, and muffled, the operation should, we think, be unhesitatingly performed.

In thus defining the conditions under which tracheotomy is called for in croup, it is clear that we are not to be influenced at all by the mere period of the disease as measured by time, but that, whenever the above symptoms are present, the operation is indicated.

There can be no doubt, however, of the far greater success of the operation when performed in the early period of the attack, before the patient's strength is materially impaired; and it is, therefore, highly desirable that the indications which render its performance necessary should be appreciated so soon as they appear.

A still further argument in favor of the timely performance of the operation is adduced by Dr. George Johnson (*British Med. Jour.*, Jan. 15, 1870), who dwells upon its value at an early stage, when the indications are present, on account of the danger of œdema of the lung from venous congestion, and of the coagulation of the blood in the pulmonary artery.

Trousseau, also, in his last publication upon this subject (*Clin. Méd.*, 2d ed., t. i, p. 450), speaks as follows: "I wrote in 1834, and repeated in 1851:

so long as tracheotomy was not a trusty weapon in my hands, I said, we should operate as late as possible; but now that I can number many successes, I say, we should operate as early as possible. In removing from this assertion whatever may seem too absolute, I still affirm it, by saying, that *the chances of the success of the operation are so much the greater in proportion as it has been the earlier performed.*"

Notwithstanding this, however, should we be called to a case where the last stage of asphyxia has been reached, it is still not too late to perform the operation. Thus, in one of the cases that occurred in our own practice and which ended favorably, this condition was fully developed, and the bluish skin, drowsiness, and insensibility to pain, showed that the patient had already sunk into very advanced asphyxia.

Perhaps we cannot do better in closing our remarks upon this point than to quote the concise and forcible axiom laid down by Archambault: "We should never operate too late; it is never too late to operate, so long as death is not actually present."

There are, however, certain conditions which have been thought by many authorities to contraindicate the performance of the operation, even under the circumstances above described. The first of these is the very early age of the patient, and it has been advised to refuse the operation in all cases occurring under the age of two years. It is unquestionably true, as might be expected, that age exercises a most powerful influence upon the prognosis after the operation, owing partly to the difficulty in performing it on account of the narrowness of the trachea and the shortness of the neck, but chiefly to the deficiency of vital power, and to the difficulty of nourishing the infant afterwards. Notwithstanding these influences, which render the prognosis so unfavorable in tracheotomy before the age of two years, there are so many successful cases on record that the most tender age can no longer be regarded as a positive contraindication. The following list embraces the names of the operators and the age of the infants in the cases which have been successful at a very early age:

Baizeau,	at	10	months.	Vigla,	at	17	months.
"	"	15	"	Potain,	"	18	"
" (in hands of his colleague),	"	15	"	Moutard-Martin,	"	18	"
Isambert,	"	16	"	Trousseau,	"	13	"
Archambault,	"	13	"	Barthez,	"	13	"
"	"	18	"	"	"	7	"
Roger,	"	19	"	Maslieurat Lagemand,	"	23	"

In adults, on the other hand, tracheotomy in croup is less successful than in children, probably because, as Trousseau suggests, the form and size of the larynx allow the pseudo-membrane to extend deeply into the bronchia before producing the symptoms of croup.

There is another condition which, it is thought by many, ought to constitute an insuperable bar to the operation, and the possible existence of which, in any case, is one of the most serious objections that has been

brought against its performance. The condition to which we allude is the presence of pseudo-membranous exudation in the bronchia.

The existence of this condition must greatly lessen the chances of a successful operation, but that it renders success impossible, as has been supposed, cannot be admitted. MM. Rilliet and Barthez (*op. cit.*, 2ème ed., t. i, p. 338) say: "It has been said that one contraindication was the presence of false membrane in the bronchia. But, besides the fact that the symptoms denoting its presence are uncertain, we cannot see in this a positive objection to the operation. Recovery has been known to occur, in effect, after the rejection of bronchial false membranes, and we were ourselves witnesses of a remarkable example of this kind. And is there any better mode of facilitating the escape of foreign bodies than by opening to them a passage below the larynx? Under such circumstances, we must expect to be sure, a greater mortality than under more favorable conditions. This opinion is, moreover, that of M. Bretonneau." Numerous cases are indeed on record, and we have ourselves met with such, where, after the operation, large membranous casts of the trachea and bronchia, which could certainly never have escaped through the larynx, have been discharged through the tracheal opening, and their escape followed by complete recovery.

It appears evident, therefore, that if in such cases, when death is even more surely imminent than in those instances when the exudation does not extend below the larynx, tracheotomy affords even a very slight additional chance of recovery, it should be performed despite the fact that the child will in all probability die.

But, apart from this consideration, it must be borne in mind that statistics prove that the false membrane extends below the larynx in about one-third of all cases, and still further, that there are no means by which we can with certainty determine in any individual case whether such extension has taken place or not.

It was at one time thought that auscultation might afford the desired information, but more careful observation has shown that it is not to be depended upon. As already said, in most cases the laryngeal stridor is so loud as to mask all chest-sounds, and, even when this does not happen, we have frequently observed that no definite and reliable information is to be gained from physical examination. The following cases may be quoted, out of the number on record, besides several that we have ourselves seen, as proving this statement. MM. De La Berge and Monneret (*Comp. de Méd. Prat.*, t. ii, p. 587) mention a case in which they could not believe that the bronchia contained false membranes, as the vesicular murmur was extremely pure and was heard everywhere; and yet, during the operation, a false membrane was drawn out, which represented the trachea and the division of the principal bronchia. The child died in 15 hours.

The late Prof. William Pepper, of this city, reported 2 fatal cases (*Summary of Trans. Coll. Phys.*, vol. iii, No. iii, p. 106), in one of which "distinct vesicular murmur could be heard throughout the lungs, marked only occasionally by sibilant and sonorous râles," a few hours before tracheotomy was performed. The child died 20 hours after the operation, and

the exudation was found to implicate the larynx, trachea, the large bronchia, and even some of the smaller ramifications. In the other case, the state of the respiration was carefully examined the day before death, and not the least respiratory murmur could be heard over any part of the chest, and yet, in this instance, the exudation was confined strictly to the larynx; not a vestige of false membrane was to be found either in the trachea or bronchia.

In a case recently attended by us, where tracheotomy had been performed, so that all laryngeal stridor was absent, auscultation, eight hours before death, revealed quite strong respiratory murmur, much obscured by snoring bronchial râles. The antero-lateral parts of the chest were alone ausculted. Death occurred somewhat suddenly from the lodgment of a very large tubular membrane from the left bronchus in the trachea; and at the autopsy there was a tubular membrane found extending throughout the trachea, and through the right bronchus to its third divisions. The left lung was collapsed and congested; the right one distended and emphysematous.

Since, then, we can learn little or nothing from auscultation, or any other means, as to the presence of false membrane in the bronchia, the question becomes one of expediency, so far as this contraindication is concerned, whether to leave two-thirds of the patients, many of whom could certainly be saved by the operation, to perish without an effort to save them, because one-third *must* probably die; or to perform the operation, with very little prospect of success in one-third, for the sake of the chance of saving many of the remaining two-thirds who must otherwise perish.

The presence of pneumonia is also universally recognized as greatly lessening the chances of recovery after tracheotomy. It must be borne in mind, in regard to this point, that pneumonia is frequently overlooked, and indeed that it frequently cannot be recognized on account of the loud tracheal râles which hide all auscultatory sounds; while, on the other hand, its presence may be simulated by the occurrence of collapse of some portion of the lung, owing to occlusion of the bronchus leading to it. Millard suggests that the degree of dyspnœa may be of service as indicating the presence or absence of pneumonic complication. Thus he has found that in croup not thus complicated the rate of respiration is from 32 to 48, while, when pneumonia is present, it rises above 50. It is probable, also, that by a careful study of the temperature, the occurrence of pneumonia may be suspected by a marked elevation of several degrees. Pneumonia of one lung is not, according to Guersent, a contraindication, nor is even double pneumonia regarded by some operators as absolutely interdicting the operation, though at the same time we are not aware of a single instance in which it has been successfully performed where this condition was unquestionably present.

Another condition in which tracheotomy is thought by many to be contraindicated, is when membranous croup occurs as a secondary affection, during the course of some constitutional disease other than diphtheria, as, for instance, scarlatina, measles, or pertussis. Such cases were regarded even by Trousseau as absolutely unfit for operative treatment. Still, that

this contraindication, although of the greatest weight, does not entirely forbid tracheotomy, is shown by a case of croup following scarlatina, in which Dr. Voss operated, and the child survived 31 days, the tracheal wound being nearly closed. Millard, also, in his excellent essay on tracheotomy (*De la Trachéotomie dans le Cas de Croup*, Paris, 1858), records 3 cases of croup secondary to measles, successfully treated by operation. He regards croup occurring in the course of pertussis as far less unfavorable, since the violent cough favors the expectoration of the false membranes.

There remains, finally, one condition to be indicated in which the operation is, in the almost unanimous opinion of authorities upon this question, absolutely contraindicated. We refer to the cases of profound general diphtheritic infection, where the danger of the child depends upon the constitutional disease, even more than upon the laryngeal obstruction, where the blood is gravely altered, and the well-known tendency exists to the formation of pseudo-membranes upon all abrasions or wounds, so that in all probability the operation would merely serve to invite the extension of the exudation.

Trousseau opposes the operation under such conditions, in the following words: "If the diphtheritic infection have profoundly attacked the constitution; if the skin, and especially the nasal passages, are occupied by the specific inflammation; if a frequent pulse, delirium, and prostration show the system to be deeply poisoned, and if the danger is rather from the general condition than from the local lesion of the larynx and trachea, *the operation ought never to be attempted*, for it is invariably followed by death."

Even under this most unfavorable of all conditions, however, there are not wanting some operators of wide experience, who still recommend the operation: thus Jacobi (*loc. cit.*) asserts, that whenever the indication of suffocative dyspnœa, steadily increasing and not relieved by emetics, exists, he would operate despite any complications, general diphtheria, or anything else, and uses this powerful language: "Seeing a person suspended by the neck and being strangled, we should hardly investigate the propriety of cutting the rope from the point of view that the sufferer might be or is affected at the same time with tuberculosis, cancer, or diabetes."

After a careful review of the entire question, we believe that the facts upon record justify the following conclusions: that the condition of success which excels all others is the predominance of the characters of asphyxia; that when these are so marked that death is imminent, the operation is justifiable despite any complications which may coexist, save perhaps the presence of grave general diphtheritic infection; and finally that, when no such contraindication is present, and the dyspnœa is continuous and increasing despite all other treatment, the operation is positively indicated, and it becomes the duty of the practitioner to recommend its performance, and, if the decision be intrusted to him, to unhesitatingly assume the responsibility of operating.

We have already indicated with sufficient clearness the influence which the age of the patient, the period of the disease, and the character of the

epidemic exert upon the results of tracheotomy. But we would again allude to the marked manner in which the result is modified by the character of the previous treatment, and to the fact that its success is very much interfered with by the earlier employment of any debilitating measures, such as were, until lately, but too frequently adopted.

We have more than once been asked by the parents of children, upon whom tracheotomy was about to be performed, or who had actually undergone it, what influence would be exerted by the effects of the operation, should it be successful, upon a subsequent attack of croup; and since, as has already been seen from the cases quoted by us from our own experience, second attacks of croup are not very rare, it is interesting to know, that so far the statistics which bear upon this question tend to show that a previous attack of croup cured by tracheotomy is a favorable condition for its performance in a subsequent attack. Thus of 5 cases, collected by Millard, in which the operation was performed for the second time, every one recovered. The second operation was uniformly found much easier, on account of the cicatrix of the former incision serving as a guide, and also on account of the slight amount of the hæmorrhage.

Mode of Performing the Operation.—Tracheotomy being an operation which all physicians, whether experienced or not in the use of surgical instruments, are liable to be called upon to perform at a moment's notice, no apology is needed for the introduction here of the details of its performance. The following account is in great part borrowed from the pages of that most experienced tracheotomist, Trousseau,[1] and from a very complete and practical discussion of the operation by F. Howard Marsh, Esq.[2]

The child should be carefully wrapped up, so as to avoid all exposure to cold; and if an anæsthetic is to be employed, should be allowed to sit or lie in any position he may choose during its administration, as the constrained position necessary during the operation tends to increase the difficulty of breathing. He should then be placed upon a table, furnished with a thin mattress, and a folded pillow or roll of cloth should be placed under the shoulders and back of the neck, so as to put the skin of the throat upon the stretch, and render the trachea prominent. If the operation is performed during the day, the table should be drawn close to the window, and the patient's face directed *toward* it, so that a full light may fall upon the throat; if, however, it be at night, and there is not sufficient gaslight, a special assistant must be intrusted with the duty of holding the candles or lamp. An assistant is also needed to stand behind the patient and hold the head securely; and another, whose duty shall be to draw aside the successive layers of tissue and the bloodvessels with a hook, and to sponge the wound from time to time.

The instruments needed are a sharp-pointed, slightly curved bistoury; a blunt-pointed bistoury; two flexible hooks; a dilator to stretch the incision in the trachea so as to favor the introduction of the canula, and made

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[1] Clin. Méd., 2ème ed., tom. i, p. 414 et seq.

[2] St. Barth. Hosp. Rep., vol. iii, p. 331 et seq.

like a pair of curved dressing forceps, with a little spur projecting backward, so as to catch in the tissues and prevent its displacement; and finally a canula. The size and form of this canula are matters of great importance; and of late years several marked improvements have been effected in them. The calibre of the canula should, as first clearly directed by Trousseau, be as large as possible without interfering with its easy introduction into the trachea, and its curve should be that of a quarter of a circle.

In regard to this very important question of the size of the canula, we are indebted to Mr. Marsh (*loc. cit.*) for a series of observations, which appear to indicate that a tube somewhat smaller than that recommended by Trousseau, Fuller, and others, may be equally efficient and yet less irritating. By a series of careful measurements of the respective diameters of the trachea and cricoid cartilage, he established the fact that the latter diameter is almost invariably less than that of the trachea, to an extent varying from $\frac{1}{40}$th to $\frac{6}{40}$ths of an inch. If, therefore, as his measurements show, the diameters of the trachea are as follows: during the first two years of life, $\frac{10}{40}$ths of an inch; in the third year, $\frac{11}{40}$ths; in the fourth and to the seventh, $\frac{14}{40}$ths; in the eighth and ninth, $\frac{15}{40}$ths; and in the tenth, $\frac{16}{40}$ths; it will be seen that a canula having a diameter of $\frac{9}{40}$ths of an inch will answer for children between the ages of 1 and 4 years; one of $\frac{11}{40}$ths for children between 5 and 8 years; and one of $\frac{13}{40}$ths for children between 9 and 12 years old.

It may be added, that after the 12th year the diameters of the cricoid cartilage and trachea increase so rapidly, that the canula now usually made for adults, with a diameter of $\frac{14}{40}$ths of an inch, is rather small for children between 14 and 16 years old.

The length of the canula should be sufficient to cause it to reach from $\frac{1}{2}$ to 1 inch below the inferior angle of the wound in the trachea.

The canula must also be double, the outer tube having a broad collar in front, with holes through which the band which passes around the neck and secures the canula in position, may be passed and tied. It should also be furnished with a key, which plays easily in a notch on the upper part of the inner tube. This inner tube must so fit the larger one, as to be readily removed and replaced, being secured in position by the little key above mentioned.

In some canulas a still further improvement is introduced, by having the outer tube and collar merely yoked together by means of two arches on the collar, which receive small outjutting bars at the sides of the upper extremity of the outer tube, so that this can shift its position according to any pressure it may receive.

There is also a canula recommended by Fuller, called the "bivalve canula," the outer portion of which is not a tube, but consists of two narrow lateral blades, which are easily compressed by the finger and thumb into the form of a thin wedge, and expand again when the pressure is removed. This instrument supersedes the need of any dilator, and has the great advantage of being readily introduced. It is evident, however, that it must produce much more irritation while in position than a tubular

canula, and in addition, when the inner tube has been removed, as is frequently required, its reintroduction causes pain and irritation, from the constriction of the mucous membrane which has bulged inward between the blades of the outer portion. Mr. Marsh, therefore, advises that when there is any difficulty in introducing the canula at the time of the operation, a Fuller's tube should be used, but that this should be exchanged on the second day for one whose outer portion is tubular.

Although it is almost the universal practice to introduce a canula at the time of operation, its use has been objected to by several good authorities, as apt to cause inflammation and ulceration of the trachea, and to favor the development of pulmonary complications; and several plans have been suggested for the separation of the edges of the tracheal wound. Thus Mr. Adams, of the London Hospital, recommends the introduction of a strong metallic wire speculum, such as are frequently used in operations on the eyes, and Dr. Pancoast, of this city, employs a pair of blunt leaden hooks.

In addition to the instruments already enumerated, some operators, following the practice of the Dublin surgeons, use a hook or tenaculum to fix the trachea, while the incision is being made through its rings. This proceeding has certain advantages, especially when it is designed to excise a portion of the trachea, or in case of venous hæmorrhage, as the trachea can be raised above the pool of effused blood and speedily opened, which will usually check the bleeding. It is also of service in young children, because the trachea is then so pliable and yielding, that, unless the hook be used, its anterior wall may be easily driven in front of the point of the scalpel, till it is nearly or quite in contact with the posterior, in which case the latter also may be wounded. Trousseau, Millard, and others, however, strongly object to this practice, believing it to be dangerous to so fix the trachea and oppose the movements connected with the performance of the function of respiration which is already so much impaired. Our own observation would go to show that, while the advantages to be gained from fixing the trachea are undoubted, especially in young children, the dangers have been somewhat exaggerated.

It has been recommended by several high authorities—Lawrence, Carmichael, G. H. Porter, Brainard, Fergusson—to excise a small piece of the walls of the trachea. By some this has been adopted with the view of dispensing with the use of a canula, but it is claimed that, even when one is employed, this practice renders its introduction more easy; that the tube fits the oval opening thus made much more accurately than a mere slit, produces less pressure upon the edges, and consequently is not so apt to cause caries of the tracheal rings. It seems never to be followed by narrowing of the trachea after the canula has been removed, as might be apprehended.

This practice is followed by Dr. Pancoast, of this city, who, in the case he describes, excised an elliptical piece about one-third of an inch long and two-tenths of an inch broad, from the front part of the third, fourth, and fifth rings of the trachea. As already said, he does not employ either a canula or dilator, but holds apart the edges of the wound made in the

soft parts over the trachea by means of a piece of thick leaden wire, bent so as to form hooks at either end. The wire is of such a length as to fit accurately around the neck when the hooked ends are placed within the edges of the incision, and thus keep up just sufficient traction in opposite directions to maintain the wound open.

In regard to the operation itself, almost all who have had much experience in it direct that it must be performed with great deliberation and care.

The incision through the skin should be made precisely in the median line of the neck, and should extend from the cricoid cartilage to a little above the sternum. The slight white fibrous line which marks the interspace between the sterno-hyoid and sterno-thyroid muscles should then be followed as a guide for the next incision, and the muscular masses drawn aside by hooks.

The trachea is now exposed with the isthmus of the thyroid gland, and, occasionally, large thyroidean veins lying upon it, and great care must be observed to avoid wounding these on account of the troublesome hæmorrhage which is apt to follow. A still further reason for this caution is the occasional existence of an anomalous distribution of arteries, by which a branch of considerable size, or even the innominate artery itself, passes over the trachea directly in the course of the wound. Any bloodvessels may be drawn aside by hooks, and the isthmus of the thyroid gland may either be treated in the same way, or if it cannot be drawn away far enough to allow a sufficient incision of the trachea, may be ligated in two places and divided between (Brainard, of Chicago), although, when possible, this had better be avoided. The trachea, having been thus carefully exposed, should be punctured just below the cricoid cartilage, and the probe-pointed bistoury being introduced, and its edge guarded by the nail of the index finger of the left hand, the opening should be enlarged downwards to the extent of two or three tracheal rings.

It usually occurs that there is some hæmorrhage during these incisions; but if it be venous and moderate in amount, the opening of the trachea should not be deferred, as the re-establishment of respiration will usually speedily check it.

So soon as the trachea is incised, the dilator should be instantly introduced with the blades closed; and so soon as in position these should be moderately opened. Air now enters readily, and there is a discharge of mucus, fragments of false membrane, and blood, through the opening. The canula should then be introduced upon the dilator as a guide, its entrance being evinced by the increased facility of respiration, and the escape of mucus and blood through its calibre. A guard of india-rubber or a disk of waxed cloth should then be placed between the guard of the external tube and the skin, to prevent any irritation or chafing, and the canula may be fastened in position by a tape passed around the neck.

Should blood bubble up by the side of the canula, as Géraldes observes, the wound in the trachea has been made too large, so that the blood gains entrance during inspiration, and a larger canula should be at once substituted.

It occasionally happens, as in a case related by Trousseau, that the trachea is lined by a false membrane, which is partly detached and pressed forward by the end of the canula, so that it completely occludes the opening, and thus even increases the asphyxia. When this occurs, the canula should be withdrawn, and an attempt made to seize the false membrane with forceps and withdraw it.

When the operation has been a laborious one, emphysema of the neck may be met with, sometimes extending to a considerable distance, and causing great disfigurement or even seriously complicating the course of the case. It results from a want of parallelism between the cutaneous and tracheal wounds, or from marked disproportion between the size of the tracheal wound and that of the canula, or, as occasionally may happen, from the escape of the canula from the tracheal wound. It has also happened that the inflamed and thickened mucous membrane is stretched over and driven before the point of the scalpel, and so escapes a sufficient division.

It has not been customary to use anæsthetics in the performance of tracheotomy. Fock, however, advises the use of chloroform, and states that he has never, even in extreme dyspnœa, found any ill effects to result from its employment. At first the dyspnœa is increased by the inhalation, but anæsthesia is speedily established, and then the breathing becomes much calmer than before. Dr. Voss, who has also employed it, reports equally favorably of its effects; and Mr. Marsh, who has seen it administered in at least twenty cases, believes that, when carefully and slowly given, it is most beneficial. It must be remembered, however, that, owing to the asphyxia, the sensibility of the child is usually much blunted, so that, even without anæsthesia, the operation has appeared to us to cause but little pain, and has been borne by the little patients with scarcely any struggling.

After-Treatment.—Immediately after the successful performance of the operation, and the satisfactory adjustment of the canula, an almost incredible change occurs in all the symptoms of the patient. The wild restlessness of the little sufferer, with the agonized, appealing glances at those surrounding the bedside, and the frantic clutching at the throat as though to tear it open to admit air, the lividity of the surface, the noisy, hissing stridor of the respiration, all vanish as though by magic. Very frequently the child falls into a placid sleep, the skin and lips regain their normal color, and the breathing becomes regular, full, and nearly as silent as in health. This calm is not, however, to be of long duration; there are frightful dangers still to be undergone, from which nothing but the most assiduous care and skilful treatment can enable the patient to escape with life.

It may, in fact, be asserted that the much greater proportion of success which has of late years attended this operation, is to be attributed chiefly to the more judicious after-treatment which patients receive. Indeed, Trousseau has mostly truly said, with regard to the importance of this portion of the management of the cases, that tracheotomy, badly performed, but well treated afterwards, will end favorably in a third of all cases; whereas, tracheotomy excellently executed, but badly treated afterwards, will almost invariably be followed by a fatal termination.

It might, consequently, have been added to the contraindications already enumerated, that, unless we can secure constant and skilful attendance upon the case after the performance of the operation, there can be but little hope of obtaining a favorable result.

Wherever it is in any way possible, the constant presence, by day and night, of a physician or student of medicine, should be secured for four or five days after the operation. When this is utterly impossible, all of those engaged in nursing the case should be carefully instructed how to act in the event of any emergency, so that the child shall never be without the presence of some one competent and ready to render the prompt assistance which is frequently necessary to avert instant death. The details of the attention necessary will be given a little further on.

One of the first points to which careful attention must be paid, is to give to the air to be inspired through the canula as much as possible the temperature and degree of moisture that the air attains by its normal passage through the mouth and nose. Various means have been recommended to secure this object; thus a piece of loose coarse sponge, wetted with tepid water, and enveloped in a piece of gauze, may be applied over the canula; or, as directed by Trousseau, "the neck of the child may be surrounded by a cravat of knitted wool, or a large piece of muslin or gauze, so that the patient expires into this thick tissue, and inspires the air impregnated by the warm watery vapor which the expiration has just furnished."

This is the only means adopted by Trousseau; but we may, in addition, by the aid of a spirit-lamp, keep shallow dishes of water evaporating in the room, and at the same time employ a thermometer to regulate the temperature of the chamber, which should be uniformly kept at from 70° to 72° F., though the air should be changed frequently, so that it may be pure and fresh.

By careful attendance to this clear but long-neglected indication, we not only prevent the rapid drying of the mucus in the canula and trachea, but, as Trousseau asserts, avoid to a great extent the occurrence of pneumonia or bronchitis as sequelæ of the operation.

In regard to the treatment of the wound itself, we have already alluded to the advantage of placing a piece of lint spread with cerate, or a caoutchouc ring, beneath the collar of the canula to prevent any irritation of the skin. No sutures should be introduced into the skin incision, as the efforts during coughing will soon tear them out. Trousseau strongly advises that the edges of the wound should be cauterized daily for the first three or four days, with solid nitrate of silver, in order to prevent the formation of diphtheritic deposit.

It very soon becomes necessary, despite every care to render the inspired air moist, to cleanse the inner tube of the coating of viscid, partly dried mucus which collects on its interior, and to effect this, the inner tube should be removed as frequently as is necessary. The frequency with which this withdrawal is required varies in different cases, but it may be stated as a general rule, that it should be performed from four to twelve times in twenty-four hours.

When the tube is clear, the respiration is almost noiseless, and hence the

supervention of noisy breathing is usually the indication of some obstruction in the inner tube, which should immediately be withdrawn and cleaned.

The drying of the mucus in its interior may be partially prevented by dropping, every half hour, a few minims of tepid water into the mouth of the canula, and by smearing the inner surface of the tube with pure glycerin, every two or three hours. Some years ago,[1] Barthez recommended instillations of tepid solutions of chlorate of soda through the canula after tracheotomy, in the hope of effecting the softening of the false membranes, and their more rapid and complete expulsion. Although he was inclined to attribute a beneficial effect to the practice at the time, it appears to have since fallen into disfavor even with its originator.

We have ourselves employed lime-water in several cases, and always with obvious relief. We were induced to use it from its well-known solvent action upon pseudo-membranous exudation, and have generally employed it by atomizing warm lime-water through the canula every few hours, or so often as the breathing becomes noisy and labored, despite the removal and cleaning of the inner tube, from the collection of viscid mucus or pseudo-membrane below the end of the canula. The atomization has been continued for a moment or two, and has usually excited cough, while at the same time it softened the viscid mucus and enabled the child to reject it through the tube. So great, indeed, is the relief at times thus afforded, that in one case the little patient asked frequently that the use of the atomizer should be repeated. In all probability it does good, partly by its mechanical action in exciting cough, partly by the softening effect of the watery spray, but partly also, we are inclined to believe, by the action of the lime upon the mucus and pseudo-membranes. We are also in the habit of directing that the child shall breathe, for a few minutes in every hour, the steam from slaking lime, though in all probability this does not contain an appreciable amount of the lime itself.

Recently Dr. Böcker of Berlin (*Deutsche Klinik*, July 8, 1876) has reported the very favorable results he has obtained by means of frequently repeated inhalations, after tracheotomy, of the spray of lime-water solution, of chlorate of potash, or dilute lactic acid. Dr. Burrer, who has adopted the same practice, reports eight cases in which these frequent inhalations formed part of the after-treatment; of these eight cases only two died, while of ten cases, tracheotomies performed by the same operator before his adoption of this mode of treatment, seven were fatal.

It occasionally happens, however, that the breathing becomes noisy and obstructed and remains so even after the withdrawal of the inner tube, and the use of the atomizer. The cause of the obstruction then probably consists in the presence near the end of the canula, either of a collection of dried mucus or of a piece of false membrane too large to escape through the canula. If, under these circumstances, an access of dyspnœa should ensue, the strings securing the canula should be instantly cut and the outer tube withdrawn. If this be followed by the rejection of false membrane and a return of quiet respiration, the canula may be returned; but if there

[1] Bull. Gén. de Thér., May 30, 1858.

is reason to fear that the trachea contains false membranes too large to escape through the tube, it is better to allow it to remain out permanently.

Millard (*loc. cit.*) recommends that the external tube should always be removed at the end of twenty-four hours after the operation, when the track of the wound is usually patulous, being lined by plastic lymph, and after waiting a few minutes for the rejection of false membranes and cauterizing the wound, be again introduced.

In those cases which progress favorably, it soon becomes necessary to decide at what date the canula shall be finally removed. It is evident that this should be accomplished so soon as possible, as the tube acts the part of a more or less irritating foreign body in the neighborhood of delicate and important structures, and yet it is only in rare cases that the patient can endure its removal before the sixth or seventh day.

At the end of the fifth day, therefore, the experiment may be tried of plugging the mouth of the canula with a little roll of wool, to learn in what degree the larynx has become patulous. Should the child be unable to take a single respiration, the experiment may be deferred for several days, but should breathing be performed through the mouth for several minutes, the measure may be repeated daily, in order to gradually accustom the larynx to a resumption of its function.

About the seventh or eighth day the tube may be removed for an hour or two; and, if its abstraction be well borne, it may be finally withdrawn the following day, and the wound closed by bringing its edges together with adhesive plaster. It is very necessary to observe the caution, that the canula must never be removed unless some one competent to replace it is at hand. It occasionally happens, however, that the larynx remains impervious for a much longer time, and cases are recorded in which it has been impossible to remove the canula for fifteen, twenty-five, forty-four (Trousseau), or even one hundred and twenty-six (Fock) days; or even for months or years. The causes which thus delay the period at which the tube can be removed, are summed up by Mr. Marsh (*loc. cit.*), as follows:

1. Obstruction of the larynx by false membranes, which have been known to linger in its cavity for at least fourteen days after the operation.
2. A chronic inflammation and thickening of the mucous membrane of the larynx, which may remain after the acute disease has passed off.
3. A narrowing or complete obliteration of the passage of the larynx, by the growth of granulations above and around the canula.
4. An impairment or complete loss of those functions of the muscles of the larynx which regulate the admission of air through the rima glottidis.
5. Adhesions of the opposed surfaces of the vocal cords.

After the removal of the tube, the wound heals, either by contracting from the circumference toward the centre, when air escapes until the very last day; or the tracheal wound first closes, and the cicatrization then advances externally. The average time occupied by this process of cicatrization, is about one month, though it may be completed in two weeks or be protracted for two months.

Among the results which have been known to follow the prolonged stay of the canula in the trachea, are necrosis of the tracheal cartilages, and ulceration about the wound, or of the trachea around the canula, which, in several cases, has been followed by fatal hæmorrhage. Suppuration among the deeper structures of the neck, even extending into the anterior mediastinum, has been noticed in a few instances, when the deepseated tissues of the neck had been much disturbed.

General Treatment.—Having carefully discussed the management of the canula and the treatment of the tracheal wound, it remains to say a few words in regard to the general treatment of the patient after the operation.

The most essential point to be secured is, unquestionably, the proper alimentation of the child. It is, however, frequently very difficult to induce it to partake even of the most tempting food. We should endeavor to persuade it to take, as before the operation, nourishing animal broths, beef tea, milk, custard, chocolate, wine-whey, or weak milk-punch. If, however, these are refused, and the child expresses a desire for any other digestible article of food—as the breast-meat of fowl, finely minced, or the soft portions of oysters, or eggs—the taste should be gratified. Occasionally ice cream will be taken willingly, when other food is refused; or, when both wine-whey and milk-punch are rejected, iced wine and water, or brandy and water will be relished. Unfortunately, however, it not rarely happens that, owing partly to the soreness of the throat and partly, undoubtedly, to the pain caused by the canula during the movements of the trachea in deglutition, the little patient utterly refuses to swallow more than a mere sip of iced water. Under such circumstances, so serious a complication is abstinence, that Trousseau recommends that it should be forced to take a little food. "Do not fear," he says, "to employ intimidation. In such cases I have often—assuming an apparent severity, the expression of which I have exaggerated—forced the child to eat, and so have prepared the way for a recovery, which, without this, seemed to me impossible."

Even by this means, however, it may be impossible to secure the administration of a sufficient amount of nourishment, and we would then advise the use of nutritious enemata, consisting either of the yolk of one egg, beaten up in an ounce of milk, or of one ounce of beef tea, and given about every four hours. If they appear to irritate the rectum, and are not retained, one or two drops of laudanum may be added to each enema.

In comparatively rare cases there exists, in addition to this unwillingness to eat, a positive difficulty in swallowing liquids. This results from the inaction of the vocal cords and epiglottis, which allow the fluid to pass through the glottis into the trachea and bronchia, causing violent cough and escaping through the artificial opening. The child is so alarmed by this that it sometimes refuses all nourishment, and can only be supported by nutritious enemata. Under these circumstances, Trousseau advises that all liquid aliment should be interdicted, and that the food of the child should consist of very thick soups, vermicelli boiled in milk or broth, hard eggs, eggs very much cooked in milk, and rare-cooked meat, in rather large

morsels. If the thirst becomes ardent, he allows pure cold water, taking care to give it either some length of time after, or immediately before, the meals, in order to avoid vomiting. This difficulty in swallowing rarely begins until three or four days after the operation, and does not usually last beyond the tenth or twelfth day. Sometimes, as M. Archambault has suggested, the child is enabled to swallow with ease by closing the canula with the finger at the moment of deglutition, but at other times this fails entirely.

In many cases the difficulty in inducing the child to swallow, after the operation, is so great that all medication must be suspended, excepting the administration of small doses of opium, by the mouth or by enema, which we would advise to be continued.

Whenever it is practicable to give remedies, however—without interfering with the ability and willingness to take food—it is very important to bear in mind that despite the very great relief which the operation may have afforded, it has by no means put a stop to the disease, but has simply afforded the system another chance to overcome and cast off the constitutional affection.

Of course, the use of emetics must be suspended, and so if, on any theoretical ground, any depressing remedies have been employed, they should be discontinued. But we should recommend under such circumstances, that the use of the combination of chlorate of potash, tincture of chloride of iron, and sulphate of quinia, should be persisted in.

We subjoin the histories of two cases of true croup, which have lately occurred in our practice, and which will serve to illustrate clinically the remarks that we have made upon this disease.

In both cases tracheotomy was performed by Dr. H. Lenox Hodge, in one instance with complete success, but in the other with a fatal result.

The first and successful case was under the care of Dr. R. Bolling, of Chestnut Hill, and was seen in consultation by Dr. J. F. Meigs, and, subsequently to the performance of the operation by Dr. Hodge, by Drs. Edward Rhoads and William Pepper.

The second case was visited by both of us from the first; and was attended, after the performance of the operation by Dr. Hodge, with the most zealous and skilful care, by Drs. Wharton Sinkler and M. Longstreth.

Angina with Membranous Exudation on Tonsils—Membranous Laryngitis: Tracheotomy at end of second day—Complete Recovery.

Case 1. F. W., æt. 7½ years, a delicate child, who at the age of 4 years had suffered from a severe attack of true croup, from which he recovered without the operation. On December 23d, 1868, he was noticed to have the symptoms of an ordinary cold in the head, with slight sore throat, some dysphagia, and laryngeal cough; he was visited and prescribed for by Dr. R. Bolling. On December 24th the cough persisted, and there was slight coryza and redness of fauces, but without any membranous deposit or any croupy symptoms.

He was ordered small doses of Kermes mineral, Dover's powder, and nitrate of potash, and counter-irritation to the throat.

At 5 A.M., December 25th, the child, who had gone to sleep quietly, waked in a frightful paroxysm of dyspnœa, gasping, clutching at its throat, and with oppressed whispering voice.

Emetics of alum were given, and produced free emesis, but without the rejection of any false membrane, nor was any yet visible in the fauces. The powders were continued.

The dyspnœa persisted and grew steadily worse; the voice remained suppressed. Membranous exudation was noticed in the evening on the tonsils, and during the following night the obstruction to respiration became so intense that, after consultation with Dr. Meigs, tracheotomy was performed by Dr. H. Lennox Hodge. The trachea was opened just below the isthmus of the thyroid gland. No false membrane could be seen at the level of the opening, nor was any rejected.

A few hours later it became necessary to remove the canula, cut an oval piece from the trachea, and replace the tube, during which proceeding artificial respiration had to be maintained.

The neck was surrounded by gauze. Nutritious enemata, with small doses of laudanum, were given every two or three hours. Cream and brandy were given by mouth, and the attempt was made to give quinia and iron, but the child absolutely refused to take it. The breathing became somewhat easier, but at 9 A.M., December 26th, it was 66, and the pulse 160.

The internal tube was frequently removed and cleansed of very thick viscid mucus, which rapidly collected in it; and the other treatment was continued. In the afternoon it became evident that the internal tube was entirely too small, and it was therefore abandoned and the external one alone retained. Warm lime-water was now atomized down the tube every two hours, and on the first occasion of its use was followed by the rejection of a large piece of thick, dark-gray, glue-like false membrane. This was followed by marked relief to the dyspnœa.

The child was kept gently under the influence of opium; and was nourished by enemata of beef tea, f ℥j; brandy, f ℥j; tr. opii, gtt. iv, given every three hours; which were retained unless they provoked a fecal discharge, which happened two or three times. The urine was passed freely, and was not albuminous.

The respirations were conducted solely through the tube and once during sleep fell as low as 32.

December 27.—Still refused to eat, and the bowel also became somewhat irritable, so that several of the enemata were rejected. The respirations varied from 35 to 48; the pulse from 132 to 140. The treatment was continued; the atomization of lime-water through the tube being repeated every three hours. Towards the close of each interval the face became flushed, and the child grew restless, throwing the arms about excitedly, at times leaping up in bed, and turning round so as to lean forward on the pillows and bury his face in his hand, or else looking round with an appealing expression. The atomization was always followed by cough, and the rejection of pieces of false membrane and thick puriform matter. Towards evening he began to swallow some food.

December 28.—The tissues of the neck had become so much infiltrated and swollen, that the canula was no longer long enough to reach from the cutaneous surface into the trachea; it was in this way pushed forward till it obstructed the tracheal opening and caused great dyspnœa. It was consequently removed, and the child, though much exhausted, sank into a gentle refreshing sleep, with quiet regular breathing. The tube was not replaced, the breathing being readily performed through the wound. There was still marked indisposition to take food, and for a few times he was forced to swallow by holding his nose and pouring beef tea down his throat; this was not, however, continued, as the effort exhausted him very much, owing to his most violent resistance. The discharge from the trachea through the wound was quite fluid, purulent, and very fetid. A solution of carbolic acid, gtt. x, in Oss. of tepid water, was atomized through the wound; and the atmosphere of the room was kept impregnated by atomizing a stronger solution about the chamber.

During the day he swallowed more food; gr. ¼ of opium was given twice; his circulation and respiration improved.

December 29.—Condition still improving. Respirations 28, quite full and deep,

without râles; pulse had fallen steadily from 114 to 84, and was more full and strong. The color of surface was better. Respiration carried on partly through the mouth.

December 30.—The child passed a very comfortable day. The respirations were about 24; the pulse 78 to 86, soft, full, and strong; the capillary circulation good. Food was taken much better, the child eating a croquette made soft with cream, the soft part of several oysters, a small piece of breast of partridge cut fine and rubbed up with butter and salt, and drinking sherry wine and water, and rich chocolate. The discharge had lost to a great extent its offensive character. Took gr. ss. of opium at night, and slept five hours quietly.

December 31.—The child's condition was better in every way. The wound was contracting, the edges of the tracheal opening white and clean, and granulations beginning to project over it. The cough was stronger and more laryngeal, and the voice stronger and clearer, though still whispering. A good deal of the discharge was now raised into the mouth and expectorated. The gauze with which the wound had been covered was changed for a piece of patent lint, to encourage the larynx to gradually resume its functions.

From this time the case steadily improved. The matter expectorated grew more and more mucoid, thin, whitish, and scanty, and finally expectoration ceased almost entirely. The general symptoms rapidly improved, though he remained weak and nervous for six weeks. The external wound was covered with patent lint, at first of one, then of several thicknesses, and he gradually regained the power of breathing through the larynx, and of speaking. The larynx seemed quite clear after January 2d, 1869, eight days after the operation. The wound granulated from the bottom outwards, and was entirely cicatrized by the end of six weeks; by which time he was about the house, and had returned to his studies to occupy his mind, as he was very fretful and nervous.

November 1, 1869.—F. W. remains perfectly well, and is indeed enjoying more robust health than for several years before this attack of membranous croup.

Angina with membranous patches on tonsils; Membranous Laryngitis; Tracheotomy on tenth day; Death on thirteenth day (fifty-eight hours after operation). Autopsy.—False membrane extending from tracheal wound to third division of bronchi; right lung emphysematous; left lung collapsed; blood dark and fluid.

Case 2. K. B., girl, æt. 6 years and 1 month; rather tall for her age. Her parents are healthy; but she herself had suffered much from spasmodic asthma during infancy and first dentition. Since then she has enjoyed good health. On the morning of Tuesday, October 5th, 1869, she appeared unwell with a little croupy cough, which passed off in the middle of the day, and she was allowed to play in the square for a couple of hours. On Friday, 8th, her cough was worse, but still she seemed so bright that she was allowed to play about the room; but in the afternoon she complained of sore throat, and Dr. J. F. Meigs was called and found small patches of exudation on the tonsils.

℞.—Potass. Chlorat., ... gr. ij.
Tr. Ferri Chloridi, ... gtt. v.
Every third hour in a teaspoonful of syrup and water.

During the night, violent dyspnœa, with noisy gasping breathing, came on, for which emetics were employed with some relief.

On Saturday, 9th, there were patches of membranous exudation on the fauces and tonsils. The cervical lymphatics were only slightly enlarged. The breathing was difficult and stridulous; the voice feeble, small, usually whispering, but when raised by an effort was rather piping and shrill; the cough was short and smothered. There was no coryza. Treatment continued, and inhalations of the vapor from slaking lime ordered every hour.

On Sunday, 10*th*.—The child was restless, with at times marked jactitation; face flushed, and expression anxious; respiration labored; inspiration imperfect, with shrill stridor; expiration prolonged and stridulous. No expectoration. Membrane still visible in fauces. No albumen present in urine. Pulse frequent, skin hot and moist. Treatment continued, and cloths wrung out from hot water applied to the throat.

Monday, 11*th*.—Condition about the same; the degree of dyspnœa varying from time to time with degree of spasm, but the breathing still continuously labored and stridulous. Treatment continued, and frictions with turpentine liniment directed to be made to the throat. Marked unwillingness to eat.

Tuesday, 12*th*.—There was marked improvement in the child's condition. The breathing was easier and less stridulous; the cough less frequent and looser, with a few thick yellowish purulent sputa; the voice was raised with less difficulty, and was clearer and stronger. There was, however, the same faucial pain and obstinate indisposition to eat. The fauces were still red and swollen, and a small thin patch of exudation was visible on one of the tonsils. The treatment was continued, and the child also took a little port wine and water and beef tea, and had nutritious enemata of egg given every four hours.

Wednesday 13*th*.—The condition of the fauces was better, the breathing easier, and the voice more clear. The skin was still heated, pulse frequent, and there was still indisposition to eat.

During the ensuing night the breathing again became more oppressed and tighter, with some return of stridor. The voice also became suppressed and whispering. The circulation was somewhat obstructed, the face becoming flushed, and the lips rather dark.

Thursday 14*th*.—These symptoms were aggravated, and in the evening there was marked jactitation and restlessness. The respirations were 40 in the minute, and stridulous, with prolonged expiration; and, during the inspiratory effort, with violent action of the external respiratory muscles, elevation of the shoulders, and recession of the base of the chest and of the epigastrium. There was also complaint of pain at the epigastrium. The cough was infrequent, short, smothered, and muffled. The eyes were anxious, staring and prominent, with large pupils. The pulse was frequent, 140, and small.

During the night there was a steady aggravation of all these symptoms. The respirations rose to 46, and became extremely obstructed, the recession of the base of the chest and at the epigastrium being unusually marked during inspiration. The voice was whispering and almost suppressed; the expression strained, appealing, and anxious; the face deeply flushed and the lips livid. There was the same complaint of constant pain at the epigastrium.

Friday 15*th*, *at* 7½ *A.M.*, respirations 36, pulse 136. Tracheotomy was performed by Dr. H. Lenox Hodge, the trachea being opened just below the isthmus of the thyroid gland, and a small oval piece excised from its walls. A good deal of venous hæmorrhage occurred during the operation, but stopped immediately after the trachea was opened, and the tube adjusted.

No anæsthetic was used, but the child made no resistance, and evidently was slightly benumbed from asphyxia. Soon after the operation the respirations grew more easy, a large piece of false membrane was thrown off through the opening, the flush disappeared from the face, and the features became composed and placid.

Very soon after the operation the respirations fell to 28, and throughout the day remained easy and regular. The pulse fell to about 120. The child slept well, but would eat but little, and still had enemata of beef tea, f℥j, q. t. h., given it. The air of the room was kept pure, but warm and moist. The canula was covered with folds of gauze moistened with lime-water, and the wound was covered with a piece of greased linen, so as to protect it from the canula. The inner tube was removed every hour, cleaned, anointed with glycerin, and returned. Warm lime-water was atomized through the tube every three hours, and always produced strong cough-

ing, with the expectoration of thick purulent matter, and occasionally of flakes of tough white false membrane. All medication was suspended, save the administration of gtt. ij, or iij, of Tr. Opii Deodorata sufficiently often to keep the child gently under its influence. During the ensuing night the internal tube was removed, owing to the difficulty in expelling the thick viscid mucus.

Saturday, 16*th*.—The respirations were 24; pulse 116. During the day the child took more beef tea and wine and water, but still had nutritious enemata given. There was great thirst, and she still complained of pain in swallowing. There was no coryza, and very slight, if any, enlargement of the cervical lymphatics.

Towards evening, breathing again grew obstructed, evidently from accumulation of mucus and pseudo-membrane below the end of the tube, which was consequently removed. Its removal was followed by the discharge of several large pieces of false membrane through the wound, the edges of which were well consolidated by lymph. The breathing quickly became noiseless, easy, and tranquil again. During the following night the child enjoyed some refreshing sleep, and took more nourishment. The atomization of lime-water through the tracheal opening was repeated about every two hours, and with such great relief that she several times asked for it herself by signs, as it each time provoked cough, and caused the expulsion of thick purulent matter, dried mucus, and shreds and flakes of false membrane. Urine was discharged freely, and contained no albumen.

Sunday 17*th*.—In the morning she appeared quite comfortable. The voice was still whispering, but the cough seemed looser, and she expelled purulent matter more freely through the opening; no false membrane was discharged. The thirst was still great, but the child took beef tea more freely. The bowels have for several days been opened two or three times daily. Respirations 20–25; quite full, without recession of the base of the chest. Pulse 130–136, of rather better volume. Hands fairly warm, though at times there was a little tendency to coolness. The wound was evidently contracting. Slight emphysema of the base of the neck, which caused complaints of pain about the neck and shoulders.

At 4 P.M. it was observed that the breathing was again growing obstructed, and that there was recession of the base of the thorax during inspiration. Lime-water was freely atomized through the opening, but without causing any discharge of membrane. The difficulty of respiration increased until 5½ P.M., when suddenly symptoms of asphyxia appeared. Prolonged efforts at artificial respiration were made, and life was thus maintained for a short time, but no essential relief was afforded, and death soon followed, on the thirteenth day of the disease and fifty-eight hours after the operation.

The chest was frequently ausculted throughout the course of the case. Before the operation it was impossible to isolate any respiratory murmur, owing to the loud, snoring, whistling, and cooing tracheal and bronchial râles. After the operation, and still more after the final removal of the canula, a faint respiratory murmur could be detected, mingled with the above râles. On the morning before death only was there an obscure flapping sound transmitted to the ear with the tracheal and bronchial râles, but even then it was indeterminate in character.

During the efforts at artificial respiration, a long tubular false membrane was ejected. It had evidently been the immediate cause of death.

AUTOPSY, twenty-four hours after death. *Brain* not examined.

Thorax and Air-passages.—The wound in the neck looked well, without pseudo-membranous exudation. The larynx itself could not be examined. A long false membrane, extending from the tracheal opening down through the right bronchus to the third or fourth division, lay loose in the trachea, having been detached from the mucous membrane. In the bronchia it was still slightly attached, but separated readily on traction. It was firm, very tough, and white, and, in the upper part of the trachea, at least one line thick. Below the bifurcation it was tubular for the rest of its course; and in its terminal portions grew softer and more yellowish. There was also, in the trachea, a large patch (1½ inches long by ½ inch wide)

of false membrane, of dull white color, and tightly adherent. Upon raising it, numerous little delicate fibrous prolongations were seen attaching it to the mucous membrane. Beneath this patch the mucous membrane was deeply reddened, dry, excoriated-looking, and slightly roughened by minute elevations. There was no enlargement of the mucous follicles. The vascularity of the mucous membrane diminished in the lower part of the trachea, and was but slightly marked in the secondary divisions of the bronchi. No ulceration was seen at any point. There was no pseudo-membrane in the left bronchus or any of its branches, and the mucous membrane here was less reddened than on the right side. In all probability the false membrane removed immediately after death had come from the left bronchus. The right lung was largely distended, the posterior border dark and congested, but the rest of the organ pale and emphysematous. The left lung was dark, purplish, non-crepitant, collapsed, and yielded on section an abundant flow of dark, airless, bloody serum. No pleurisy or pleural effusion.

Heart.—The left ventricle was very firmly contracted and empty, and the tissue of its walls hard, tough, and florid red. The walls of the right ventricle were relaxed, and the cavity filled with fluid dark blood, without any clots. No excess of pericardial effusion.

The liver and kidneys were gorged with dark blood.

CHAPTER II.

DISEASES OF THE LUNGS AND PLEURA.

GENERAL REMARKS.

It would be difficult, perhaps, to overestimate the importance to the medical practitioner of a thorough knowledge of the different diseases of the lungs and pleura, as they occur in children. The diseases of the respiratory organs—and much the most frequent of them are pneumonia and bronchitis—cause, according to West, very nearly a third of all the deaths under five years of age in England; while not above one child in four dies under that age from diseases of the nervous system, and not above one in seven from those of the digestive system. In this country, it would seem, from the bills of mortality, that a larger proportion of children die of diseases of the digestive than of the respiratory system. But, while this is true, there can be no doubt that the diseases of the latter system are deserving of our utmost attention, since not only are they of constant occurrence and of fatal tendency, as idiopathic affections, but since, also, they frequently appear as complications in the course of other diseases, adding greatly thereby to their severity and danger. In measles, for instance, by far the most frequent cause of danger is the occurrence of some inflammation of the lungs or pleura. In scarlatina and typhoid fever, bronchitis and pneumonia are very common accidents, and recent researches have shown that in hooping-cough, and in all states of great debility and prostration, a certain change in the condition of the pulmonary tissue, to which the term collapse has been applied, is very apt to occur.

The morbid condition of the lung last referred to, that of collapse, is one that has been well understood only within a few years past, and yet it is so important a one, in a practical point of view, as to excite a feeling of surprise that it had not been discovered before.

ARTICLE I.

ATELECTASIS PULMONUM, OR IMPERFECT EXPANSION OF THE LUNG.

THE title of atelectasis pulmonum, from ατελης, imperfect, and εκτασις, expansion, was first employed by Dr. Edward Jörg, to designate a condition of the lungs observed by him in new-born children, a condition in which larger or smaller portions of those organs had never been penetrated by air. The respiration of the infant had, in such cases, been only imperfectly established at birth, and some parts of the pulmonary tissue had, consequently, never undergone expansion under the distending influence of the inspiratory act; these undilated parts continued in the fœtal state.

In addition to this *congenital* form of imperfect expansion of the lung-tissue, this condition is met with at all ages of life, though with especial frequency in young children, as the consequence of a *collapse* of portions of the once-expanded lung, or, in other words, of their return to the fœtal or unexpanded state. To this latter form of imperfect expansion, the terms post-natal atelectasis, collapse, and fœtal condition have been given. Before the discovery of its real nature was made, it had often been described also under the well-known names of carnification and lobular pneumonia. We shall designate it by the title of collapse or post-natal atelectasis, while under that of congenital atelectasis pulmonum, we shall describe the congenital variety of imperfect expansion.

CONGENITAL ATELECTASIS.

ANATOMICAL APPEARANCES.—In congenital atelectasis the parts of the lung most frequently affected are the posterior portion and lower edge of the inferior lobes, the middle lobe of the right lung, and the languette and lower edge of the upper lobes. In some instances that we have examined, the greater part of the lower lobes of both lungs, while, in others, still larger portions of these organs have been found to present this condition. The imperfectly expanded portions of the lung are of a dark-red or purplish color, and are diminished in size, so as to be depressed below the level of the healthy parts. They are solid to the touch, and yet they have not lost their cohesive properties, as they are neither friable, easily torn, nor readily penetrable by the finger; their cut surface is perfectly smooth; they do not crepitate under the finger, and no air-bubbles are seen in the fluid squeezed out by pressure; they sink when thrown into water. They, in fact, resemble exactly the fœtal lung. The most con-

vincing proof of the real nature of this condition is obtained by the inflation of the lung. When this is done, the depressed, hard, and dark-colored portions—unless the subject from whom the specimen has been taken may have lived long enough to have allowed the different tissues of the lung to become adherent—rise to their natural level, become elastic, soft, and crepitating, and change, under the influence of the entering air, from a dark and livid tint, to the rosy or pink color of healthy pulmonary tissue. In recent cases, this inflation is performed with great ease and with perfect success; while in other instances, in which the child has lived for some weeks or months, the distension is either effected only by strong efforts, or in a very imperfect manner, or it may fail entirely, owing to some permanent change having taken place in the tissues of the unexpanded portions. In a case that occurred to ourselves, the subject of which died, at the age of fourteen months, of acute pleurisy of the right side, after having presented, at birth and throughout its short life, many of the symptoms of atelectasis, the inferior two-thirds of the lower lobe of the left lung exhibited in the greatest perfection all the atelectasial characteristics. The whole of the unexpanded part was distended by means of inflation with a blowpipe, but only after repeated and powerful expiratory efforts; and Dr. E. Wallace, who made the examination, assured us that he was obliged to use a degree of force much greater than he ever employed to inflate healthy adult lung.

In some cases, there are found small patches of vesicular emphysema associated with the areas of pulmonary collapse. If, in consequence of commencing post-mortem decomposition, there has been any development of gas in the tissue of the lungs, it is seen, by the aid of a lens, in the form of irregular air-bubbles scattered through the interstitial tissue, which are easily distinguished from the minute shining air-bubbles, crowded together in regular arrangement, which are seen in lungs which have been inflated. —Bouchut, *Jour. f. Kinderkrankheiten*, 1863, 3–4, p. 263.

In most cases, the foramen ovale and the ductus arteriosus are found to be still open, or the latter has but partially closed.

The *causes* of congenital atelectasis have not been satisfactorily ascertained. The conditions that are probably the most frequent causes are: original debility of the infant, from any cause that has interfered with its proper development in utero, as feeble health on the part of the mother during pregnancy, or multiple pregnancy; and acquired debility, brought about by the fact of the infant's being exposed at birth to unfavorable hygienic influences, and particularly to those which interfere with the proper performance of the respiratory act, as cold, a vitiated and close atmosphere, and the use of too heavy or tight clothing. A very hurried and rapid labor has been thought to cause, in some instances, this imperfect expansion of the lung-substance. In a case that occurred to one of us (see *Am. Jour. Med. Sc.*, Jan. 1852, p. 83), the only explanation of the condition, which seemed at all plausible, was that the placenta had been separated from the uterus at too early a period of the labor, in consequence of the violent and rapid character of the latter, so that the child was for a short time before birth cut off entirely from its connection with the

mother—a time sufficient so to lower its vital forces as to bring on a condition resembling syncope, and to deprive it of the muscular strength necessary on entering the world, to produce a full expansion of the thoracic cavity, and so of course to effect a dilatation of all parts of the lungs.

In addition to this, congenital collapse of the lungs may result from the air-passages of the child becoming obstructed with mucus or fluid in consequence of the umbilical cord being ruptured during labor, and an inspiration thus becoming necessary, before the head is free from the liquor amnii or the secretions of the mother's passages. Finally the want of expansion has been in some cases found to be dependent on pressure upon the medulla oblongata, implicating the roots of the pneumogastric nerves, resulting from inflammatory exudation or from effusion of blood owing to injuries incurred during delivery.

Symptoms.—The symptoms depending on congenital atelectasis vary a good deal in different cases. There are some, however, which exist in most instances. These are the following: the child comes into the world feeble and weak, and instead of crying vigorously and loudly the moment or very soon after it is born, it fails to cry at all, or the cry is low and weak, or it is whimpering or wailing; the color, instead of being brick-red or dark-red, is pale and whitish, leaden, or livid; the muscular movements, which, in healthy children, are strong and vigorous, are in these, languid and slow, or there are none or scarcely any, the limbs being relaxed and motionless. If the breathing is observed, it is found to be short, high, and imperfect, and it is evident that the thorax is but imperfectly dilated at each movement of respiration. When these symptoms exist in a very marked degree, the infant either dies soon in a state of asphyxia, or, the muscular force slowly increasing, the respiration gradually improves, and the child is, after a longer or shorter time, either out of danger, or it falls into the same state as that of one in whom the symptoms have been from the first less severe. Under the latter circumstances, the infant continues feeble and weak. It breathes shortly, rapidly, and imperfectly, but often without any appearance of effort. The cry is rare, and when heard, is low and feeble, or there is with each respiration a constant plaintive moan, which is very characteristic, and strongly expressive of exhaustion. The color continues pale and whitish, or it is bluish, and the temperature of the extremities is lower than natural. The child sleeps the greater part of the time, and is unable to nurse or nurses very feebly, but can swallow when fluid is poured into the mouth. In such cases as these, the infant does not necessarily die, but will often recover when properly treated. In favorable cases, the symptoms just enumerated may last from a few hours to a day or two, or even a few weeks, without much change; then, under the influence of correct hygienic and medical treatment, they will often begin to improve. The color becomes less pale or less bluish; the muscular movements are somewhat stronger; the child begins to cry, and in a louder tone; the act of swallowing is easier and more perfect, or the infant is able to suck when applied to the breast, at first feebly and only for a moment, and then more strongly; the respiration becomes slower,

fuller, and more natural, and gradually the dangerous symptoms disappear.

In unfavorable cases, on the contrary, the respiration fails to improve, but becomes more and more short, quick, and imperfect; the temperature of the body falls; the color of the surface changes, becoming leaden, bluish, or even livid, the change showing itself first in the neighborhood of the mouth, and in the hands and feet, and extending gradually to the rest of the body; the difficulty in swallowing becomes greater, and very generally some spasmodic twitchings begin to show themselves about the muscles of the face. The respiration is very often attended with slight wheezing or rattling, and the convulsive movements returning frequently, and becoming more violent and more general, the child dies in convulsions, or it sinks very slowly and gradually, without convulsions, as though in a state of syncope. According to Steffen (*Klinik. d. Kinderkr.*, 1865, 1 Bd., p. 50), thrombosis of the cerebral sinuses has been found after death under such conditions.

There is another symptom of imperfect expansion of the lungs in newborn and very young infants, which ought not to be passed unnoticed. It is one mentioned by Dr. George A. Rees, of London, in an essay on this subject (London, 1850), and is of much diagnostic value, although not a pathognomonic symptom of this condition as regarded by him. It is an altered movement of the ribs in respiration. During the inspiratory effort the ribs are seen to move inwards toward the mesial line of the trunk, instead of outwards as in ordinary respiration, thus diminishing instead of expanding the transverse diameter of the thorax. The explanation of the altered movement is as follows: when the diaphragm descends, the lung ought to expand in such a way as to fill up the increased space produced in the thoracic cavity by the descent of that great muscle. Instead of this being the case, however, the lung is collapsed and inexpansive, and cannot enlarge sufficiently to fill up the space alluded to, so that there would remain a vacuum in the chest were it not that the thoracic walls are driven inwards by the pressure of the atmosphere upon their outer surface. In a case that we saw ourselves in a child fourteen months old, who had presented symptoms of atelectasis from birth, and in whom we found after death very extensive collapse, this symptom was very marked. The base of the thorax was indented on both sides by a deep gutter or depression, which remained depressed and unchanged during the inspiratory movements, or which, indeed, rather became more distinctly visible during those motions, so that the chest presented the curious spectacle of dilatation or expansion in its upper parts, during inhalation, and of contraction or collapse at its base.

In regard to this interesting sign the reader is referred to our article on rickets, where is mentioned the explanation given of it by Jenner, in connection with the latter disease.

Symptoms of Collapse in the Early Weeks of Life.—Before taking up the regular consideration of post-natal collapse, as it occurs at all ages of childhood, we wish to refer, for a moment, to that condition as it appears in the first few weeks of life, in infants who have exhibited no

sign of it whatever, perhaps, at the moment of birth. We desire to do this now, because the symptoms to which it gives rise resemble much more those of congenital atelectasis, than those of collapse in children over a few months old. And let it be remarked that these symptoms are very different, and much more severe and threatening than those of collapse at later periods. They are in fact those of cyanosis, and, in some instances, are as strongly marked as those observed in the worst cases of that condition, caused by malformation of the heart or great vessels. The cyanosis and other symptoms of disordered circulation evidently depend on the obstacle offered by the collapsed and condensed portions of lung-tissue to the discharge of blood from the right side of the heart. Though this obstacle to the venous circulation is doubtless the chief cause of the symptoms in these cases, we cannot but think ourselves, that the great difference between the symptoms of congenital atelectasis, as well as of post-natal atelectasis occurring in the first few weeks of life, and the collapse of later periods, must be explained in part, at least, by the fact that the fœtal openings, the foramen ovale, and ductus arteriosus, and especially the former, are still patulous, or in such a condition that they may be reopened under pressure, and so allow a portion of the contents of the overloaded and congested right side of the heart to pass into the left auricle, thence into the left ventricle and aorta, and so to the whole body.

In this form of atelectasis, the child may have been born perfectly healthy, or only weaker than usual, or it may have had some difficulty in establishing the respiration, which, however, has afterwards been effected in the most complete manner. Some days, or even weeks after birth, from a cause disturbing the function of respiration, portions of the lung may collapse, and give rise to the different symptoms of that condition in the manner above described. The most important of these symptoms are difficulty of breathing, consisting either in an increased or diminished rate of that function, diminution of the muscular power, cyanotic hue of the skin, and slight or severe spasmodic phenomena. In a case that occurred to one of ourselves (see *Am. Journ. Med. Sc., loc. cit.*), a child who had exhibited at birth, and for five days after, every appearance of fine health, was observed on the sixth day to cry rather violently in the morning. At one o'clock in the day he began to moan, and appeared distressed; at two he ceased to moan, became bluish, and seemed to lose his breath. He was placed in a bath, in which the blueness passed off, but the breathing continued irregular and uneven. He soon became blue again, and breathed slowly and irregularly, but had no spasm. At about four o'clock another paroxysm occurred, in which the whole surface became first bluish, and then dark, while at the same time, the trunk and limbs became stiff and rigid under the influence of tonic muscular spasm, and the respiration was slow and imperfect. After the attack had lasted for some moments, the blueness and spasmodic phenomena disappeared, but the child remained in a state of stupefaction. There were two slight paroxysms of convulsive stiffening between this and evening, and later in the evening there was still some blueness, with irregular and short respiration. During the night the breathing was short and uneven, and attended with

moaning, but on the following day the symptoms had disappeared entirely, and there was no return.

In another case the symptoms of collapse did not appear until the twenty-fifth day after birth. The infant had been hearty and strong at birth, and had established its respiration fully and completely. Between the birth, however, and the time of the attack, circumstances connected with the lactation had caused the development of diarrhœa with thrush, which had debilitated the child a good deal. On the day of the attack, frequent sneezing, with stuffing of the head, and some cough, seemed to show the existence of catarrh, and on the same day, the child was unfortunately exposed, owing to the accidental opening of one of the gas-burners, to the inhalation of some gas. Late in the evening, a slight whistling or stridulous sound was heard in the breathing, the skin became suddenly a little bluish, and a slight convulsion followed. During the night there were frequent and strong convulsive seizures, always preceded and followed by deep blueness of the mouth, hands and feet, and it was noticed that the least disturbance, as lifting or nursing, or changing the position, always brought them on. The next morning the attacks continued, but with diminished violence, under the effects of treatment, and they ceased after the middle of the day. The color of the skin had now changed; it had become rosy red, instead of pale or blue, and the hands and feet, which had been cold, were now warm and natural. There was no return after this.

In a third case, a female infant, who had been perfectly well at birth and up to the moment of this attack, was put suddenly into a bath by the nurse on the eighth day, directly after its waking from sleep. The child, who was not thoroughly waked up, seemed greatly terrified, and began to scream most violently. Instead of removing the infant from the water, the nurse persisted in holding it immersed for some minutes, when it became deeply blue, and partially convulsed; it frothed at the mouth and nose, seemed to be suffocating for breath, and appeared to be dying. These symptoms continued for three-quarters of an hour, when they gradually passed away, and it fell into a heavy sleep. When we saw the infant, soon after this, the only signs of disorder that remained, consisted of an unusual paleness, drowsiness, and an expression of feebleness. Some three hours later, it waked, nursed, and from that time seemed quite well.

In a fourth case, a child born apparently well, with the exception of its having had a rather frequent respiration, and who nursed very well on the second and third day, was attacked on the fourth day with blueness, moaning, short and panting respiration, and then with slight convulsive symptoms. It was unable to nurse, and though kept perfectly still, and fed from time to time with small quantities of milk and brandy, became gradually more deeply blue, had paroxysms of very slow respiration and circulation, with general convulsive seizures, and died at the end of twenty-four hours.

The reader will also find this form of cyanosis referred to in our article on that disease.

Diagnosis.—There can be no difficulty in detecting the nature of the case when the imperfect expansion exists from birth, and when the physician is present at that event.

When, however, collapse of the lung-tissue continues after birth, and the physician is called upon to determine, at the age of some days, weeks, or even months, the cause of the feeble health and puny growth of the child, or to explain those sudden attacks of collapse in very young infants who had previously well established, to all appearances, the respiration, the diagnosis becomes more difficult. In the former class of cases, attention to the following points will usually, however, enable us to make a correct diagnosis. The previous history is particularly important, since, in all such cases, it will be found that the infant was either still-born and resuscitated with more or less difficulty, or that it was born weak and feeble, and that the respiration had not been established as thoroughly and completely as it ought to have been. Dr. Rees states that certainly half of the cases of this form, in his own practice, occurred in twins, and that they were all born in a more or less completely asphyxiated condition. The present symptoms are also very important. The feeble appearance of the child, and its puny growth, in connection with its past history, and the absence, as ascertained by careful examination of the case, of other morbid conditions to explain the general ill-health, ought to direct the attention of the physician to the true nature of the disease; and if we add to these considerations the local thoracic symptoms, the short, rapid and imperfect breathing, with, perhaps, the altered movement of the ribs, the indentation instead of expansion during inspiration, mentioned above; the absence of fever; and the existence of the physical signs of more or less extensive solidification of the pulmonary tissue, without those of pneumonia; there will seldom be any difficulty in forming a correct diagnosis.

The cases described under the head of collapse in the early weeks of life may be readily understood from the simple fact that the symptoms cannot be satisfactorily explained by referring them to any other condition than that of collapse of portions of the lung, with impeded and deranged circulation.

Prognosis.—The condition of imperfect expansion of the lungs in a new-born child, does not necessarily cause it to die immediately or very soon after birth. The fate of the child will depend very much upon the cause of the atelectasis, upon its degree of innate strength and vigor, and upon the kind of hygienic conditions to which it may be consigned. When the child is well developed, and not enfeebled by any fault in the mother's health during the pregnancy, but merely by some momentary condition that has occurred during the labor, there is every reason to hope that proper hygienic and medical treatment may restore it to health. The danger is greatest in those who continue weak and feeble, in spite of the proper measures of care and treatment, for some days or weeks after birth. We have a record of ten examples of this condition in new-born children, in nine of which the symptoms persisted during a period varying between six hours and five days. Of these, seven lived, while three died in from twenty-one hours to three days.

The prognosis of the second class of cases—those in which collapse occurs suddenly a few days or weeks after birth, and after the apparently complete establishment of respiration—will vary, of course, with the violence of the symptoms. Of five cases of this kind that came under our observation, recovery took place in three in spite of the most dangerous and alarming symptoms, while in two death occurred in a period of about twenty-four hours.

In cases where the collapse of the lungs has been extensive, and has in part persisted without proving fatal, serious organic changes in the heart have been found to follow, both by F. Weber and Steffen. The long-continued obstruction to the pulmonary circulation prevents the closure of the ductus arteriosus, and subsequently causes hypertrophy with dilatation of the right side of the heart, a patulous state of the foramen ovale, and at last eccentric hypertrophy of the left auricle and ventricle. Undoubtedly, in most cases, death occurs before these changes in the heart are induced, but it is important to be aware that imperfect expansion of the lungs may thus serve to develop serious cardiac disease of a form likely to be attended with cyanosis.

When the imperfect expansion depends upon the presence of accumulations of mucus in the air-passages, well-directed efforts usually succeed in effecting the removal of the obstruction, and the establishment of free inspiration. In those cases, finally, where there is pressure upon the pneumogastric nerves near their origin, a fatal result must always follow.

Treatment.—The treatment of congenital atelectasis must be directed to the removal of its probable cause. If this is suspected to be obstruction of the air-passages by collections of mucus, the infant's mouth should be cleansed, and vomiting provoked by tickling the fauces. In addition to this, all the measures calculated to stimulate respiration should be employed.

When the imperfect expansion appears to depend merely on the weakness of the infant, the treatment resolves itself almost entirely into the employment of such means as tend to invigorate the general health of the child, and to promote the activity of the respiratory act. In a recent case, one dating from birth, in which the function has always been imperfect, and in which there are present great feebleness, drowsiness, and paleness or blueness, the room in which the infant is placed should be kept up to a temperature of 70° or 75°, and the child should be abundantly covered with warm clothing. Perfect quiet, or at least very gentle motion, is very important, and when there is any disposition to deep blueness or to convulsive movements, attention to this point is essential. It is in such cases, and in those in which these symptoms come on a few days or weeks after birth, that the position recommended by the late Dr. C. D. Meigs, for the treatment of cyanosis neonatorum, was found by him so useful. This position is one upon the right side, with the head and shoulders raised at an angle of 45°. It is obtained by arranging pillows in such a way as to form a plane inclined at that angle. Upon this the infant is placed, and orders are given that it is not to be moved at all, if possible, or only with the greatest care and gentleness, for twenty-four or forty-eight hours. There can be no doubt that this position and the attendant repose have, in many

cases recorded by Dr. C. D. Meigs, and in several that we have seen ourselves, been of very great use in controlling the symptoms. Its good effects in cyanosis were supposed by him to depend on the fact that the septum auricularum becomes horizontal in this position of the body, so that the blood in the right auricle must rise against gravity, in order to pass through the foramen ovale, while, at the same time, the valve of that opening is disposed to fall down by its own weight, and close the foramen, and is, moreover, pressed downwards by any blood that may enter the left auricle from the pulmonary veins. This explanation will apply, of course, only to those cases of atelectasis accompanied by very extensive and deep blueness or purple color of the surface, in which we may suppose that so much of the pulmonary tissue is solidified, as to produce a degree of obstruction to the passage of blood from the right side of the heart into the lungs, sufficient to overload the right ventricle and auricle, until the latter pours a portion of its contents into the left auricle, thus causing admixture of the two kinds of blood. In a large majority of the cases of atelectasis, however, this explanation of the benefit resulting from the treatment referred to, cannot be received, as there is no reason to suppose that in them the slight cyanotic symptoms present indicate anything more than the existence of a moderate degree of congestion of the right side of the heart, unattended by any escape of blood from the right into the left auricle. In such cases the position on the right side is useful, because it is the one most favorable to a full and easy performance of the respiratory and circulatory functions. It leaves the left side free and unembarrassed, so that the heart can act with the greatest possible freedom, while the partial elevation of the head and shoulders renders the movements of the chest more easy and complete than when the body is lying on a horizontal surface. The perfect quiescence which constitutes a part of the treatment is also very important, as in many recent and particularly in cyanotic cases, the symptoms are greatly aggravated, and convulsive attacks often brought on by moving the child, especially if this be done suddenly or rudely.

Various means are also recommended for rousing the force of respiration, as by compelling the infant to cry, by frictions of the surface, by plunging the body alternately into warm and cool water, or by allowing a stream of cold water to fall on the nape of the neck with the view of exciting the respiratory nerve-centres.

Attempts may also be made to produce full inflation by gentle mouth-to-mouth respiration. The other modes of attempting to accomplish this are either (as by compressing the thorax at regular intervals) of but little value, or (as in case of Hüter's proposal to inflate the lungs after catheterization of the larynx) highly objectionable.

Perhaps the most important point of all in the treatment of this affection, especially when the symptoms tend to become persistent, is the mode of nutrition of the child. If possible, the infant should always have a good breast of milk, and if unable to suck, the milk ought to be drawn by means of a breast-pump, and given to the child in small quantities from a spoon. About two or three teaspoonfuls may be given at first every half hour or hour, and the quantity gradually increased until the child gains strength

enough to be put to the breast. If breast-milk cannot be procured, cow's milk and water may be substituted, in the proportion of one part of the former to two or three of the latter. The only medicines to be given are, at first, while the child is still very young and weak, mild stimulants, of which the best, in our opinion, is fine old brandy. Of this about five drops may be given each time that the milk is taken; or, we may make use of from three to five drop doses of the aromatic spirit of hartshorn, or of proper quantities of wine-whey.

When the symptoms of congenital atelectasis tend to persist for several weeks or months, or when we first see the patient some time after birth, the chief points to be attended to in the treatment are, as before, the mode of nutrition, which ought to be by nursing and the use of gentle stimulants and tonics. Brandy, wine, or Huxham's tincture of bark, are the best stimulants; whilst quinine, in the dose of a quarter or half a grain, three times a day; extract of cinchona, in the dose of from one to three or four grains, three times a day; or iron in the form of Quevenne's powder, or in that of the iodide, are the best tonics.

Vogel (*Dis. of Children*, Amer. ed., 1870, p. 55) speaks very highly of the advantage derived from the cautious application of electricity to the pectoral muscles.

COLLAPSE OF THE LUNG, OR POST-NATAL ATELECTASIS.

General Remarks.—By collapse of the lung is meant the return of that organ to its fœtal or unexpanded state. It is in fact a condition of atelectasis or imperfect expansion of its vesicular structure. The terms collapse or post-natal atelectasis are employed to contradistinguish it from congenital atelectasis, the former being applied to imperfect expansion as it occurs in lung-tissue after previous expansion, and the latter, as stated in the preceding article, to the same condition as it exists in children who have never expanded certain portions of the pulmonary substance.

The true nature of collapse of the lung was never understood, and its great practical importance never appreciated, until since the year 1844, when MM. Legendre and Bailly published, in the *Archives Générales de Médecine*, their researches on the subject. Since then various observers have repeated the investigations of those gentlemen, and thrown new light upon the matter. Among the most important of the later writers on this subject, we may mention Dr. Charles West of London, MM. Hardy and Behier of Paris, Dr. W. T. Gairdner of Edinburgh, and MM. Rilliet and Barthez, in the second edition of their work.

This discovery in pathology was one of very great value, not merely because it renders our knowledge of the morbid conditions of the lungs more exact and philosophical than it ever was previously, but because it explains certain anatomical changes in the pulmonary structures, often before noticed and described, but never satisfactorily accounted for; and still more, because it points to methods of treatment much more rational and much more successful than those employed under the influence of former ideas as to the nature of the lesions alluded to. The most im-

portant result of the new views is the disclosure of the fact that several lesions met with after death, which were formerly thought to depend on inflammation of the affected tissue, are in reality the consequences of collapse or obliteration of the vesicular structure of the lung, and not of inflammation, as was at one time supposed. The lesions alluded to are those which have been hitherto described under the names of lobular pneumonia and carnification.

The peculiar character of the lesions met with in many of the supposed cases of pneumonia, had often attracted attention and been commented upon, before their real nature came to be understood. The points of difference between these alterations and those of true pneumonia were particularly noticed by MM. Denis, De La Berge, Rufz, Rilliet and Barthez, Dr. Gerhard, and Dr. West. In fact, M. Rufz, and MM. Rilliet and Barthez, both approached very near the truth in regard to these lesions, each comparing them, but the former at an earlier period than the latter, to the condition of the lung of a fœtus that has never breathed. The latter writers, in the article on pneumonia in their first edition, have described a condition of the lung which differed so much from ordinary pneumonia as to create a great difficulty in their minds as to its true nature, and to it they applied the term carnification. They were on the very verge of detecting its real character; they did in fact suggest its real character, but were so possessed with the idea that it must be the result of some inflammatory action as to neglect to pursue their own suggestion, but endeavored to explain the condition on the ground that it was "one mode of termination of pneumonia, or else chronic pneumonia." The following passage, quoted from their work (1ère ed., t. i, p. 74), will show how closely they approached the truth: "The first idea that enters the mind on examining this tissue (carnification) is, that it resembles the lung of a fœtus that has not breathed; we should feel inclined to say that the pulmonary vesicles had not yet been dilated under the influence of the thoracic expansion, and had not, therefore, admitted air into their interior; or, rather, it would seem as though they had been obliterated by some attack of disease, perhaps inflammation, without, however, remaining engorged, and after having lost the power of dilatation."

In the second edition of their great work, MM. Rilliet and Barthez adopt, in great measure, the views of MM. Legendre and Bailly, and of Dr. Gairdner, not only in regard to carnification, but also in regard to the yet more important lesion hitherto generally called lobular pneumonia.

But it is not only the condition of the lung called carnification that has been shown to consist, not in inflammation, but in a collapse of the pulmonary tissue. A much more important consequence of the recent researches has been the discovery that in a very large majority of cases the so-called lobular pneumonia, generalized lobular pneumonia, and pseudo-lobar pneumonia of different writers, are also the results of collapse of the lung, variously combined with bronchitic inflammation and congestion of the pulmonary tissue. The latter discovery has lessened very much the importance of pneumonia as a disease of early life, while it has augmented

in the same proportion that of bronchitis, for it has shown that a very large number of cases, formerly regarded as true inflammation of the parenchyma of the lung, are in fact cases of bronchitis combined with collapse of the tissue of the organ.

Now that the nature of collapse of the lung, in connection with bronchitis, and sometimes, also, with true pneumonic inflammation or congestion, has been made known, a number of symptoms occurring in the pulmonary affections of children, which formerly seemed obscure and irregular, have become easily explicable. It had been often observed that many of the supposod pneumonias of children did not present the same symptoms, pursue the same course, nor require the same treatment as the pneumonia of adults, or as some cases of the disease in children. In a great many of the supposed cases there was an unusually large amount of bronchial inflammation, the general symptoms were much less acute than was to be expected in a parenchymatous inflammation, and what was most singular of all, the physical signs of solidification of the lungs were very variable and uncertain, there being present on one day the signs of simple bronchitis, while on the same day or the following, and over the same region of the thorax, these would be associated with or masked by the signs of induration of the lung; and again, in a day or two, the symptoms indicative of condensation might disappear, to be succeeded yet again by those of simple bronchial inflammation. The effects of treatment seemed also to point clearly to a radical difference between the lobular or broncho-pneumonia of children, and the acute phlegmasial disease of adults. It was found, in fact, that depletory measures were seldom borne well in the lobular pneumonia of children, while in the pneumonia of the adult, and in some acute cases occurring in early life, which presented the same general symptoms and the same physical signs as pneumonia in the adult, antiphlogistics, as is well known, are amongst the most successful remedies that can be made use of.

Anatomical Lesions.—Collapse of the lung (post-natal) occurs in two different forms, the *diffused*, and the limited or *lobular*. The only difference between the two forms is in the number of lobules affected, and their mode of distribution. In the diffused variety, a large number of adjoining lobules collapse, and give a condensed and solid appearance to larger or smaller portions of the lung, most frequently to the edges merely of one of the lobes, but at others to the greater part or the whole of a lobe, or even the major part of a lung. In the lobular variety, on the contrary, single lobules or clusters of lobules become collapsed in different parts of a lobe or lung, and the affected portions take the form of irregular hardened patches or tumors, situated upon the surface, or disseminated through the interior of the pulmonary texture. In the former kind of collapse, the appearance of the altered portion of the lung is somewhat that of lobar pneumonia, and it is to these cases that the terms generalized lobular, pseudo-lobar, carnification, and splenization, have been applied; while in the latter kind, the isolated and distinct condensed portions have been described by the term lobular pneumonia.

The peculiar or fundamental characters of collapsed pulmonary tissue

are the same in both varieties. We will mention them as succinctly as possible, and then compare them with those of pneumonia, for the reason that it is with the lesions of that disease that those of collapse have been so frequently confounded.

Collapsed lung is generally of a dark violet color, but it may be much darker in tint, and even black, when it is much engorged with blood. Its consistence is always changed; the condensation may amount merely to slight hardening, with a diminution of the crepitation, or it may be very dense with an entire absence of crepitation, in which case portions thrown into water sink rapidly. Though more or less hardened, the tissue still retains a certain degree of flaccidity and suppleness. When cut into, the surface is seen to be smooth and uniform, having somewhat the appearance of muscle, and presenting no granulations. Pressure or scraping causes the exudation of more or less semi-transparent bloody serosity. Close examination shows that the organic elements of the tissue, the vessels, bronchia, cellular tissue, etc., can still be distinctly traced. Lastly, inflation of the lung distends the condensed parts, and gives to them again, more or less completely, their natural physiological characters.

MM. Rilliet and Barthez, in their second edition, treat, at considerable length, of congestion of the lung as a very constant accompaniment, and as a very important element in the state of collapse. They regard this congestion as being connected nearly always with bronchitic inflammation, and as being not merely a passive state, but as exhibiting phenomena, in most instances, which prove it to be in some degree an active condition. They say (*op. cit.*, t. i, p. 428): "We readily acknowledge that a state of debility, prolonged dorsal decubitus, and the obstruction to the circulation thus occasioned, facilitate the production of this condition, and give to it the appearance of a simple passive congestion. But we believe that there exists, moreover (frequently, if not always), a really active and even inflammatory movement." They regard this opinion as proved chiefly by the fact that they have found the texture of the affected parts to be somewhat softened, as shown by the facility with which they are torn by the finger or by scraping with a scalpel; by the swelled and turgid condition the tissues exhibit; by the quantity of sanguineous or sero-sanguineous liquid which escapes on pressure; and by the presence of a serous exudation around the pulmonary vesicles, while the interior of the vesicles appears to be healthy. The last-mentioned condition they found upon their own observation, and upon a microscopic examination made by M. Lebert.

The color is different in the two alterations; being, in collapse, purple or livid, and, in pneumonia, brownish-red or fallow-red. In pneumonia the pleura covering the hepatized portions is often covered with false membrane, showing thereby the inflammatory nature of the disease; in collapse this is rarely the case, and only when there is some accidental concomitant pneumonia. The density of the lung in the two conditions is of a different kind: in pneumonia it is hard to the touch, and unyielding; in collapse it always retains a certain degree of flaccidity and softness, like that of muscular tissue. In pneumonia the diseased part is

turgid and swelled, so that it projects above the common level of the surrounding surface; in collapse, on the contrary, it is shrunken and depressed below the neighboring parts. In pneumonia the effect of the inflammatory process on the tissues is very strongly marked, and produces changes in them very different from those occasioned by mere collapse. In the former disease the cohesive properties of the pulmonary structure are very much lessened, so that the inflamed parts are readily penetrated by the finger, and are easily torn; in simple collapse, on the contrary, the diseased part is as firm and resisting, or even more so, than in health; whilst in collapse occurring in bronchitis and attended with congestion, though the cohesion of the tissues is somewhat lessened, it is never nearly so much so as in pneumonia. In the true hepatization of pneumonia, a cut surface always presents a granular aspect, while in collapse, on the contrary, it is smooth and even. On scraping a cut surface it is found that, in the former alteration, a plastic, fibrinous matter, of a yellowish, orange, or gray color, comes off on the knife; while, in collapse, only some semi-transparent bloody serosity is scraped off. In the former, the anatomical arrangement of the lobules cannot be seen, as the inflammation attacks indifferently the lobules themselves, the interlobular septa, and parts of neighboring lobules; but, in the latter, the alteration can always be seen to be more or less regularly confined to the lobules, the cellular interstices between the lobules remaining more or less apparent; so that in pneumonia the alteration is not bounded at all by the outlines of the lobules, while in collapse the alteration always affects, more or less, the lobular form. To conclude, the effects of inflation are altogether different in the two conditions. M. Legendre (*Recherches Anatom.-Path. et Clin. sur quelques Mal de l'Enfance*, p. 164) states that air can never be made to penetrate by inflation into a completely hepatized lung. Neither in hepatization of the lobar form, nor in true partial hepatization, has he ever been able, even with the utmost effort, to push air into the inflamed tissues. After repeated trials, the tissue remained compact and friable, and sank as rapidly as before when thrown into water. In the fœtal state, on the contrary, the slightest effort sufficed to fill and distend the collapsed air-cells, and to give to the altered portion its natural appearance, excepting that it became more red in consequence of the oxygenation of blood contained in the capillaries. Dr. Gairdner (*Pathol. Anat. of Bronchitis, etc.*, Edinburgh, 1850, pp. 13, 14) remarks that, though this test "is very useful in demonstrating the nature of the lesion, in a favorable case, to one not familiar with its character, I do not believe it to be applicable to the determination of the presence or absence of pneumonia in those mixed cases in which alone there is any difficulty." He has observed, in fact, that partially pneumonic lung may be inflated when the affection is recent and combined, as it frequently is, with bronchitic collapse, while in the latter lesion, in its purest forms, complete inflation is often very difficult or impossible after the collapsed state has been of some duration.

The part of the lung in which collapse is most frequently met with depends somewhat on the form of the alteration. In the diffused variety, it may affect a more or less considerable portion of either or both lungs,

but is most common at their posterior part. The lobular variety is most common on the anterior edges, but may, like the diffused, occur in any other part. As a general rule, the alteration is most frequent at the periphery of the organ, where its edges are thin, as along the margins of the lobes, in the languette of the upper lobes, and at the bases of both lungs. The parts just named are those most distant from the primary air-passages; they are those in which the inspired air would arrive last, and with the least force of impulsion.

Causes.—It has been generally acknowledged that there are two principal causes by which to explain the production of collapse of the lung. These are the presence in the bronchia of some condition which acts as an impediment to the ready passage of the inspired air, and a want of power in the muscular apparatus by which the function of respiration is carried on. To these Dr. Gairdner adds another,—the inability to cough and expectorate, and thus remove the obstructing mucus; but this is, in fact, included in the preceding.

The most important of the above-mentioned causes is evidently the deficient respiratory power, since this is noticed and insisted upon by all observers. It has been found, in fact, that collapse seldom occurs to any considerable extent except in children who are exhausted and debilitated. The debility may be congenital, it may be the result of wearing diseases, as diarrhœa, hooping-cough, measles, typhoid fever, etc., or it may depend on exposure to unwholesome and enfeebling hygienic conditions. It is easy to understand that a child who is either born weak and feeble, or who becomes so in after years from any of the causes just alluded to, must lose, with the general decay of the strength of the body, some portion of the muscular power by which alone a complete and efficient dilatation of the thoracic cavity can be accomplished, and that, when this is the case, the inspirations must be short and imperfect, and that portions of the lung most distant from the primary air-passages, not being reached by the inspired air, will remain in an unexpanded or collapsed state. If we add to this state of feeble respiratory power, the presence of opposing secretions in the air-tubes, whether these be the consequence of bronchial inflammation, as they are in the immense majority of cases, or, as Dr. Gairdner suggests they may sometimes be, the mere natural secretion of these tubes, accumulated for the want of power to throw them off, it becomes abundantly easy to comprehend the mode of production of collapse, in at least some of the examples.

Whether a simple deficiency of inspiratory force alone, without obstructing mucus in the bronchia, will give rise to collapse, is a somewhat mooted point. Dr. West agrees with MM. Legendre and Bailly, in the opinion that it is often due to the inspiratory power having been inadequate to overcome that natural elasticity of the lung which opposes a full dilatation of the organ. Dr. Gairdner (*loc. cit.*, p. 33) cannot "see reason to believe with Dr. West, that mere debility, apart from any obstruction in the tubes, is a sufficient cause for collapse in the child." He remarks, and with strong show of reason, that the very fact of the lesion being usually more or less lobular, or partial in its distribution, appears to indicate special circum-

stances of a local kind, as having a marked influence on the production of this affection. What is of most consequence, however, to the working physician, as an important practical truth, is the fact stated by several observers, and adverted to by Dr. Gairdner himself, that in some cases no signs whatever of obstructive bronchitis or of bronchial accumulation can be discovered during life. Before leaving this point, we desire to call attention to the opinion of Hasse (*Pathol. Anat.*, Syd. Soc. ed., p. 253), that, though this partial introduction of air might be deemed at variance with the laws of respiration, inasmuch as the atmospheric pressure must necessarily distend the entire lung equally, not to the exclusion of a lobe, and still less to that of a lobule, the objection falls to the ground when it is considered that the operation of these laws is the result of previous muscular action. He refers to the fact that in pleurisy one-half of the thorax, and in partial pleurisy certain portions of that cavity, do not share at all in the movements of the remainder. "We need, therefore," he says, "be at no loss to understand how defective breathing may originate in a merely partial activity of the intercostal or other respiratory muscles."

Dr. Gairdner, as already stated, considers as one of the causes of collapse, an inability to cough and expectorate, and thus to remove the obstructing mucus. The views which he expresses on this point are very interesting, and also, we think, very important. He states that Laennec supposed the expiratory force of respiration to be weaker than the inspiratory, while in fact the experiments of Hutchinson and Mendelsohn, to which he refers, prove that though *ordinary* inspiration is more of a muscular act than *ordinary* expiration, yet the residual effective force for overcoming adventitious obstruction is very considerably greater in expiration. "The *forced* or *muscular* expiratory act is, in fact, about one-third more powerful, as measured by its effect upon a pressure-gauge, than the extreme force of inspiration; and it is this force which is thrown into action when obstruction in the tubes is to be overcome." In the act of coughing, the air in the vesicles is brought to bear upon the obstructing substance within the bronchia, at a maximum amount of outward pressure, and with the additional mechanical advantage of a sudden impulse, so that the practical efficiency of the expiration in forcing air through obstructions must be far greater than that of inspiration. It is clear, therefore, that if the secretions in the air-passages be so abundant or so viscid as to interfere materially with the entrance and exit of air, they must necessarily occasion collapse, either partial or total, of the parts beyond them, since not only does the air enter with difficulty, but being expelled with greater force and in larger quantity than it can be drawn in, the amount remaining in the vesicular structure must gradually diminish. This effect of obstruction will be still more remarkable when the muscular force of respiration is diminished by debility of the patient, for then the inability of the inspiratory act to replace the air driven out by expiration, will be yet more marked than when the muscular powers of the body retain their full force.

There is still another mechanical condition which tends to produce collapse from obstruction, to which Dr. Gairdner refers. This condition is to

be found in the form of the bronchial tubes. These tubes are a series of gradually diminishing cylinders, and if a plug of any kind, but especially one closely adapted to the shape of the cylinders, and possessing considerable tenacity, be lodged in any portion of such a cylinder, it will move with much more difficulty towards the smaller end, and in doing so will close up the tapering tube much more tightly against the passage of air, than when moved in the opposite direction into a wider space. From this arrangement of the parts, it will happen that at every expiration a portion of air will be expelled, which, in inspiration, is not restored, owing in part to the comparative weakness of the inspiratory force, and in part to the valvular action of the plug. "If cough supervene, the plug may be entirely dislodged from its position, or expectorated, the air, of course, returning freely into the obstructed part; but if the expiratory force is only sufficient slightly to displace the plug, so as to allow of the outward passage of air, the inspiration will again bring it back to its former position, and the repetition of this process must, after a time, end in pefect collapse of the portion of lung usually fed with air by the obstructed bronchus."

We have been thus particular in our consideration of the causes of collapse, because we are convinced, from personal observation, that it is a subject of very great importance in practice. Many times, in the last few years, we have met with cases of bronchitis, either primary or secondary, in weak and debilitated children, in which the general and local symptoms have pointed clearly to the existence of collapse of the lung, and in which, moreover, the good effects of a sustaining and even stimulating treatment have shown the great utility of an acquaintance with the nature of this affection, and its proper remedies.

Symptoms.—As collapse of the lung occurs almost always in connection with bronchitis, though sometimes, also, after, or concomitantly with pneumonia, it is clear that the symptoms which reveal its existence must be mingled, in a greater or less degree, with those of the two diseases just named. It is true, nevertheless, that it sometimes occurs unassociated with more than very slight evidences of any other disease of the lung. Cases of the latter kind have been usually observed only in children dying in states of utter exhaustion, in whom the muscular power of respiration has been so greatly weakened, as to prevent a dilatation of the thoracic cavity sufficient to carry air into the deeper parts of the lung. In such instances, the symptoms of collapse do not show themselves until a very short time before death, and they consist in the sudden appearance of very rapid and oppressed breathing, with little or no cough, in more or less extensive dulness on percussion over different parts of the chest, but most frequently the inferior dorsal regions, and in feeble or suppressed respiratory murmur, or more frequently a distant and imperfect bronchial respiration. In some cases, however, in which there is very little bronchial complication, as shown by the rarity and small amount of the catarrhal râles, the symptoms of collapse continue with more or less irregularity, as to situation and extent, for periods of several weeks, or even months. But here, also, as in the cases previously referred to, the general debility and low health of the child are strongly marked, and are, with slight variations persistent. As

an instance of this kind of collapse, we may cite the following case, which occurred in the practice of one of ourselves:

A boy, between three and four months old, who, at birth, and up to the time of this attack, had presented every appearance of strong and vigorous health, was seized, on the 3d of October, 1849, with symptoms of a somewhat irregular and anomalous character, but which we soon suspected to be the signs of an intermittent fever. We were induced in part to make this diagnosis, from the fact of having attended the mother during her gestation of this child, in a severe attack of intermittent fever. At the beginning of the sickness, there was some little coryza, but no cough whatever. On the 3d of October, after the coryza had lasted for a few days, he became worse, and we were sent for. During the six days following this, he had one or two attacks each day of coldness of the extremities, followed by violent fever, and ending sometimes with perspiration. He was exceedingly fretful, screamed a great deal, was at times drowsy and dull, and vomited occasionally. The stools were regular and perfectly natural. The breathing was rapid and short nearly all the time, but there was no cough whatever. On the seventh day, the respiration was 100 by the watch, and irregular. The child was pale, weak, drowsy, and entirely without cough. Percussion revealed nothing, and no râles could be heard. On the eighth day, the breathing was 96, and a slight, dry cough was heard two or three times. When roused up, the intelligence of the child seemed perfect. On the ninth day, the breathing was 63, and the pulse 120. There was rather more cough, though still very little, and there was a slight return of the coryza, of which there had been none for several days before. Neither auscultation nor percussion revealed any decided change in the lungs. On the eleventh day, the paroxysms of chilliness, followed by fever, were still noticeable, though there was no clearly marked periodicity in the returns. When without fever the breathing was 54; during the fever it was 67. Auscultation revealed nothing decided. Percussion showed dulness beneath the right clavicle. By the seventeenth day, the intermittent nature of the disorder was more decidedly marked, and under a few doses of quinine the symptoms had improved, so that the breathing fell to 30 during sleep. The cough was a little more frequent, though still very slight, and it was loose. The coryza, also, was more considerable, the nasal discharge being quite abundant.

After this the case went on badly, owing, we think, in great measure, to the circumstance of the quinine being abandoned in consequence of the opposition made by the parents to its administration, an opposition which we allowed to influence us more than was proper. During November and December, the child remained weak, pale, languid, and with uncertain appetite, sometimes refusing the breast for a whole day at a time. The quinine was suspended at first on account of the great improvement which had taken place in the symptoms, and though resumed afterwards, was given in such small quantities, and for so short a time, for the reasons just mentioned, as to be of no service. In December the child was very ill. It looked badly, having a pale, waxy face, and a dull, languid expression, though without any want of intelligence; it emaciated moderately, and had occasional vomiting; the stools were natural. At this time also it took the mother's breast with some difficulty, and refused artificial food altogether. Occasionally during this month there was observed a slight blueness around the mouth, and also about the hands and feet. Late in the month it was attacked with thrush in a slight degree, which lasted several days. In the first week of January, finding that it was fast sinking from refusing the mother's breast and artificial food, a wetnurse was procured, and for a few days it seemed to improve a little, but this did not last. It grew weaker and thinner, the thrush returned, it had now a good deal of loose cough, the abdomen became somewhat contracted and felt hard and doughy, and the breathing was very rapid, though not greatly oppressed. The child died

at last on the 26th of January, having, for ten days before that event, looked wretchedly languid and haggard, and having presented for three days before, slight diarrhœa, loose, frequent cough, entire loss of appetite, thrush, drowsiness, and, finally, coma.

At the autopsy there were found some fibrinous exudation, and a few adhesions over the lower half of the left lung. The lower two-thirds of the left and the lower half of the right lung were dark-colored, more dense than usual, not friable, and exhibited no granulations on a cut surface. These portions were in fact collapsed. The upper lobes were spongy, crepitant, and healthy. Not a tubercle was found. The foramen ovale presented an oval-shaped opening, of the size of a goose-quill. The abdominal organs were healthy.

When, as indeed most usually happens, collapse occurs in the course of bronchitis, it is associated of course with the symptoms of that disease. The bronchitic symptoms have lasted in their usual form for several days, having been marked by sonorous, sibilant, and subcrepitant râles, when suddenly, or in the space of a few hours, the breathing becomes much worse, the pulse rises in frequency but becomes small and feeble, and certain changes take place in the physical signs which are very important. The subcrepitant râle continues to be heard, but it is associated now with prolonged expiration, and a little later with bronchial respiration, which, however, is of a different kind from the bronchial respiration of pneumonia, being distant and smothered, instead of near and metallic, as in that disease. The percussion becomes, at the same time, dull and obscure, but never, scarcely, to the same extent as in pneumonia. The general symptoms are those of exhaustion, rather than of high reaction. The surface is pale or slightly bluish, the skin is either natural in temperature, slightly warmer than usual, or coolish, the strength is very much reduced, and the child appears more seriously ill, and particularly more oppressed than the amount of bronchitis present would seem to explain.

As an example of collapse occurring in the course of bronchitis, we will give the following case:

A girl between two and three months old, healthy when born and up to the time of this sickness, saving that she was rather paler and smaller than most robust infants, was seized with coryza and slight cough, and after a few days with the symptoms of a mild bronchitis. For two days there was frequent cough, some little fever, quick but not oppressed breathing, occasional sibilant and mucous râle, perfect ability to nurse, and very moderate restlessness or fretfulness. On the third day, without any apparent reason, the symptoms became suddenly very alarming. The breathing became extremely rapid and most violently oppressed, so that the movements of the chest at each respiration were heaving and laborious, the shoulders being lifted high at each respiration, the outer angles of the mouth drawn downwards, and the alæ nasi widely dilated. There were at the same time abundant subcrepitant, intermingled with dry râles over the dorsum of the chest. There was marked constriction of the base of the chest with each inspiration. The cough was frequent and racking, and occurred in paroxysms. The child was still and quiet, pale, had a haggard and exhausted look, was unable to nurse at all, and its surface was cool and white, especially that of the extremities. These symptoms continued with very little modification for twenty-four hours, when, under the use of brandy administered every hour in milk drawn from the mother, of the spirit of Mindererus and paregoric, perfect quiet, and the assiduous employment of mild revellents, they began to moderate, and at the end of another twenty-four hours

the constriction at the base of the thorax during inspiration had disappeared, the breathing was easy and gentle, the extremities had become warm, the child nursed eagerly and abundantly, and, with the exception of a slight catarrh, which lasted a few days longer, it was well.

Collapse depending on bronchitic inflammation, in debilitated children, may sometimes last a considerable length of time. In one case, indeed, that we saw a few years since, and of which an account was published (see *Am. Journ. Med. Sci.* for January, 1852, p. 98), the symptoms, owing probably to the fact that the bronchitis causing the collapse was an accompaniment of hooping-cough, continued with slight variations in degree for a period of about three months, after which the child entirely recovered.

Diagnosis.—The diagnosis of collapse of the lung must always be more or less uncertain where it is of the lobular form, for the reason that the collapsed lobules being disseminated irregularly through the pulmonary tissue, afford no physical sign by which we can detect their condition. The presence of this form ought, however, to be suspected whenever, in a chronic disease, and especially in the course of a catarrhal attack occurring in a feeble and debilitated child, the breathing becomes excessively quick and labored, the skin pale and coolish, when the base of the thorax presents a depression instead of an expansion during inspiration, and, especially, when these symptoms occur without there being a sufficiently severe and extensive bronchitis to explain their existence.

In cases of collapse affecting a considerable or the greater part of a lobe, the diagnosis, though still perhaps rather uncertain, is much more clear and positive than in the lobular form. In the latter form we are obliged to depend, indeed, almost exclusively upon the rational symptoms, the physical signs being either very slight or entirely null. In collapse of considerable portions of the lung-tissue, we have, on the contrary, some very useful physical signs. These are, the existence of dulness, greater or less, on percussion; feeble respiratory murmur; prolonged expiratory sound, and sometimes bronchial respiration; which, when they occur in connection with, and in the course of bronchitis, are usually quite sufficient to render the diagnosis easy.

The only diseases with which collapse of the lung, presenting the physical signs just mentioned, could be confounded, are pneumonia and pleurisy. From both of these it is usually distinguishable by the absence in collapse, or the slight severity, of the reactional symptoms, by the paleness or blueness and coolness of the surface, by the absence of acute pain, by the greater severity in collapse of the bronchitic symptoms, and by the fact that it rarely occurs except in enfeebled, broken-down subjects, or in those laboring under severe bronchitis. The character of the physical signs, moreover, is different. Though we have dulness on percussion in collapse, it is not so absolute as that either of pleurisy with large effusion, or that of confirmed pneumonia. The bronchial respiration, too, is in collapse different from that of pneumonia. It is muffled and distant, instead of being clear, metallic, and close under the ear, as in pneumonia; and is heard, too, much more in the expiration than in inspiration. In collapse

there is also heard, unlike either pneumonia or pleurisy, an abundant subcrepitant râle. To add to these differences, it is proper to say that, in cases of pneumonia and pleurisy, the course of the disease is much more regular, and the special symptoms so well marked as to leave no doubt as to the real nature of the attack.

Prognosis.—The prognosis of collapse must depend, in great measure, on two circumstances,—the amount of bronchitis which accompanies it, and the constitutional state of the child. When it occurs during the course of extensive bronchitis, as shown by a great abundance and extent of the bronchitic râles, it must add greatly to the danger of that disease; and if, at the same time, the child be weak and debilitated, either from causes long previously in action, or from the severity of the present attack, the risk to life is very great indeed. Collapse is dangerous, also, but far from necessarily fatal, in subjects in whom its chief cause has been simple debility. The possibility and the probability of recovery will depend on the hygienic conditions to which the child is exposed, the degree of vital strength it is likely to inherit from its parents, the extent of the collapse, as indicated by the severity of the thoracic symptoms, both rational and physical, and the effects of treatment. When the subject can be placed under favorable hygienic conditions, when it has inherited from its parents a good and vigorous hold on life, and when the symptoms of collapse are not very violent, a proper and rational treatment will in all probability save it, while, under opposite circumstances, the chance of recovery would be very small, if there were any.

Treatment.—The treatment of collapse, or post-natal atelectasis, must vary somewhat in different cases. One general rule will apply, however, to all; that is, to employ a sustaining and strengthening system of medication, to the exclusion of all exhausting means.

In cases which are entirely, or almost entirely, independent of bronchitis, the most important measures to be attended to are the regulation of the temperature in which the child is kept, of the clothing, and of the diet, the use of mild stimulants and of tonics, and the external employment of revellents. The child ought to be kept in a warm, even temperature of from 70° to 75°; it should be clothed in soft flannels, and its diet ought to be nourishing and strengthening. If at the breast, we should be sure that the milk is of a good quality, and that the nurse has an abundant flow. If weaned recently, it ought to have, if possible, a wet-nurse, and so also if it be supposed that the mother has too little milk, or that this is not perfectly healthy. If permanently weaned, the diet should be so arranged as to give to the child what is at the same time easy of digestion and nutritious. In a severe case, coming on suddenly, the most suitable internal remedies are brandy, in small doses, frequently repeated; quinia in full doses, or Huxham's tincture of bark, the spiritus Mindereri or the aromatic spirit of hartshorn, or carbonate of ammonia given in emulsion. In slower and more chronic cases, we must depend on a well-selected and nutritious diet (and food ought to be given almost by force, or at least it should be urged strongly on the child), on warm clothing, and on the use internally of brandy, quinine, the citrate of iron and quinine, pure metallic iron, the

iodide of iron, Huxham's tincture of bark, or some such remedy. In sudden cases, the best revellents are the following: mustard weakened by admixture of flour or Indian meal, and applied once in three or four hours; a plaster made of suet or simple cerate grated over with nutmeg; or liniments composed of ammonia, spirit of turpentine, or oil of amber, mixed with sweet oil. In chronic cases, the Burgundy pitch, or compound Galbanum plaster, made somewhat weaker than those used for adults, should be applied over the front and back of the chest, or we may rub the thorax twice a day with any ordinary ammonia liniment, made, if necessary, rather more irritating than usual by the addition of some oil of monarda. The daily use of a gentle emetic of ipecacuanha has been recommended, and supposed to prove useful, by emptying the bronchia of their secretions, and also by the fact that its operation induces several deep inspirations, and in that mode promotes the better performance of the respiratory act. We have never employed the emetic except in cases accompanied with a good deal of bronchitis and consequent accumulation of mucus in the air-tubes, and not then when the prostration was very great. In fact, the operation of any emetic is sometimes productive of so much exhaustion of the strength, as to cause us to hesitate in prescribing a remedy of that class; though we can fully understand that the act of vomiting, if not followed by too much prostration, could scarcely fail to prove beneficial in collapse, by the strong efforts at breathing which it gives rise to, and also by the succussions it must impart to the lungs through the medium of the diaphragm.

In cases of collapse occurring in the course of, or towards the termination of severe bronchitis, the treatment must resemble a good deal that which we have just described as proper for the same condition, when it exists unassociated, or associated only to a slight extent, with that disease. When the symptoms of imperfect expansion appear towards the termination of, or after the patient has partially recovered from bronchitis, and when of course the strength is more or less reduced by the severity of the previous acute sickness, and also perhaps by the necessary measures of treatment, the case ought to be managed very much in the same way as has just been recommended for those in which the collapse was caused chiefly by exhaustion, and less by the presence of obstructing secretions in the bronchia. Nourishing, but very light and digestible food; mild stimulants, as small quantities of brandy or wine-whey; the bitter tinctures, iron, or quinine, with counter-irritants to the surface of the chest, warm clothing, and repose, constitute the necessary and most reasonable remedies. When, on the contrary, the atelectasial condition supervenes in the midst of extensive and severe bronchitis, we are called upon to treat at the same moment two morbid states, one consisting of active inflammation, and another of want of power in the muscles of respiration to force the atmospheric air through the secretions which are obstructing the air-passages. Under these circumstances, there is almost always associated with the bronchitis, as we shall find when we come to treat of that disease, more or less intense congestion of the collapsed portions of the lungs. We must employ, therefore, such remedies as tend to modify the inflamma-

tion of the bronchial mucous membrane, and diminish thereby the amount of secretion poured into the air-passages; such as may serve to expel mechanically those secretions; and those which shall unload the congested lung of its excess of blood, always taking care, in our selection of the agents to accomplish these ends, to choose those which are the least perturbative and exhausting. To moderate the inflammation of the bronchial mucous membrane, and with a view also to unload the congested parts of the lung, we may apply a few dry cups, or rely on counter-irritation, the best mode of effecting which is by the repeated application of mustard poultices, consisting of one-third mustard to two-thirds Indian meal or flour, and by mustard foot-baths. These poultices ought to be applied first to the dorsum and then to the front of the chest, once in every three or four hours, and they should be made large enough to cover a considerable portion of the thoracic walls. Counter-irritation, assiduously made use of, is, we believe, one of the most, if not the most effectual means of treatment in the case. Emetics ought to be given twice a day, or even three times, if they do not reduce the strength too much. The best are those which operate with the least subsequent prostration, such as ipecacuanha or alum. When they are found to exhaust much, and to increase thereby the labor of breathing, their use must be suspended.

After emetics, or when these cannot be used, the remedies from which we have obtained the greatest benefit are carbonate of ammonia or liq. ammon. acetat., and seneka, either in decoction or syrup, combined sometimes with small quantities of opium. To a child two years old we should give one or one and a half grains of carbonate of ammonia or twenty drops of the acetate of ammonia solution, with ten of the syrup of seneka, or with a teaspoonful of decoction of seneka, every two hours. When the cough is paroxysmal, painful, and harassing, about ten drops of paregoric, half a drop or a drop of laudanum, or from four to six drops of solution of morphia, may be added to each of the above doses. The opiate ought to be continued until the cough and restlessness diminish, and then be suspended. In all these cases, there should be no hesitation in giving small quantities of brandy or wine-whey, whenever the symptoms of prostration are so marked as to indicate danger; and these stimuli are urgently called for when the pulse is very rapid and small, when the skin is cool or pale and bluish, and when the general aspect of the patient, and the convulsive and labored character of the breathing, show that the muscular strength of the child is scarcely sufficient to carry on the function of respiration.

ARTICLE II.

PNEUMONIA.

Definition; Synonyms; Frequency; Forms.—The term pneumonia is now, by universal consent, applied only to inflammation of the parenchymatous structure of the lungs. It is often called, in this country, catarrh-fever, lung-fever, or inflammation of the lungs.

It is one of the most frequent, and, therefore, one of the most important of the acute diseases of childhood. Dr. West, in a paper on the pneumonia of children (*Brit. and For. Med. Rev.*, April, 1843), informs us that the English tables of mortality show pneumonia to be the cause of a larger number of deaths in childhood than any other disease, with the exception of the exanthemata. From the third report of the Registrar-General, he quotes the facts that of all the deaths in the metropolitan districts under fifteen years of age, 13.6 per cent. were from pneumonia, 13.0 per cent. from convulsions, and 5.4 per cent. from hydrocephalus. He obtained nearly similar results from an examination of the returns from Manchester, Liverpool, and Birmingham.

In this city it appears from the bills of mortality that the deaths from this disease are strikingly below the percentage calculated by Dr. West. Thus, during the seven years ending with 1869, the total mortality from all causes (excluding still-born children) was, at all ages, 105,785; under fifteen years of age, 50,151; and under five years, 43,322. The total mortality from pneumonia during the same period was, at all ages, 5567, or 5.26 per cent. of the entire mortality; under fifteen years, 2985, or 5.95 per cent. of the mortality under that age; and under five years, 2746, or 6.33 per cent. of the mortality under that age. During the same series of years, the total mortality from bronchitis was, at all ages, 969, or less than 1 per cent. of the entire mortality; under the age of fifteen years, 509, or 1.01 per cent. of the mortality under that age; and under the age of five years, 495, or 1.14 per cent. of the mortality during the first five years of life.

Any one who will study with attention the various doctrines in regard to pneumonia and bronchitis that have been set forth in the different works on the diseases of children, will most assuredly acknowledge that there are few diseases about which there has prevailed so much diversity of opinion as to the real nature of the lesions forming the essential anatomical characters of the disorder, and, as a consequence of this, so much doubt as to the proper mode of classifying and describing them. From the time of the appearance of the works of M. Valleix, M. Barrier, Dr. Gerhard, and especially that of MM. Rilliet and Barthez, up to the moment of publication of the essay of MM. Legendre and Bailly (referred to in the article on atelectasis), it was commonly believed that inflamma-

tion of the parenchyma of the lung exhibited in children very different characters in the majority of the cases, from those which marked the pneumonia of the adult. Two principal forms of the disease were therefore described by most writers,—the *lobular* and the *lobar*. The former was supposed to be almost peculiar to children, and to occur only on rare occasions in adults; the latter was held to resemble, in almost every respect, the pulmonic inflammation of the adult. Moreover, lobular pneumonia was generally believed to be by far the most common form assumed by the inflammation in children under five years of age, whilst lobar pneumonia was thought to be comparatively rare under the age mentioned. Besides these two chief varieties of pneumonia, two others have been described under the names of *vesicular* and *marginal* pneumonia, while to yet another MM. Rilliet and Barthez applied the title of *carnification*.

The researches of MM. Legendre and Bailly, published in 1844, caused a great revolution in the views of medical observers and writers. These authors first pointed out (as stated in the article on atelectasis) that a very large proportion of the cases previously described under the titles of lobular pneumonia, generalized lobular pneumonia, pseudo-lobar pneumonia, marginal pneumonia, and the carnification of MM. Rilliet and Barthez, were in fact cases of bronchitis variously associated with congestion and collapse of the tissue of the lung. Since the publication of these views, the whole subject has been repeatedly investigated, and we believe that a general agreement now exists in regard to most of the important pathological questions connected with collapse of the lung and the different forms of pneumonia. We would refer any one who desires to study the progress of medical opinion on these important subjects to the able essay, *On the Pathological Anatomy of Bronchitis and the Diseases of the Lung connected with Bronchial Obstruction*, by Dr. W. T. Gairdner, of Edinburgh, and to the elaborate article in the second edition of the work of Rilliet and Barthez. We shall ourselves adopt the division of pneumonia into the *lobar* and the *catarrhal* forms. The former of these is sufficiently understood as corresponding with the same form in the adult, while the latter corresponds with the form which we, in previous editions, described under the term *partial*, and which has also been named *lobular*. Despite the fact that formerly many cases of bronchitis with lobular collapse were regarded as cases of lobular pneumonia, it is probable that the catarrhal form must still be regarded as of at least equally frequent occurrence in children as the lobar. In infants under the age of two years, pneumonia is especially apt to assume the catarrhal form. Rindfleisch, however, exceeds the truth in asserting that in children under the age of five, hardly any other form of pulmonary inflammation occurs (*Pathological Histology*, Syd. Soc. ed., vol. ii, p. 14).

Predisposing Causes.—It is generally believed that pneumonia is most apt to occur in the course of other affections. This is certainly true in regard to both forms of the disease as it prevails in hospitals, and probably amongst the poorer classes of society also. MM. Rilliet and Barthez state

that of two hundred and forty-five cases observed by themselves, only fifty-eight, or a little less than a fourth, occurred in children previously in good health. The proportion of cases in which lobar pneumonia occurs in private practice as a secondary affection is much smaller, since of fifty-one well-marked cases, observed by ourselves, in which this point was noted, only six were secondary. On the other hand catarrhal pneumonia is usually a secondary lesion, and frequently occurs as the result of an extension of severe bronchitis.

Age forms a strong predisposing influence. Of the two hundred and forty-five cases above quoted, one hundred and seventy-two occurred under five years of age. Dr. West (*loc. cit.*) says that during the first five years of life, the cases of pneumonia were in the proportion of 10.3 per cent. to the total of diseases, while in the succeeding five years they were in the proportion only of 1.3 per cent. The mortality bills of this city exhibit the same marked excess in the proportion of deaths from pneumonia under five years of age, as compared with the ensuing years. We have already seen that the proportion during the first five years of life is 6.33 per cent. of the entire mortality under that age; while during the ensuing ten years the deaths from pneumonia form but $3\frac{1}{2}$ per cent. of the total mortality during that period of life. These statements do not agree with our own experience in private practice, since of fifty-five cases that we have seen in which this point was noted, twenty-eight occurred under five, and twenty-six between five and eleven years of age, showing that the frequency in the first five and the subsequent six years of life is very nearly the same. Lobar pneumonia is much less frequent in private practice in the first two, than in the succeeding years of life.

Sex.—A larger number of cases occur in boys than girls. The excess is probably not more, however, than may be accounted for by the preponderance of male over female children. Of fifty-five cases of the lobar form in which we have noted the sex, thirty occurred in boys, and twenty-five in girls.

Constitution.—It is doubtful whether constitution has much or any influence upon the liability to the disease. Dr. West says that weak health is not a predisposing cause, according to his experience. We are convinced that lobar pneumonia attacks strong and vigorous children more frequently than those of more delicate constitution. In children of feeble health and weak stamina, the very same causes which produce pneumonia in the robust, give rise to bronchitis, or perhaps to catarrhal pneumonia.

Season.—The disease is most prevalent during the winter and early spring months, as will be seen from the accompanying table, in which is shown the mean monthly mortality in Philadelphia, for the seven years ending 1870, from this disease, as well as from bronchitis. From this it will be seen that in December, January, February, and March (and the same is very nearly true of April also), the deaths from these diseases are three times as numerous as in August.

Months.	Mean monthly mortality for 7 years, from Pneumonia and Bronchitis.	Mean total mortality from all causes (including still-born) for 7 years.	Mean monthly percentage for 7 years, from Pneumonia and Bronchitis.	Mean monthly temperature (F.) for 7 years.
January, . .	Pneumonia, . 46 Bronchitis, . 6.29	1296.71	3.54 0.48	30 87°
February, .	Pneumonia, . 45.57 Bronchitis, . 8.43	1206.71	3.76 0.69	33.89°
March, . . .	Pneumonia, . 48 57 Bronchitis, . 7.14	1344.29	3.61 0.53	40.85°
April, . . .	Pneumonia, . 41.57 Bronchitis, . 5.71	1281.14	3 24 0.44	52.27°
May, ...	Pneumonia, . 34.76 Bronchitis, . 6.57	1234 29	2.81 0.53	62.77°
June, ...	Pneumonia, . 26.14 Bronchitis, . 5.00	1178.14	2.21 0.42	71.97°
July, ...	Pneumonia, . 24.14 Bronchitis, . 4.00	1837.00	1.31 0.21	77.71°
August, . .	Pneumonia, . 20 14 Bronchitis, . 3.00	1825.43	1.10 0.16	76.62°
September, .	Pneumonia, . 14.57 Bronchitis, . 5 29	1215.43	1.19 0 43	68.31°
October, . .	Pneumonia, . 22.43 Bronchitis, . 5.43	1218.14	1.84 0.44	56.30°
November, .	Pneumonia, . 28.86 Bronchitis, . 5 71	1052.14	2.74 0.54	46.68°
December, .	Pneumonia, . 39.57 Bronchitis, . 8.14	1191.00	3 32 0.58	34.74°

We have also placed in parallel columns the mean percentage of mortality from these two diseases, and the mean monthly temperatures, in order to show the marked correspondence between the coldness of the weather and the frequency of pneumonia and bronchitis. It is evident, however, that there is another element, besides the mere temperature, in determining their frequency, since, in both February and March, more deaths occurred from these causes than in January, although this latter is the coldest month of the year. The additional element is undoubtedly to be found partly in the sudden atmospheric changes, and damp raw days which are so frequent, in both February and March, in our latitude, and partly in the impaired vitality found in many children, as the result of the intense cold of the preceding months.

Previous Diseases.—It is apt to occur as a complication of all the diseases of children, and most frequently in measles, pertussis, typhoid fever, enteritis, and bilious remittent fever. We have already stated that the catarrhal form is very frequently consequent upon severe bronchitis.

Exciting Causes.—The continued action of some of the predisposing causes must be regarded as the exciting cause in the majority of the cases. External violence, as a severe fall, or a blow upon the chest, will sometimes act as an exciting cause. The action of *cold* is almost always alleged to be the immediate cause of the attack. M. Grisolle states that it is impossible to determine the exciting cause in more than a fourth of the cases, and that in nearly all of these it is cold.

Anatomical Lesions.—*Lobar* pneumonia in the child is marked by

the same physical characters as in the adult. The three stages of the inflammation—engorgement, red hepatization, and gray hepatization—exhibit the same alterations of the tissues as in adult life. Moreover, the three stages occur with about the same frequency in early as in later life. Dr. West (*loc. cit.*, 2d ed., p. 189) shows that the third stage occurs very nearly as often in children as in adults, he having met with it in the former in the proportion of sixty-eight per cent., while M. Grisolle found it in seventy-two per cent. of the latter. The chief difference in the disease, as it exists at the two ages, consists in the more frequent coexistence of all three of the stages in the young subject.

In the first stage, or that of engorgement, the affected portion of lung is distended, so that it does not collapse in the same proportion as the healthy portions, when the thorax is opened. It is heavier than usual, so that it sinks somewhat in water; it is of a brownish-red color; it pits upon pressure, and crepitates less than healthy lung, the crepitation being observable only here and there. The natural degree of cohesion between the tissues is somewhat diminished, so that the diseased portion is much less tough and elastic, and more soft and friable than it ought to be. When cut into, a large quantity of frothy, and more or less deeply-tinged sanguineous fluid escapes.

In the second stage, or that of red hepatization, the lung is increased in volume, so that it continues to fill the side of the chest after that cavity is opened; it is dense and hard, has ceased entirely to crepitate, from the fact of having become completely impermeable to air, and sinks rapidly when thrown into water. Externally, the diseased portion is of a deep-red color, while internally the same color is observed, but often of such different shades as to give to a cut surface a marbled aspect. The cohesion between the tissues is, in this stage, much less strong than in health or in the first stage of the disease; the finger penetrates the lung with some ease, and the texture can be crushed between the finger and thumb. When cut into, there escapes a non-aerated and reddish fluid, which is much less abundant than in the first stage. The most important feature of red hepatization is, however, the granular character of an incised surface. This granular appearance is produced by the presence of numerous minute flat granular elevations, which are the air-vesicles distended with the plastic lymph which has been exuded within them. It is best seen by examining a torn surface of the lung. The most recent investigations tend to show that while some part of the exudation which distends the vesicles may be due to the multiplication of the epithelial cells lining their walls, the greatest portion is derived directly from the blood and either escapes through the walls of the vessels without rupture or, to a small extent, is associated with rupture of the capillary walls. The exudation itself is seen, on microscopic examination, to have a finely-fibrillated structure inclosing a number of red and colorless corpuscles. (Rindfleisch.)

In the third stage, or that of gray hepatization, the lung continues to exhibit the same volume, density, impermeability to air, and consequent total absence of crepitation, as in the second; but the process of softening has made still further progress, so that a portion of the lung may be squeezed with the greatest ease between the finger and thumb into a pulp.

The color has now changed from deep-red to a dirty light-gray, or a pale straw-yellow. When incised, the surface still presents a granular appearance, but the granules are more irregular and flatter. The diseased portions are now infiltrated with a puruloid fluid, which escapes in considerable quantities in the form of a yellowish-gray liquid, whenever the lung is cut into.

Occasionally instead of lobar pneumonia involving an entire lobe or a considerable portion of one continuously, it presents itself in the form of several scattered patches, irregular in form and imperfectly circumscribed, but which present the three stages above described, of engorgement, red hepatization, and gray hepatization.

On the other hand, in catarrhal pneumonia there is not the same process of free exudation into the air-vesicles, but instead there is a rapid multiplication of the alveolar epithelial cells which soon fill the vesicles. The accumulated cells are mixed with some sero-mucous secretion, but there is found little or no trace of fibrillation, such as is present in the exudation of the lobar or croupous form. The catarrhal inflammation affects separate lobules, and then gives rise to nodules scattered over and through the lung. These vary in size, from that of a hemp-seed, if a single lobule be affected, even to that of a pigeon's egg, if a large number of affected lobules coalesce. At first they present a reddish or reddish-gray appearance; but later, owing to fatty changes in the proliferated cells, the color changes to a grayish or yellowish-gray. This change may at times occur in the centre only of the nodule, or over its whole extent, or again on its circumference. If the case is destined to end favorably, the cells, after having undergone complete fatty change, are absorbed, or else, an excess of serum being present, may be discharged into the bronchioles and expectorated. The alveolar wall returns to its original condition and a perfect cure is effected. Or, on the other hand, the changes in the alveolar wall persist, the contents of the alveoli undergo cheesy or caseous metamorphosis, and the case passes into a chronic and highly unfavorable stage.

Abscesses are not very uncommon in the lobar pneumonia of children. They occur as a result of the third stage of the disease, so that in the same lung may be observed the first, second, and third stages of the inflammation, and abscesses. The cavities of the abscesses are generally circular, sometimes oval, and they measure from half a line to an inch or more in diameter. Sometimes the abscess is multilocular, each of the purulent cavities being partially separated from its neighbor by a wall of hepatized tissue. They are found in various parts of the lung, but seem disposed, generally, to approach the surface of the organ. When the latter event happens, adhesive inflammation between the pulmonary and costal pleura usually takes place; but should this fail to occur, the abscess may rupture into the pleural sac, and produce pneumothorax. MM. Rilliet and Barthez met with two examples in their autopsies in which this accident had occurred, and they report another case in which it occurred during life, and in which the child recovered. We have met with three cases of pneumothorax ourselves, produced in the same way. One occurred in a boy eleven years old, during an attack of secondary pneumonia complicating

a severe bilious remittent fever. The patient recovered entirely after a most violent illness. The two others occurred in very young children, and proved fatal.

We are desirous, before closing our remarks on the anatomical lesions of the disease under consideration, of drawing attention to the subject of simple non-inflammatory congestion of the lung, for the reason that the latter has no doubt, especially when associated with collapse of the pulmonary tissue, been frequently mistaken for pneumonia.

Congestion of the lung occurs either in the lobular or lobar form, the distinction between the two being the same as that between lobular and diffused or lobar collapse. When lobular, the lung presents, generally along the posterior edge of the organ, disseminated lobules, distinctly circumscribed by the interlobular cellular septa, which are rather protuberant than depressed, more friable, and of a lighter purple color than collapsed lobules, and which afford, when squeezed, a considerable quantity of frothless bloody fluid. In very young infants, the congestive disposition often assumes the lobar or diffused form, and is supposed by M. Legendre to have frequently been taken for pneumonia. In this variety of congestion, the affected portion of the lung is increased in size, and is distended and gorged with fluids. The color of the congested part varies from a light to a dark purple, or almost blackish tint. The cohesion of the lung is also variable, the differences depending on the degree of the congestion. When this latter is very great, the part is very friable, while it is much less so under the opposite condition of things. Though the lung is harder in this state than natural, it still retains a certain degree of flaccidity which does not exist in true hepatization. Pressure causes an abundant exudation of blood and serosity from a cut surface, and the latter, instead of being granulated, as is always the case in hepatization, is smooth and even. Neither does the lung exhibit any granulations when it is torn. Lastly, inflation distends all the vesicles, and gives to the condensed parts their natural lightness and their rosy color, though, be it remarked, the development of the affected parts under the operation is not complete and entire, as in collapse, in consequence, no doubt, of the large amount of blood they contain.

Inflation of the lung after death has been much employed of late, as any one who has read the previous remarks on atelectasis must have seen, as a means of distinguishing between pneumonia and collapse. It was there stated that, whilst inflation distended and restored more or less completely to their natural condition parts of the lung that were merely collapsed, it failed almost entirely to have any effect on parts of the lung affected with true pneumonia. It is easy to understand why inflation should fail to exert much effect on inflamed lung, at least when the disease has reached the state of hepatization. In fact the alveoli are distended either with the croupous exudation of the lobar form, or the accumulated epithelial cells of the catarrhal form, so that it becomes impossible to force the air into the midst of the agglutinated structures. In the first stage of pneumonia, that of congestion, inflation will distend in some

degree the affected portions, but, in the second and third stages, not even the strongest force has any effect on the impermeable vesicles.

Lobar pneumonia is stated by most authorities to be generally confined to one lung, and such has been our own experience in regard to it, since of 56 cases in which its location was carefully determined, it was unilateral in 52, and double only in 4. It is much more common on the right than left side, according to most writers. In the 52 cases just referred to, the distribution was nearly equal, the disease being seated 29 times on the right side, and 23 times on the left. It attacks the lower lobe much more frequently than the upper, though pneumonia of the upper lobe is much more frequently met with in children than in adults. Of 51 cases in which this point was determined, the upper lobe was the part affected in 20, while in 31 the base of the lung was the seat of the disease. Of the 20 cases of inflammation of the upper lobe, in 13 it was seated on the right, and in 7 on the left side. Of 31 cases occurring in the lower lobes, 15 were on the right, and 16 on the left side. In the 4 cases of double pneumonia, the inflammation attacked the lower lobes of both lungs in one; in one the postero-inferior part of both upper lobes was especially involved; while in the two others it attacked first the base of the left lung, and afterwards the summit of the right.

The statements just made as to the seat of the pneumonic inflammation, in the cases that have come under our own observation, do not, we are well aware, agree exactly with the experience of other observers. Dr. West, for instance, found (*loc. sit.*, p. 190) that double pneumonias preponderated greatly, in early life, over those wherein only one lung suffered. This, it will be observed, is widely different from the result of our experience, and it is also directly opposed to that of MM. Rilliet and Barthez, Rufz, and Barrier. M. Barrier, in fact, cites (*Mal. de L'Enfance*, t. i, p. 286) 144 cases of lobar pneumonia as having been observed by the authors just mentioned, and by himself, and of these only 15 were double. Our results in regard to the frequency of double lobar pneumonia agree, therefore, with those of the authors last mentioned, but they differ as to the relative frequency with which the two lungs are attacked. Thus, in our cases, the inflammation occurred with nearly equal frequency in the two lungs, whilst of 129 cases of unilateral pneumonia observed by the above authors, 84 were seated in the right, and 45 in the left lung. These writers state, as most others do, that lobar pneumonia of the lower lobe is more common than that of the upper lobe. This tallies with our observations, but, as it seems to be a general opinion in the profession, that inflammation of the summit of the lung is rare in comparison with that of the base, we wish to call attention again to the fact stated above, that of 51 cases, in which we ascertained accurately the seat of the disease, it was in the upper lobe in 20, and in the lower in 31.

In regard to catarrhal pneumonia, the statement of West above quoted is certainly true, and it is frequently found that both lungs are involved, and in some cases that there is a more or less symmetrical disposition of the affected nodules.

In the lobar pneumonia of children, as in that of adults, bronchitis does

not usually exist to any very considerable extent. It is true that before the recognition of the true nature of collapse of the lung, the association of bronchitis and lobar pneumonia was thought to be more frequent, because a considerable number of cases of bronchitis with extensive collapse of lung-tissues were regarded as instances of true lobar pneumonia.

But, on the other hand, although the catarrhal form may occur without any associated bronchitis, it is undoubted that bronchitis does very frequently precede or accompany the development of the catarrhal inflammation of the alveoli.

When bronchitis is present it varies from simple increased vascularity with augmented mucous secretion, to intense congestion with purulent or pseudo-membranous secretion.

Pleurisy is a frequent complication, as it is found to exist in about half the cases.

Emphysema is another common complication. It generally occupies the upper part of the lung, or its free edge, and is found most strongly developed in the lung which presents the greatest amount of inflammation, or in both, when both are inflamed. Its degree depends on the extent of the pulmonary inflammation and bronchitis, and the severity of the dyspnœa. The vesicular form is much more frequent than the interlobular.

Symptoms; Sketch of the Disease; Course.—In order to present a faithful account of the disease in its different forms, a general sketch of the symptoms will first be given, after which the most important ones will be considered separately under the head of particular symptoms, so that the reader may first obtain a notion of the course of the disease, and then become intimately acquainted with its details and peculiarities by reference to the remarks on each particular symptom.

Lobar or Croupous Form.—True lobar pneumonia, with well-marked hepatization, is not, according to our experience, a common affection in young infants in private practice, since out of fifty cases of the disease that we have met with in children, in which we have noted this point, only two occurred in infants within the first, and three in the second year. Of the two cases within the year, one occurred in a child six weeks old, and the other in one seven months.

In *new-born children, and those still at the breast*, pneumonia is apt to be of the catarrhal form, and very generally begins with more or less marked symptoms of bronchitis, though in some instances it commences suddenly, as it does in adults, without any previous sign whatever of bronchial inflammation. When it occurs during an attack of bronchitis, the symptoms which belong to the pneumonic inflammation will, of course, have been preceded by those which depend on the disease of the bronchial mucous membrane. In these cases, the development of the pneumonia will be indicated by an aggravation of the general symptoms, by an increase of fever with elevation of the temperature, by an increase of the oppression, by the fact that the cough and breathing both become more painful than before, and in some cases by the occurrence of the physical signs peculiar to lobar pneumonia. In these latter cases, which are very rare, the character of the

physical signs and the course of the case is very much such as are described below.

When lobar pneumonia appears as a primary affection in young children, without preceding bronchitis, as sometimes undoubtedly happens, though much less frequently than in children over five years of age, and especially than in adults, the attack is usually sudden. The first symptoms observed are restlessness, peevishness, disposition to cry, a diminished appetite for the breast, and feverishness. These symptoms are most marked in the evening and night. From the very first, or by the second day at least, cough is heard, and careful examination of the breathing will show that it is somewhat hurried. The cough is dry, short, and hacking, at first, and not very frequent, but it soon becomes louder, fuller, more straining, and especially it becomes painful. The fact that it is painful may always be ascertained by watching the motions of the child, its cry, and the expression of the face. We can always perceive, even in an infant, a disposition to restrain the cough, to smother it, a struggle to make it short and sudden, when it causes sharp pain. At the moment of the cough, too, a marked expression of pain, a kind of sudden grimace or twisting of the features, may always be observed, which is accompanied or followed instantly by a loud, sharp cry, or a spell of crying. This grimace of pain, with the accompanying cry, we have never observed in their most characteristic form in simple bronchitis, but only in pneumonia and pleurisy. We have occasionally seen these symptoms so decidedly marked that they could not fail to have drawn any one's attention; as, for example, in an infant six weeks old, who died of a most violent and extensive pleuro-pneumonia, and again in a child thirteen months old, who died of pleurisy resulting in the formation of pure pus in the pleural sac. The nature and extent of the lesions were ascertained, in both cases, by examination after death. The presence of pain in the side is shown also by the fact that full inspirations, caused by changing the position of the child, and those which occur during fits of crying, occasion a sudden arrest or stoppage, so to speak, of the act of inhalation, which gives to the crying, and often also to the breathing, a sobbing character, while across the countenance passes at the same moment the expression of pain already referred to. The breathing, which is only slightly disturbed at first, soon becomes frequent and attended with more or less effort, and gives rise to an unusual play of the nostrils, a symptom which ought always to attract attention to the respiratory system as the seat of disorder. It interferes also with the act of nursing, so that whether the child takes the breast less frequently than usual, from want of appetite, or seeks it with greater avidity than common, from thirst, the act of sucking is attended with some difficulty. The infant seizes the breast for a few instants, then lets go in order to breathe more easily, and seizes it again; or it drops the nipple suddenly and begins to cry, as though the act of sucking were painful from the necessity it begets of taking occasionally a fuller and deeper inspiration than usual. As a general rule, the bowels are torpid, while vomiting, which is rather unusual in older children, is quite common in young infants.

When the disease is once established, whether it have been preceded by bronchitic symptoms, or occur as a primary affection, the symptoms are generally well marked, so as to leave but little difficulty in the recognition of the disorder. The child now loses all gayety and cheerfulness, and becomes either dull and listless, or very restless, peevish, and troublesome. Young infants generally lie quietly on the bed, or in the lap, merely fretting and crying when they cough, or when they are moved for any purpose, while children of several months old, and those in the second year, are usually very cross and restless, crying and screaming when anything is done for them, and insisting upon being frequently moved from the cradle or bed to the lap, or from the lap to the cradle. As a general rule they are contented only upon the lap, always crying to get back when they are removed from it to the cradle or crib. In some instances, however, they, like young infants, are quiet and dull, being content to lie still when placed in a comfortable position, and crying only after coughing, for the breast or drink, or when disturbed.

A febrile reaction now displays itself in full force. The skin becomes hot and dry, and the pulse frequent, rising to 150 and 160, or higher, in infants, and to 140 and 150, or even 160, in those of several months old. The temperature rises very quickly, so that by the close of the first twenty-four hours it may reach 104°, 105°, or even 105.8° (Roger). The dyspnœa becomes more and more evident. The respiration rises to 60, 70, 80, or even higher. In a case of pleuro-pneumonia at six weeks of age, we counted it at 128. The breathing is at the same time more or less labored and difficult, the alæ nasi being seen to dilate spasmodically at each inspiration, while the motions of the chest, and especially those of the abdomen, are much stronger and more active than in healthful respiration. The cough is now more frequent than before, evidently painful, and usually dry, though sometimes a slight degree of looseness may be detected in the sound which it occasions.

Percussion now reveals manifest dulness over the seat of disease, which is usually the base, though not at all unfrequently the upper region of one side. When the disease is double, which is oftener the case, as already stated, in children than in adults, though not so often as has been supposed by some, the percussion will be dull of course over the affected region on each side. Together with the dulness of sound on percussion, and sometimes when this is faintly marked, there is an evident diminution of the elasticity of the walls of the chest, and this becomes, therefore, an important symptom, especially when dulness on percussion is absent. The dulness on percussion is not, indeed, so marked a symptom in infants as in adults, from the fact that the natural resonance of the chest is so much greater in the former than the latter.

Auscultation reveals over the diseased part distinct and abundant fine subcrepitant râle; but the crepitant râle or fine crepitation, which is the pathognomonic sign of pneumonia in adults, and which in them is rarely wanting, is absent in young children, or is heard only when they make deep and free inspirations. It is most apt to be heard in young children during the deep inhalations which they make just before crying, or during

the act of crying. It is, therefore, much less constant, less strongly marked, and more fugitive, in children than in adults, and is, in the former, replaced in good measure by a fine subcrepitant râle. In connection with these symptoms we always have more or less well-marked bronchial respiration. This may be pure, which is rarely the case; it may be, as usually happens, associated with crepitant or subcrepitant râles, or it may be heard only in the expiration.

The symptoms above described show that the inflammation has reached the second stage, or that of red hepatization. After attaining this point, the disease usually remains stationary for a few days, and then either subsides, in favorable cases, by the resolution of the inflammation, or in unfavorable cases, terminates fatally in this stage, or else passes into the third stage and causes death by a more or less extensive suppuration of the lung. In favorable cases, which are said to be rare in very young infants, but more common in those several months old and in the second year of life, the severity of the symptoms gradually diminishes. The fever subsides, the pulse becoming less frequent, and the skin cooler and less dry; the breathing becomes easier and slower, and is attended with less pain; the cough grows looser, less frequent, less difficult, and ceases to be painful; the child begins to nurse without pain and with greater ease and facility; the restlessness and fretfulness, or the somnolence, when that has been a marked symptom, diminish, and the child becomes more placid, and sleeps quietly and tranquilly. The chest is now less dull than before on percussion; the bronchial respiration begins to diminish in intensity, and is very much masked by the subcrepitant râle, which becomes more and more evident, until at last it takes the place entirely of the bronchial breathing. The symptoms continuing to amend, the physical signs of the disease cease at length to be perceptible, the cough grows more and more loose and rare, the countenance becomes natural, the fever ceases, and convalescence is fully established.

In unfavorable cases, death may occur rather suddenly in the second stage, without any very decided change in the physical signs, from exhaustion or from the supervention of collapse of portions of the lung-tissue. In these cases, the breathing becomes more and more rapid and labored, or it becomes slower than before; the moist râles increase in abundance and extent, while the percussion often remains about the same; the difficulty of sucking increases, so that the child, when put to the breast, attempts to draw but two or three times and then lets go exhausted and distressed, or it makes no effort whatever; the cough becomes less frequent, but is still painful and difficult; the skin grows pale and white, excepting about the face, hands, and feet, where it often assumes a bluish or cyanotic hue; the extremities, and often the face too, become cool; the child becomes exceedingly restless, and then dull and perfectly quiet or comatose, and death at last occurs from asphyxia. In another class of cases, which, however, are much more rare in very young children than in older ones, the disease passes into the third stage, or that of suppuration, so called. In such cases the febrile symptoms continue much longer than in those just now described; the pulse becomes, and continues for several days together, very

frequent and jerking; the skin retains its heat and dryness, though it is often pale at the same time; the child is usually excessively irritable and distressed; the breathing is rapid and oppressed, and often very irregular and uneven; the dulness on percussion extends; the bronchial respiration becomes more distinct and is heard over larger surfaces, and is accompanied with less of the subcrepitant and crepitant râles; the cough is paroxysmal, painful, and often very harassing; the appetite is lost, and the sleep uneasy and often broken. These symptoms continue for several days, or a week or two, when they assume the same characters they exhibit in more rapidly fatal examples; that is to say, asphyctic phenomena develop themselves, and the child dies exhausted and comatose or perhaps convulsed, or after presenting for some hours, or a day, more or less severe spasmodic affections of different muscles or of the extremities.

The *lobar pneumonia of children over two years*, and especially of those over five years of age, exhibits most of the symptoms that characterize the same disease in adults. The chief differences to be noticed at these two periods of life, are the greater predominance of bronchitis in children, particularly in those under five or six years of age, which gives to the physical signs some peculiar features not observed in adults; the frequent absence of expectoration, and when it is present, certain differences between it and that of adults; certain peculiarities in the character and seat of the side-pain; and the existence in many instances of more marked and more dangerous nervous symptoms.

The mode of onset is very different in different subjects. Generally, the attack begins with violent fever, increased frequency of breathing, more or less pain in the side, and short, dry cough. In such cases there is no difficulty in perceiving that the disease consists of some form of thoracic inflammation. But, in other instances, instead of this open and frank development, the disease comes on with symptoms which might well mislead any but a very attentive and competent physician, as to the true nature of the case. The most common cause of obscurity is a predominance of the nervous symptoms, which often gives to the case very much the aspect of a meningeal inflammation. In an example that occurred to one of ourselves, a boy between six and seven years old was seized, after a short exposure during a ride on a raw and cold day, with violent fever, pain in both ears, severe frontal headache, and great sensibility to light when exposed to it. He was, at the same time, very drowsy, sleeping nearly the whole day, but he could be roused when loudly and vehemently spoken to so as to answer a few questions and manifest great irritability, and, what was extremely suspicious of disease of the brain, when taken with the other symptoms, he vomited frequently. On the second day, the headache was very severe, the sensibility to light continued excessive, and he still vomited frequently, rejecting even water. The bowels were freely moved. There was up to this time no full cough, but only an occasional and slight hacking, that scarcely attracted attention. The respiration was accelerated, but there was no dyspnœa. No pneumonia could be detected, though carefully sought after. On the third day, the breathing was still more frequent, but not at all laborious; the vomiting continued, but the other

nervous phenomena had lost some of their intensity, and auscultation revealed well-marked bronchial respiration before and behind, over the summit of the right lung, while over the same regions the percussion was dull. We have met with several cases in which the onset of pneumonia was attended with nervous symptoms that made the diagnosis difficult and obscure.

In other cases the onset of the disease is marked by symptoms of gastro-intestinal irritation, or by such a degree of fever and disturbance of the nervous system, with absence of evident local phenomena, as to render the nature of the attack obscure and uncertain. In one, for instance, occurring in a boy between four and five years old, and six weeks after recovery from measles, the attack began suddenly with violent fever, great restlessness and distress, vomiting, and distension of the abdomen. The case appeared to be one of gastro-intestinal disorder, as there was nothing to call attention to the thorax. On the second day, the symptoms were much worse, the skin being hot and dry, and the pulse one hundred and sixty in the minute, and jerking. The child was drowsy and heavy; it was difficult to make him answer questions, and his answers were confused and unintelligible; his movements were tremulous and uncertain. The tongue was dryish and very thickly coated, and he complained confusedly of pain in the abdomen, which was much distended, and sonorous on percussion. There was no sign of respiratory disease, except quickening of the breathing, and a very slight cough, scarcely to be noticed. At this moment, however, when scarlet fever was apprehended from the great frequency of the respiration, the drowsiness, and the tremulous character of the muscular movements, auscultation and percussion revealed the true nature of the sickness in the shape of a lobar pneumonia of the lower lobe of the left lung.

In a majority of the cases, however, instead of the obscure and deceptive onset we have just described, pneumonia begins with fever, acceleration of the respiration, pain in the side, and short, dry cough. In some instances the disease supervenes upon catarrh or bronchitis. The child ceases to play, refuses to be amused, and is either irritable and cross, or lies listlessly upon the bed, or, if still quite young, insists upon being kept upon the lap. In some few cases, in very young children, convulsions occur. The appetite is lost, or else very much diminished; the thirst is acute, and when the disease is once established, more urgent than in almost any other affection. Vomiting is quite common, especially in young children, but diarrhœa is rare, the bowels being generally more torpid than usual. From the first day often, and almost always by the second, we can perceive either crepitant or subcrepitant râle, and sometimes bronchial respiration, confined usually to one side, and more frequent below than above, though, be it remarked, not at all rare over the latter part.

As the case proceeds, the fever increases, the bronchial respiration becomes more distinct and is heard over a larger extent of surface, whilst the râles diminish in abundance. The skin is now very hot and dry, so as to impart a burning sensation to the hand; the pulse augments in frequency, seldom counting less than 140 in the minute, often mounting to

160, and in severe cases, and in young children, even to 170, and becoming full and hard; the respiration becomes more and more accelerated, until it rises to 40 or 50, and in a great many cases to 60, 70, or even 80, while it often becomes at the same time oppressed, and, when full inspirations are made, painful; the cough is frequent, dry, or almost dry, and painful at first, but after a few days begins to be moist, and, in children over six or seven years of age, is not unfrequently attended with an expectoration of rusty or sanguinolent sputa; the thirst continues intense, the appetite is null, and the child is very restless and irritable, or drowsy and inattentive. About the fourth or fifth day, as a general rule, the disease has attained its height, the febrile and local symptoms being then most marked, and the extent of the inflammation greatest, as shown by the physical signs.

At this stage of the disease, the bronchial respiration is generally strongly marked, being clear and distinct, audible both in inspiration and expiration, and accompanied by bronchophony and increased resonance of the cry. The dulness on percussion is also very evident, the change from the natural sound being easily perceptible on a comparison of the two sides.

The symptoms generally remain stationary at this point for one or two days, and then begin to subside. The heat of skin diminishes and perspiration often appears; the pulse falls in frequency and force; the respiration becomes slower, easier, and full inspirations can be taken without pain; the alæ nasi no longer dilate; the cough becomes quite loose, and ceases to be painful; the thirst is less acute; the child loses some of its irritability and restlessness, and if it have been soporose and dull, becomes more wakeful and observant; the flushing of the face disappears, while the expression is more natural. On auscultation, the bronchial respiration is found to have lost some of its intensity; it has become more distant, or it is heard only in the expiration, and is mingled with, or in part replaced by, crepitant or abundant subcrepitant râles. The dulness on percussion is less marked. A little later, the fever ceases entirely, the respiration reassumes its natural rate, the appetite returns, the thirst disappears, the cough subsides very much, and the child begins to be interested in its toys or occupations. About the tenth or fifteenth day, and in some cases rather earlier, convalescence is fairly established, though auscultation may still reveal some prolongation of the expiratory sound and diffuse resonance of the voice.

In unfavorable cases, death seldom occurs early in the disease, but usually at some distance of time from the invasion, and in consequence, no doubt, of the transition of the inflammation into the third or suppurative stage. In such cases the disease has usually pursued the course just described up to the period of resolution; but, instead of resolution and convalescence taking place, the fever continues, though perhaps with diminished violence, the skin being less intensely hot, and the pulse less full and active, while it remains quite as frequent. The breathing is sometimes less frequent than before, but it is often more laborious, and very generally it becomes irregular, and is easily hurried under exertion. The cough varies very much, being sometimes almost suppressed, and in other cases

very troublesome; it is almost always loose. The strength diminishes, the voice becoming weak and feeble, and the muscular movements tremulous and languid; the face looks pale, haggard, and sunken; the child is sometimes very restless, tossing about from time to time on the bed or lap, with a quick, short, and evidently feeble movement, or it is dull and soporose, awakening only when spoken to, but showing then by its fretfulness and peevishness that its intelligence is retained. While these symptoms are present, the extent over which the bronchial respiration is heard has generally augmented, showing the gradual extension of the hepatization, while outside of the part where the respiration is blowing, and sometimes over the same part, and intermingled with that sound, are heard more or less copious subcrepitant and mucous râles. This condition seldom lasts more than two or three days, at the end of which time the child dies in a state of coma, or after one or more convulsive seizures, which are the result of a gradually increasing asphyxia.

In other cases, again, the termination is more gradual. The child, after presenting many of the above symptoms, may seem to improve somewhat. The fever may diminish, the appetite return to some extent, the respiration become easier, the restlessness subside, and the child becomes more cheerful again; but the face continues pale, emaciation makes progress, the appetite fails again, the pulse remains frequent, diarrhœa comes on, the cough becomes more troublesome, thrush often attacks the mouth, the strength decays continually, and, after some weeks perhaps of struggling, the child dies in a state of great emaciation and debility.

Catarrhal Form.—The symptoms of catarrhal pneumonia are much more obscure and uncertain than those of the lobar form of the disease. Owing to the fact that the inflamed patches of the lung are disseminated or scattered through healthy portions of the organ, the signs afforded by physical examination are either very imperfect, or entirely masked by the sounds produced in the healthy texture. We are forced, therefore, to depend much more in this than in the lobar form, on the rational symptoms, in determining the nature of the sickness. The rational symptoms of partial pneumonia are nearly the same as those of the lobar form. The chief differences between the two are in regard to the pain, the dyspnœa and, when there is expectoration, the amount of the sputa. The febrile and nervous symptoms, and the disturbances of the digestive system, are the same in the two forms, the only difference being in their degree of severity. In the lobar variety they are usually more acute and severe than in the partial. The mere degree of temperature attained does not differ materially in the two forms, and it is not unusual to find a temperature of 103° on the second day of an attack of the catarrhal form. Roger (*loc. cit.*) notes, however, that while in lobar pneumonia the high temperature is sustained for six or seven days until defervescence occurs, in the catarrhal form the course of the temperature is marked by a succession of irregular remissions and exacerbations. The local symptoms present important differences which should be noted. In the form under consideration, the pain is either wanting entirely, or is much less acute than in the lobar form. When the inflamed patches are few in number,

and they are seated in the central parts of the lung, there is entire absence of pain; but when they are more numerous and superficial, pain is complained of, but it is usually diffuse, of slight intensity, changeable, and felt only during cough, or during full inspirations. It makes its appearance commonly on the first day, and very seldom after the third. Cough is rarely wanting. It usually marks the onset of the sickness, is extremely variable as to its frequency and severity, and is not acutely painful, as in the lobar form, unless the inflamed patches be superficial. There is seldom any considerable amount of expectoration, and in some cases none; when there is any it is small in quantity, and it may or may not be characteristic. In one case, however, that came under our observation, in which we had every reason to believe, from the nature of the rational symptoms, and from the absence of physical signs, that the disease was catarrhal pneumonia, there was a rare expectoration of thick, viscous mucus, streaked with blood. The respiration is accelerated, and when the lesion is at all extensive, there is dyspnœa, the degree of these symptoms being determined by the extent and number of the inflamed patches.

The physical signs are not, as above stated, very significant. The percussion is natural, the amount of tissue consolidated being insufficient to affect the sonorousness of the chest. According to Eustace Smith, a general want of healthy pulmonary resonance can be detected over the back by means of broad percussion, striking with three fingers upon three fingers placed on the chest-wall as plexímeters. Auscultation affords no signs of the pneumonic inflammation when the number of affected patches is small; when they are more numerous it is of some, but not of very great utility. Crepitant râle is sometimes heard here and there over circumscribed points of the thorax, and, disseminated in the same way, there is also heard in some instances rude respiration, prolonged expiratory murmur, and bronchial respiration. When, as often happens, this form of the disease coexists with bronchitis, it will be entirely concealed by the dry and moist râles of the latter affection. If a number of affected lobules coalesce and form a superficial patch of some size, we may have distinct signs of consolidation over a circumscribed area. This is, however, rare.

The *duration* of lobar pneumonia has been fixed with considerable accuracy by the observations of various persons. As a general rule, the disease reaches its highest point of severity in about four or five days, then remains stationary for one or two days, and diminishes regularly until between the tenth and fifteenth day, when convalescence is established. In our own practice, the longest duration in 22 unmixed cases, in which the period was accurately noted, was 17 days, and the shortest 5. The duration of the 22 cases was as follows: in 1 case, 17 days; in 2 cases, 14 days; in 1, 11; in 4, 10; in 5, 9; in 3, 8; in 2, 7; in 2, 6; and in 2, 5 days. One case lasted 33 days, but it was accompanied and followed by bronchitis.

It is difficult to assign any definite duration for the catarrhal form. In favorable cases, judicious treatment will often be followed by convales-

cence in from a week to ten days. But in many instances the symptoms persist longer than this; and not unfrequently the case shows a strong tendency to pass into a chronic form.

Particular Symptoms; Physical Signs.—In order to practice auscultation and percussion in a young child, it should be placed, by the mother, in a sitting posture on her knee, while the physician, kneeling on the floor, or sitting on a low chair, makes the examination he deems necessary. If the child be old enough to take notice, it should be attracted and amused by some toy or glittering object. Even, however, should it cry violently, much valuable information is to be obtained by the examination, for we can ascertain the presence or absence of râles and their characters during the deep inspirations between the cries, and can observe resonance of the cry and cough, and practice percussion.

The physical signs of *lobar pneumonia* are crepitant or subcrepitant râle, feeble respiratory murmur, bronchial respiration, bronchophony, exaggerated resonance of the cry and cough, and dulness on percussion. They are, in fact, the same in the great majority of cases as in adults. Under five years of age, this form often begins with subcrepitant râle, while after that period the earliest stethoscopic signs are crepitant râle, or feeble respiration. The bronchial respiration makes its appearance soon after the subcrepitant or crepitant râle, is heard first in the expiration, and then in both inspiration and expiration, and is accompanied by bronchophony, resonance of the cry and cough, and dulness on percussion. Bronchial respiration was present in 46 of the 57 cases of lobar pneumonia observed by ourselves; crepitant râle was present in 31, and subcrepitant in 10.

These alterations of the auscultatory phenomena are confined to one side, in the great majority of cases, and are best observed over the postero-inferior portion of the lung. MM. Rilliet and Barthez state that they have never known the bronchial respiration to disappear, in favorable cases, before the fifth day, and in the majority not before the seventh, eighth, or ninth; while, in fatal cases, it continued to the moment of death. Its persistence is always a highly unfavorable symptom in very young children, whilst in those who are older, as in adults, it sometimes remains for several days or weeks, though the general symptoms have entirely disappeared. In *catarrhal pneumonia* on the other hand, as we have already stated, the physical signs are often present on both sides, and are much less definite.

Rational Symptoms.—*Cough* may be said to be invariably present. It is dry at first, and not very frequent, but in one or two days becomes more frequent, often very troublesome, and from dry and harsh, becomes more or less humid and loose. It continues until the disease moderates, lasting generally from nine to sixteen days. In fatal cases it usually persists to the last. In infants it is not very frequent, occurs in short paroxysms, and in fatal cases often ceases one or two days before death. MM. Rilliet and Barthez remark that in pneumonia of the upper lobes, it has a peculiar character. It is little, short, smothered, as it were; or piercing, teasing, or slightly hoarse. We will merely add that cough is sometimes scarcely noticeable in cases which simulate hydrocephalus,

during the early part of the attack. In a case already referred to, that occurred to one of ourselves, in which the symptoms bore for several days very much the aspect of a meningeal attack, there was no full cough whatever during the first two days; on the third day, though auscultation and percussion showed the existence of pneumonia of the upper lobe of the right lung, the child coughed only three or four times, and it was not until the sixth day that it became at all frequent. In three other cases the cough was so slight in the early stages of the disease, during the continuance of the cerebral symptoms, as not to have been noticed unless particularly inquired after. Later in the attack, after three, four, or five days, and as the cerebral symptoms moderated, the cough became frequent and loose, and the pneumonic symptoms pursued their regular course.

Expectoration is almost invariably absent under five years of age. MM. Rilliet and Barthez, and Dr. Gerhard, have never observed rust-colored sputa under the age mentioned. In older children there is sometimes, though not very often, voluntary expectoration. Even in them, however, the sputa seldom present the characteristic rust-color and viscidity observed in adults, but consist simply of mucus tinged with blood, or of whitish, brownish, viscous, or non-viscous phlegm. We once, however, saw a child three and a half years old, voluntarily expectorate viscid mucus, tinged copiously with blood. Sanguinolent expectoration was noticed in five of the fifty-seven cases seen by ourselves (not including the one just spoken of). In three the sputa were of the characteristic rusty color, in one they were composed of mucus streaked with blood, and in another portions of mucus streaked with blood were rejected by coughing, and some also by vomiting. The age of the five subjects, just alluded to, was in each case between five and nine years. In another case (not included amongst the five), in a girl seven years old, affected with lobar pneumonia supervening upon pertussis, there was a free expectoration of tenacious mucus, sometimes streaked or dotted with blood, sometimes brownish, and sometimes rust-colored.

M. Valleix mentions a whitish or sanguinolent viscous froth, as sometimes escaping from the mouth of new-born children laboring under the disease, and Bouchut has also noticed in a single case, a little reddish sanguinolent froth, situated on the edge of the lips of an infant with pneumonia. We have never met with this symptom, but know of one case of a child within the month, who, during an attack of pneumonia, vomited mucus tinged with blood. The child died, and presented the lesions of pneumonia. The nipples of the mother were perfectly healthy, so that the blood could not have been sucked by the child from them, but must have consisted of the sputa which had been swallowed after being coughed into the fauces.

It is scarcely necessary to say that the absence of expectoration is only seeming, for children undoubtedly cough the sputa into the fauces, whence, instead of being rejected, as by the adult, they pass into the stomach.

Thoracic Pain.—It is impossible to ascertain the presence of this symptom with positive certainty prior to the age at which children talk, and very often not for some time after, as they refuse or do not know how to de-

scribe their sensations. And yet, even in infants, the presence or absence of the stitch in breathing, and of pain in coughing, may be inferred, almost with certainty, by watching the gestures and expression of the child, and the cries which accompany a full inspiration and the act of coughing. In effect, the deep inspirations induced by moving the child, those which take place during vomiting and gaping, and those also which occur in the act of coughing, cause the child to cry out suddenly and sharply, and give at the same moment an expression of acute suffering to the countenance, which can be referred to nothing else than the causes just mentioned, and which reveals almost as plainly as words the painfulness of a deep inhalation and of the act of coughing. In older children, we have several times known the pain to be most intense, causing bitter and repeated complaints, with crying, fretting, and evident acute suffering. The seat of pain, as complained of by children who talk, ought also to be noticed, since the account given by them might well mislead an unwary and inexperienced physician. It is quite common, in fact, for them to refer the pain to the false ribs, to one of the flanks, to the abdomen, and even to the hip.

The *respiration* is always quickened, except where the constitution of the patient has been greatly deteriorated by long and severe illness or other causes, under which circumstances it may remain at the normal rate, or be very slightly accelerated. This symptom usually dates from the invasion, soon after which the breathing rises as high as 40, 50, and 60 in the minute in older children, and from 60 to 80 in the younger. It sometimes becomes excessively rapid, reaching, as it did in a case of pleuropneumonia in an infant six weeks old under our charge, 128. In favorable cases, the acceleration subsides usually about the seventh, eighth, or ninth day. In most of the cases the breathing is even and regular, while in others it is short, abdominal, uneven, and jerking. When the dyspnœa is very great in a young child, the nostrils dilate widely, the mouth remains open, and its angles are drawn downwards and outwards; the last of these symptoms is almost a fatal one. Sometimes the rhythm of the function is changed, so that it begins with a sudden, active, and moaning expiration, followed by the inspiration, after which comes the interval of rest. MM. Rilliet and Barthez state that unequal, jerking respiration, occurs almost exclusively in cases of inflammation of the upper lobes.

Physiognomy.—The face is almost invariably flushed. The color, at first scarlet, becomes after a day or two deeper and darker, and in severe cases assumes a livid-red tint. We have noticed in very severe pneumonia, in addition to the deep-red tint, a peculiar glazed appearance of the skin, which looks as though it had been varnished, while the edges of the flush are distinct and abrupt. The lips are generally deeply colored, simultaneously with the face. The flush commonly subsides about the same time, or a little before the diminution in the rate of the respiration. In fatal cases, the face is apt to lose its color, and become pale and sallow, as the unfavorable symptoms become more and more marked, The pallor of the face is most striking in severe and fatal cases occurring in infants; the face is blanched and the features pinched.

The expression of the face is one of anxiety and oppression in the early stage; in very severe cases, or those about to terminate unfavorably, the features become drawn and contracted.

Fever exists in all the idiopathic cases. The pulse, at all ages, is rarely under 130 from the first to the sixth or seventh day; in the youngest children it rises as high as 140, 160, and even 180; while in those who are older, it is seldom above 140. In favorable cases, it diminishes about the fifth, sixth, or seventh day. In fatal cases, it is apt to diminish at the same period, but soon becomes more frequent and continues so to the end.

The range of *temperature* in pneumonia is higher than in any other inflammatory disease of children. This is true of the disease in both of its forms—lobar and catarrhal. The highest temperature we have found recorded for pneumonia is 105.8°, which Roger, in his latest contribution to this subject (*Recherches Cliniques sur les Mal. de l'Enfance*, 1872, p. 356), states was observed by him in 2 out of 47 cases of pneumonia. In two-thirds of the entire number the mercury reached or exceeded 104°; and the mean of the highest temperatures in all the cases was 103.9°. Such high degrees are more apt to be found in children over than under 2 years of age. The maximum temperature reached in any case would not seem to be much influenced by the seat or extent of the inflammation.

In lobar pneumonia the course of the temperature is regular and characteristic. The accession of fever is often very sudden, and the mercury may rapidly rise to its maximum point, marking 104°, 105°, or even 105.8°, within twelve hours from the onset. After the first abrupt rise, it is sustained nearly at the same point, with moderate morning remissions and evening exacerbations (the variation usually not exceeding one or one and a half degree) until defervescence, which is usually rapid, or even abrupt, occurs. In the catarrhal form, on the other hand, the initial rise of temperature is less abrupt, and the course of the fever is marked by the occurrence of irregular remissions and exacerbations, which Roger attributes to the development of successive patches of pneumonia.

The ratio between the temperature, pulse, and respiration may be quite closely preserved, and the elevated degree of febrile heat be associated with marked acceleration of the pulse and breathing. Thus Roger found that the mean furnished by 47 cases was: temperature, 103.94°; pulse, 133; respiration, 52. It is not, however, at all rare in both forms of the disease for the pulse-respiration ratio to vary from the normal 1 to 4 to 1 to 2, or even 1 to 1.5. In the lobar form, it will frequently be found that, following the defervescence, the temperature falls below the normal point, as to 98° or 97°, for a day or two.

The *nervous system* shows more or less marked symptoms of disorder. There is restlessness, peevishness, and irritability during the day, and these increase towards evening. As the night advances, the child becomes still more restless; infants will not sleep except in the arms, and wake crying or fretting every few minutes or hours; older children sleep uneasily, talk in their sleep, or start and cry out, and are often delirious. In some instances, the irritability is most distressing, both to the child and to those around. The child is constantly fretting and whining; it wants its play-

things, but will not touch them; food, but rejects it; and slaps and scolds at everything about it. Convulsions sometimes occur at the invasion. They last an uncertain length of time, and are usually followed by insensibility, from which the child wakes with fever, accelerated respiration and cough, indicating the true seat of disease to be the lungs, and not the brain, as might at first be supposed. We have met with but three cases, all of the lobar form, attended with convulsions. One occurred in a boy between ten and eleven years of age, on the second day of the disease. The attack was induced more, however, by an unwholesome meal taken on the first day of his sickness, than by the mere effect of the local inflammation. In a second case, which occurred in a boy between five and six years old, there were two convulsive seizures, a violent one on the first day of the pneumonia, and a slighter one a few days later. In the third case, which occurred in a boy aged two years, the pneumonia occurred in the course of intermittent fever; there were three marked convulsions, but the child subsequently recovered perfectly. The headache is sometimes very severe; in a few instances we have known it to be so violent as to constitute the most prominent symptom of the case. On one occasion, indeed, it was so intense, and so much complained of, during the first two days of the fever, as to withdraw our attention from the true seat of disease, and it was not until the third day that we discovered the existence of pneumonia. The cough was in this, as in other instances, in which the nervous symptoms were strongly marked, so slight as to escape notice.

Digestive Organs.—Complete anorexia is generally present from the first; the thirst is intense, greater indeed than in almost any other affection of childhood. The tongue is moist, as a general rule, and covered with a whitish or yellowish fur. Vomiting and diarrhœa occur at the invasion of about half the cases in hospitals; in private practice, vomiting often occurs, but diarrhœa much less frequently.

Urine.—The amount of urine is materially lessened in acute lobar pneumonia, the extent of the reduction being from one-third to one-half (Parkes).

During the height of the disease the urea is increased, and with it, as in most febrile diseases, the uric acid. Simon and Redtenbacher first called attention to the fact that the chloride of sodium is diminished or entirely absent during the early period and at the commencement of hepatization, and reappears during, or rather after resolution; and further researches have fully confirmed this observation, since very few exceptional cases have yet been recorded. The disappearance does not depend upon the reduced diet, since Howitz and Parkes both state that even when chloride of sodium is administered, none can be detected subsequently in the urine. And the fact that it is in reality retained in the system, is further shown by the very excessive excretion during convalescence. According to Beale's observations, the exudation in the lung is very rich in chloride of sodium; and it has been found that as this salt disappears from the urine, it appears in the sputa, and in turn as it returns in the urine, it disappears from the sputa.

It is true that more extended observation has shown that the chloride of

sodium is absent or deficient in many other affections, both febrile and inflammatory; but still, although not pathognomonic of pneumonia, this sign is an aid in its diagnosis, and probably serves to distinguish it from collapse of the lung or tuberculous consolidation.

One more condition of the urine in pneumonia, although as yet, so far as we know, only noticed in adults, deserves attention. We allude to the presence of albumen, which has been noticed by several observers, as Finger, Becquerel, Parkes, and Heller, in almost 45 per cent. of their cases; though others have but rarely found it.

The period of its occurrence is variable; according to Heller and Parkes, it appears at the time when the chlorides are most deficient, as hepatization advances. The fatality is much increased in cases where albuminuria is present; the combined record of the observers above referred to, yielding a mortality of almost 50 per cent. of such cases; whilst the mortality in cases without albuminous urine was only 14 per cent. According to Parkes, renal cylinders are very common in the albuminous urine of pneumonia; and a little blood is also frequently present, but is usually out of all proportion to the albumen.

Diagnosis.—The *lobar* pneumonia of children is most liable to be confounded with bronchitis, pleurisy, and meningitis. There is little probability, however, that lobar pneumonia would be mistaken for bronchitis by any but a careless or incompetent observer; for the presence, in the former, of subcrepitant, and very often of crepitant râles, of bronchial respiration, bronchophony, resonance of the cry and cough, and dull or flat percussion, confined to one side, would easily distinguish it from bronchitis, which is marked by dry and moist râles over both sides of the chest, and by a normal condition of the percussion. It is difficult and often impossible, as already stated, to detect the existence of catarrhal pneumonia, or at least to make the diagnosis with absolute certainty. The cause of the difficulty, as before explained, lies in the fact that it presents, in a great many instances, no clear physical signs. When the number of inflamed nodules scattered through the healthy texture of the lung is small, and especially when they are deeply seated, no alteration whatever of the natural respiratory sounds can be perceived, and we are obliged to depend entirely upon the rational symptoms,—the accelerated breathing, oppression, pain, cough, fever, and the absence of the physical signs of other pulmonary inflammation. A careful study of the temperature may here be of service. We have seen that in pneumonia the temperature usually rises quickly to 104° or 105°, while in bronchitis, it rarely attains even the lower of these, and often does not exceed 101° or 102°. Sometimes the presence of the characteristic sputa of pneumonia will, in older children, make the diagnosis clear. When the inflamed nodules are situated near the surface of the lung, we may, in some instances, detect crèpitant or fine subcrepitant râle, and bronchial respiration, over circumscribed portions of the lung, and there would be, under such circumstances, no hesitation as to the diagnosis.

It has been stated that pneumonia might be confounded with pleurisy. This could not happen in regard to the catarrhal form, as the slighter de-

gree of the pain, the limited extent of the râles and bronchial respiration, and the absence of dulness on percussion in the latter, would prevent such a mistake. The distinction between pleurisy and the lobar form is more difficult, but may generally be made out by attention to the fact that pleurisy is rare under six years of age; by the greater severity of the pain, the less abrupt and extreme elevation of temperature, the absence of râles and presence of friction-sound, the effect of change of position on the sounds yielded by percussion, the shorter duration and greater mildness of the general symptoms, the entire absence or small amount of expectoration, and by the continued dryness of the cough in pleurisy; and lastly, by the disposition on the part of pleurisy to become chronic, while lobar pneumonia nearly always runs an acute course.

Lobar pneumonia in children not unfrequently simulates, in its early stage, an attack of meningitis, constituting a form of the disease sometimes called *cerebral pneumonia*. Vomiting, constipation, extreme irritability or restlessness, and complaints of headache, occur in both; while the absence of thoracic symptoms to draw attention to the true seat of the disease in pneumonia, may readily mislead. The cough in the early stage of pneumonia is sometimes very slight, and not being observed by the attendants, is not reported to the physician. The frequency of the respiration is overlooked, or, if noticed, it ascribed to the fever, which is supposed to depend on the cerebral inflammation. In pneumonia, however, the vomiting is not usually very frequent, nor very obstinate, nor are the bowels so much constipated as in acute hydrocephalus. These variations from the ordinary symptoms of the latter disease, minute though they be, ought to attract the notice of the physician, and lead him to examine the case more carefully, when, in all probability, the physical signs would immediately reveal the pneumonia. We may mention, in illustration, that we attended a boy six years old, who, for three days, suffered from violent fever and excruciating headache, which last was the only symptom complained of. There was neither cough, expectoration, nor any marked acceleration of the respiration. After three days the headache moderated, and he had slight pain in his side; on examination, we found him laboring under well-marked lobar pneumonia. In April, 1847, one of us was called to see a boy nineteen months old, who had been taken sick with slight fever, a little hoarse cough, and mild pharyngitis. After remaining in this condition for five days, he began to be drowsy and very irritable, the surface became pale, and the extremities rather cooler than natural. From the sixth to the tenth day there was great somnolence, the child sleeping nearly all the time; when waked from sleep, he was always exceedingly irritable and cross, scarcely opening his eyes, and then shutting them again immediately to avoid the light, which was evidently painful. During this time he took scarcely any food, but little drink, and vomited several times freely; the bowels were moved without medicine; the surface remained very pale, and the extremities often cool; the pulse was frequent and small, the respiration perfectly regular, for which reason it attracted no attention, and there was *no cough* whatever. Under these circumstances, we hesitated between regarding the case as one of meningitis, or of hydro-

cephaloid disease, as described by Dr. M. Hall. We took the latter view, however, and treated it with small quantities of brandy, cold to the head, and the frequent employment of mustard pediluvia. From the eleventh day the child began to improve; it would open its eyes from time to time, and look round for a few moments; the face began to show a slight degree of color, and the palms of the hands, which had been white and transparent, exhibited a tinge of the natural pink hue which they have in children. Observing about this time that the respiration was accelerated, though perfectly free and regular, and without cough, we counted it, and were astonished to find it 80 in the minute. We now examined the chest carefully, and finding slight dulness on percussion with bronchial respiration, over the inferior half of the left side behind, immediately understood the nature of the case: it was one of latent pneumonia, simulating hydrocephalus. The child was now treated for pneumonia, and after an illness of twenty-seven days longer, recovered perfectly. As the case progressed, the rational signs of pneumonia were more and more apparent, the cough becoming frequent and painful, and after a time loose, while the cerebral symptoms gradually disappeared.

In addition to these cases, we have met with several others which during the early stage resembled very closely the invasion of cerebral disease. One of these has already been referred to in the account of the symptoms of the disease. Two others occurred in children within the year, and one in a child between one and two years old. Attention, however, to the rate of the respiration and the physical signs, and the presence of slight cough, revealed, in two of them, after a little hesitation, the true character of the attacks. The third case, which occurred in one of the children within the year, was unattended by any cough during the first few days, and was, therefore, very obscure, until our attention was attracted by an acceleration of the respiration, when the physical signs, and, at a later period, the cough, explained the real nature of the attack. We may remark, in addition, that in all these cases, the absence of constipation, the infrequency and short duration of the vomiting, and some clearness of the intelligence when the child was fairly roused, though but for a few moments, from its state of somnolence, were other motives for doubting the attacks to be meningitis.

We have dwelt at length upon the danger of making this serious mistake in diagnosis, in the hope that our remarks will aid in impressing upon the mind of our readers the great importance, which has indeed been alluded to on several previous occasions, of making a careful examination of the chest by auscultation and percussion in every case of acute disease in children, even though the symptoms do not appear to indicate any affection of the heart or lungs.

Dr. West states that pneumonia is often overlooked in teething children, in whom the cough is called a tooth-cough, whilst the diarrhœa, which frequently occurs, and becomes the prominent symptom, is supposed to depend upon dentition, and is alone attended to. The diarrhœa is obstinate, and when, at last, the cough attracts attention, it is ascribed to phthisis, and the physician is astonished to find at the autopsy purulent

infiltration of the lungs, but no tubercles, and no disease of the intestines. The diagnosis is to be correctly made, under such circumstances, only by careful physical examination.

The disease with which catarrhal pneumonia is most apt to be confounded is bronchitis. The two are frequently associated, and, owing to the fact that the physical signs of consolidation of lung-tissues cannot always be detected in the catarrhal form, our diagnosis must sometimes be based solely upon the general symptoms. If we find, however, that with or without previously-existing bronchitis the cough has suddenly assumed the pneumonic character, the temperature rapidly risen, and the degree of dyspnœa suddenly increased, there is strong reason to believe in the supervention of catarrhal pneumonia. If we find, in addition to this, impaired resonance at various points, with imperfect bronchial breathing and perhaps subcrepitant râle at these spots, our diagnosis would be confirmed. We must also bear in mind the resemblance which exists between catarrhal pneumonia and lobular collapse of the lung. The points of resemblance and the fact that both are apt to appear during the course of a bronchitis have already been alluded to. In lobular collapse, however, although the dyspnœa may be extreme, the symptoms do not indicate any increase in the inflammatory action, but, on the other hand, the temperature is normal, or even lower than natural.

Prognosis.—It may be stated in general terms that lobar pneumonia is the more dangerous in proportion as the child in whom it occurs is younger; and that the secondary, consecutive, or intercurrent form of the disease is much more dangerous than the primary. It is usually supposed to be almost necessarily fatal in newborn children, and to be still very dangerous up to the sixth year of age. There has been so much confusion, however, in regard to atelectasis of the lung and true pneumonia until within a few years past, that it is scarcely possible to trust to former statistics upon this point. From six years of age up to fifteen, the disease is generally curable when of the primary form; when of the secondary form the result is much more doubtful, and will depend in great measure, of course, on the nature of the disorder during or after which it occurs.

MM. Rilliet and Barthez (*loc. cit.*, p. 535) state that they lost about one-eighth of their cases in private practice. Of these, the youngest was a year old, the oldest, three years old. To quote their own words: "Some evidently died of accidents caused by the medication (poisoning by tartar emetic); one was the victim of a relapse, due to faulty hygienic care; and others died of cerebral pneumonia of the upper lobe; they were undergoing the process of dentition." In the hospital, they lost a seventh of their patients. The subjects under five years of age died of cerebral, gangrenous, or intestinal complications. Those over five years of age died, some because they were scrofulous or feeble, the inflammation though lobar, being double; and the others, in consequence of the inflammation having become complicated with pleurisy, scarlet fever, or meningitis. They add, that in the hospital, six-sevenths of the patients attacked with secondary pneumonia died.

In 1862, however, Barthez stated, in a memoir to the French Academy

(*Med. Times and Gaz.*, May 10th, 1862), that during the previous seven years, having abandoned the use of depletion in the pneumonia of children, he had treated 212 cases, with a loss of but 2 patients.

The results of our experience, which, it ought to be remarked, has been acquired chiefly in private practice amongst the easy classes of society, have been as follows: Of 65 cases of well-marked lobar pneumonia, only 2 were fatal. Of these two, one occurred in an infant six weeks old, and was accompanied with extensive and violent pleurisy, and the other occurred in a child between two and three years old, lasted thirty-three days, and was attended with considerable bronchitic inflammation.

I addition to these, we have seen a certain number of cases which are not included in the statistics of our own experience, since some of them were only seen, and, perhaps, but a single time, in consultation, while others occurred among the children in the large public institutions of this city. A far larger proportion of these latter cases proved fatal.

We may conclude, therefore, that pneumonia under two years of age is always dangerous, and much more so when secondary than when primary; that primary pneumonia, between the ages of two and five years, will, if treated judiciously, terminate favorably in the great majority of cases in private practice; and that when the disease attacks children between six and fifteen years of age, the termination is nearly always in health.

The following are some of the most unfavorable symptoms of the disease: convulsions; small, weak pulse; extreme rapidity of the respiration; persistence of the bronchial respiration in young children; incomplete resolution of the disease within the ordinary period; excessive and obstinate diarrhœa; severe cerebral symptoms; great emaciation; greatly altered physiognomy; excessive irritability; and a yellowish tint of the skin. M. Trousseau regards as an unfavorable symptom the occurrence of swelling of the veins of the hands, which he supposes to depend on an obstacle to the function of hæmatosis.

The prognosis in catarrhal pneumonia is much more grave than might be supposed. Supervening, as it so frequently does, in very young children already exhausted by a previous attack of bronchitis, there is danger that the violence of the attack may cause it to prove fatal in the acute stage. The symptoms which would indicate great danger are high temperature, greatly altered pulse-respiration ratio, with extreme frequency of breathing, lividity of face, and the evidences of serious interference with aeration of the blood.

When the attack is less violent, the chances for future recovery are naturally much greater; but, it must be remembered that this form of pneumonia frequently runs on into a chronic stage and, by the persistence of the changes in the alveolar walls, and the cheesy metamorphosis of the accumulated epithelial cells in the alveoli, leads to the development of chronic pulmonary phthisis. The prognosis therefore should always be a guarded one.

Treatment.—When one of the former editions of this work was published, a great change had begun to take place in medical opinion as to the proper treatment of disease, and especially of acute disease. In that

edition this change of opinion was referred to, and its effect upon our own convictions and methods of procedure freely acknowledged. Since that period this revolution, as it might be called, has continued to make progress, until, at the present moment, no one can candidly express his own views without referring to it. In view of these facts, we shall not hesitate to write at some length on the treatment of pneumonia, in order that our readers, and especially the younger members of the profession, may be able to comprehend not only the changes that have taken place, but some of their causes.

There is another consideration which has been forced upon us by time and experience, which makes us unwilling to dismiss the treatment of so important a disease in a few words, and this is, that the method of cure to be followed in individual cases must be determined not alone by the simple fact that the patient has an inflammatory exudation in the lung-tissue, but, in large measure, by the state of the general vitality of the subject. What folly, for instance, to suppose that we can safely apply the same therapeutic measures to a case of pneumonia in a child just issuing out of severe measles, to one in the midst of a dangerous typhoid fever, to a third in the spasms of hooping-cough, or to a fourth who was yesterday in consummate health, with every function, up to the moment of the attack, in the finest possible working order. To be sure, this is putting the case in very strong terms, but they are not too decided to make our meaning clear.

Moreover, we think there is a tendency, in some of the later works on diseases of children, and in some, too, of the general treatises on the practice of medicine, to lengthened scientific descriptions of anatomical changes, symptoms, diagnosis, etc., and to a corresponding diminution of the space devoted to therapeutics. This error, as we think it (not to be wondered at, perhaps, when we consider the relative difficulty of writing on these different subjects), we desire to avoid, and, indeed, we have found it impossible to state our opinions on the subject except at some length.

Bloodletting.—Twenty years ago depletion formed an almost inevitable item in the treatment of pneumonia, but, within the last eight or ten years, the views of most observers have undergone a more or less radical change in regard to its utility and necessity. Some have abandoned it altogether; others employ it still to a moderate extent. In order that the younger practitioner may see the changes which have taken place in this respect, we shall quote the views of some of the more important authorities, and then give our own.

Dr. Charles West (4th Am. ed., from 5th English ed., page 285) writes as follows: "I cannot forget the good results which I saw years ago from the abstraction of blood at the outset of an attack of pneumonia in previously healthy children." He, however, does not advise depletion when small crepitation has become generally diffused, still less when dulness or bronchial breathing is perceptible. He gives no statistics as to his own results whatever. Dr. J. Lewis Smith, of New York, in his work, does not even mention bloodletting. Dr. Eustace Smith (*Medical Times and Gazette*, May 3d, 1873, page 460) says he has never drawn blood from a

child suffering from pneumonia, and that he has never met with a case in which such a method of treatment has appeared to him to be in the slightest degree desirable. Dr. Thomas Hillier, of London, says of bloodletting that it "is now for the most part discarded. I have never had occasion to resort to it." He says further, however, that cases might occur where it would be proper to recommend it. Such conditions would be, the second day of the disease, a large extent of inflammation of the lung-tissue, full and bounding pulse, great pain and dyspnœa, and a temperature of 105° or more. If these conditions existed in a previously healthy child, he would think it wise to take a few ounces of blood from the arm. We have already referred to the communication from M. Barthez to the Academy of Medicine of Paris, in April, 1862, intended to vindicate the expectant treatment of pneumonia in early life. In this paper it is stated that of 212 cases of lobar pneumonia, occurring between the ages of two and fifteen, in the course of seven years, at the Hôpital Ste. Eugénie, only 2 had a fatal termination, although no approach to active treatment was adopted in more than a sixth of the number. Dr. J. Hughes Bennett gives, in *The Practitioner*, for May, 1869, the results of the restorative treatment of pneumonia in 153 cases. Of these, 129 were simple and 24 complicated cases. Of the 129 simple or uncomplicated cases, of which 35 were double, all recovered. Among the 24 complicated cases there were 5 deaths, making of the whole number a mortality of 1 in $30\frac{3}{5}$ cases. Dr. Bennett's cases all occurred in adults, but the results are useful to us as showing the effects of this kind of treatment.

In a former edition of this work it was stated that one of us had treated 50 cases of well-marked lobar pneumonia, with two deaths, in private practice. Full notes of only 46 of these cases were kept. Of the 46 cases, 39 were primary or uncomplicated, and 7 secondary or complicated. The 2 fatal cases occurred, one at six weeks old, and this was attended with very severe pleuritic inflammation, and the other between two and three years old; the latter case lasted 33 days, and was attended with considerable bronchitic inflammation. Depletion was employed in 16 of the 39 primary, and in 2 of the 7 secondary cases. It is proper to state that depletion was not employed in either of the fatal cases.

How difficult is the task of estimating the comparative value of different plans of treatment in any given disease. MM. Rilliet and Barthez lost one-eighth of their cases of pneumonia in private practice, and one-seventh in hospital. We lost one-twenty-fifth of ours in private practice; a result very nearly as good as Dr. Bennett's, though ours were all in children under 15 years of age, and of 37, whose ages were recorded, 19 were under 5 years (2 in the first year, 3 in the second, 5 in the third, 4 in the fourth, 5 in the fifth). Dr. Bennett condemns bleeding almost wholly; we took blood in 16 of 39 primary, and in 2 of 7 complicated cases, and did not deplete at all in the 2 fatal cases. M. Barthez reports 212 cases, treated by the expectant method, with only 2 deaths, or less than one in a hundred; and these cases, too, in children between 2 and 15 years of age, in hospital practice. These last statistics are the most surprising we have seen. We have been unable to find the original memoir of M. Bar-

thez, but have seen the report made to the Academy of Medicine, by M. Blache (*Bulletin de l'Acad. Imp. de Médecine*, t. xxx, p. 21), on the memoir, in which it is stated that "the author has taken care to eliminate the lobular or generalized pneumonias, the pseudo-lobar pneumonias, broncho-pneumonias, and catarrhal pneumonias; he has also thrown aside the lobar congestions which occur in the course of low fevers, and the secondary lobar hepatizations; that is to say, those which occur in the course of any well-determined disease, and particularly tuberculosis." We cannot help thinking that the elimination of so many forms of pneumonia, must be a chief reason for the very great success of the plan of treatment used.

This much, however, has been plainly established by the observations and experience of late years, that the old plan of bleeding, as a rule of absolute practice, merely because of the existence of pneumonia, and especially the Sangrado system of bleeding, *coup sur coup*, was a gross mistake, and one which did great harm. But we do not think it has been proved that the restorative or expectant system, to the exclusion of bloodletting under any circumstances, is always and inevitably the right one. We have been led to think that bloodletting was not the only cause of the heavy mortality under the old systems of treatment, but that the use of such agents as antimony, ipecacuanha, and perhaps calomel, in large and frequently administered, and long-continued doses (and particularly the antimony) by their action upon the stomach, in destroying all power to take and digest food, and by the general prostration which their action (especially antimony) upon the nervous system occasioned, were answerable for a large share of the fatal results of those days. We doubt, in fact, whether depletion, used in anything like moderation, is not safer for the patient than the continued use, for two or three days, of nauseants and depressants, more particularly of antimony. But of the action of antimony upon children, we shall speak more at length hereafter.

Our own opinion, after the enlarged experience of later years, is, that depletion should not be used save in exceptional cases. When the pneumonia is pursuing a regular and safe course, it is best to trust to the simple means to be spoken of hereafter—to follow a mild expectant method. Where the physician doubts as to its propriety, and especially when he is young and inexperienced, it is safest to abstain from it entirely, or to employ it only in a very moderate degree. But there is a certain class of cases, in which we believe that local depletion, by cups and leeches, is not only allowable but most useful. When the subject is vigorous and strong, with a fine sanguification; when the temperature is very high; the pulse strong and full; the muscular force good, and the side-pain and cough very severe, we think that the local abstraction of from two to four ounces of blood, at the age of three or four years, has great power to relieve all these symptoms. Again, when the dyspnœa is very great; when the heart pulsates with great force, whilst the pulse is small and feeble, showing that the right heart is overloaded, and the arteries comparatively empty, in consequence of obstruction to the passage of blood through the lungs; and when the child is tolerably vigorous, and not reduced by previous illness,

a moderate venesection is often of more use, and of more efficacy in palliating these conditions, than any treatment we know of. The quantity to be taken should seldom be over four ounces, at the ages of from three years and upwards. We venture upon these statements the more boldly when we find such men as Chambers and Niemeyer, and even Bennett, giving the same advice. Dr. Bennett (*loc. cit.*) lays down amongst his axioms the following: "Small bloodlettings, of from six to eight ounces, may be used in extreme cases, more especially in double pneumonia and broncho-pneumonia, as a palliative to relieve tension of the bloodvessels and congestion of the right heart and lungs." Niemeyer (*Text-Book of Pract. Med.*, Amer. ed., vol. i, p. 184) says, pithily: "Highly as I prize venesection, however, in certain emergencies which may arise in the disease, I had rather that any one, dear to me, and sick of pneumonia, were in the hands of a homœopath, than in the hands of a physician who thinks that he carries the issue of the malady upon the point of his lancet." He recommends venesection in three conditions: 1. When the pneumonia has attacked a vigorous and hitherto healthy subject, is of recent occurrence, the temperature being higher than 105° F., and the frequence of the pulse rating at more than 120 beats a minute. "Here danger threatens from the violence of the fever, and free venesection will reduce the temperature, and lessen the frequence of the pulse. In those who are already debilitated and anæmic, bleeding increases the danger of exhaustion. Should the fever be moderate, bloodletting is not indicated, even in healthy and vigorous individuals." 2. "When collateral œdema, in the portions of the lung unaffected by pneumonia, is causing danger to life, the pressure of the blood is reduced by bleeding, and by prevention of further transudation of serum into the vesicles, insufficience of the lung, and carbonic acid poisoning are averted. Whenever the great frequence of respiration, in the commencement of pneumonia, cannot be traced to fever, pain, and to the extent of the pneumonic process alone, *as soon as a serous, foamy expectoration appears, together with a respiration of forty or fifty breaths a minute*, and when the rattle in the chest does not cease for awhile after the patient has coughed, we ought at once to practice a copious venesection, in order to reduce the mass of blood, and to moderate the collateral pressure. The third indication for bleeding arises upon the appearance of symptoms of pressure upon the brain, not headache and delirium, but a state of stupor or transient paralysis." We have made this long quotation because the authority is so high, and because we have nowhere found such clear and concise statements upon this most important point of practice.

Antimony.—In a former edition of this work it was stated that tartar emetic, in the dose recommended by some of the highest authorities of the day, had been found by us a very dangerous drug. Time has but confirmed this opinion. At that time we were in the habit of administering it in doses of a forty-fifth or sixtieth of a grain every hour or two hours. This was at a time when Rilliet and Barthez used it in doses of from two to four grains, dissolved in four ounces of water, in twenty-four hours, for very young children, and for those who were older six grains in the same space of time. They continued it for two, three, or four days, and advised its

suspension should it give rise to excessive vomiting or severe diarrhœa. Dr. West at that time gave it in doses of one-eighth of a grain, at the age of two years, every ten minutes, until vomiting was produced; to be continued every hour or two afterwards for a period of twenty-four or thirty-six hours. Dr. West had reduced the doses, and the time of continuing it, one-half, between the time referred to and the date of his essay on pneumonia, published in 1843.

The doses used by us, as mentioned above, may seem to some who have not employed them ludicrously small, but we soon found that even they were quite frequently, in certain constitutions, more than could be given with safety. Antimony, even in those small quantities, sometimes caused a very peculiar general prostration. Perhaps without any vomiting whatever, or with only a rare effort at that act, the patient would refuse all nourishment, become very pale and weak, grow limp and motionless, take on a haggard and pinched expression of face, pass into a state in which it would pay no attention to what was going on around, be very peevish and irritable when disturbed, get a very frequent and feeble pulse, and look to an experienced eye as though a very little deeper degree of such prostration might end fatally. After seeing this condition a few times, and finding that the withdrawal of the drug and the use of small doses of brandy (ten to twenty drops in water or milk) every hour or two hours, was followed by rapid improvement, we learned the greatest caution in the use of the remedy. Of late years we never use tartar emetic at all, but give, not unfrequently, in strong and vigorous children, with high febrile heat and rapid circulation, small doses of the precipitated sulphuret of antimony, always watching its effects carefully, and withdrawing it at once should the above symptoms make their appearance. The formula found most useful and safest is the following:

℞.—Antimon. Sulphurat., ... gr. j.
Pulv. Doveri, ... gr iij.
Sacch. Alb, ... gr. xij.

M. et div. in chart. no. xii. One to be given every two, three, or four hours.

To infants under two years of age it is best to give no antimony at all.

Mercury.—In former years, in obedience to the prevailing rules of the day, we gave calomel in very moderate quantities in some cases of pneumonia. We never felt sure that it was of any special service, and of latter years do not give it except under some very clear indication. When, however, especially in the early stage, there are signs of gastro-hepatic congestion, such as a flabby tongue with whitish fur, fulness of the hypochondriac regions, anorexia and perhaps nausea, a few small doses of calomel, or of blue mass followed by a mild saline laxative will be followed by relief.

Salines.—Citrate of potash, either in the form of the neutral mixture or dissolved simply in water with a little sugar, is one of the best febrifuges that can be used. In doses of two and a half grains to children over three or four years old, and half a grain to a grain for younger children and

infants, every two hours, it is an excellent remedy. It may be given alone, or combined with small doses of syrup of ipecacuanha and opium. Spirit of nitrous ether may be added when the urine is scanty, or when the ipecacuanha cannot be borne.

The solution of *acetate of ammonia*, either alone or combined with the spirit of nitrous ether, is useful when the child is feeble, and when the stomach or bowels are irritable, in which case the citrate of potash sometimes offends the stomach and acts upon the bowels. The dose of this remedy may be from twenty or thirty drops to half a drachm or a drachm, according to the age, in sweetened water, or some aromatic water, every two hours.

Quinia is unquestionably a remedy of great value in both forms of the pneumonia of children. When given in full doses, it diminishes the intense febrile heat and the great rapidity of pulse; and, at the same time, is believed by many observers to possess a tendency to check the extension of the exudation process. It is usually perfectly well accepted by the stomach, and does not interfere with the power of taking food; while, on the other hand, by its tonic influence it must be of service in sustaining the system until the necessary stages of this exhausting disease have been passed.

Ipecacuanha is preferable to antimony in all conditions except those referred to above. In infants under two years of age, in children of highly nervous temperament, or of feeble and delicate constitutions, in most cases of the secondary form, and in all mild cases, it is much safer than the other drug. The most convenient preparation is the syrup, of which ten drops may be given every two hours at four years of age, five drops between one and three years, and from one to three drops to infants of two or three months. It is often useful to combine the spirit of nitrous ether with it, and, when the stomach is irritable, or the patient very restless and irritable, to add small doses of opium. When the patient is much oppressed by the presence of secretions in the bronchia, and not too much prostrated, an emetic is often very useful. Ipecacuanha is the most suitable remedy for this purpose, as it produces less exhaustion and depression than any other, except, perhaps, alum.

Muriate of Ammonia has of late years been very largely employed in the acute pulmonary affections both of adults and children. It has seemed to us to possess the power of hastening the softening and resolution of the exudation, and when there is expectoration, of rendering it less viscous and freer. The best period for administering it is in the lobar form after the hepatization is clearly established and the attack has reached its full development; or, in the catarrhal form, after the acute symptoms have somewhat subsided. It may then be given, associated with the febrifuge employed, or else dissolved in a little syrup of Tolu or syrup of wild cherry bark and water. The proper dose is one grain for children under 2 years of age, and 2 to 3 for those between 2 and 5 years, given every 6, 5, or 4 hours, according to its effect and the way in which it is tolerated by the stomach.

If the resolution of the exudation does not progress rapidly, and espe-

cially if symptoms of exhaustion make their appearance, the carbonate of ammonia may be substituted in about the same doses, for the muriate.

Purgatives.—A purgative dose, with or without a previous small dose of a mercurial, is useful at the beginning of the attack, when the child is constipated, and when the abdomen is tumid and hard. A teaspoonful of castor oil, or two teaspoonfuls of simple syrup of rhubarb, will answer every purpose. After this period cathartics need be used only so as to keep the bowels moderately soluble. If they are moved spontaneously every two or three days, there is no occasion to give purgative doses. If they do not move, a simple enema, or the doses mentioned, will be sufficient. Violent or frequently repeated doses of purgatives are injurious, by exhausting the patient through the disturbance of the stomach which they occasion, or by setting up diarrhœa.

External Applications.—MM. Rilliet and Barthez were of opinion that neither blisters, Burgundy pitch, nor tartar-emetic plasters, exerted the least influence upon any one of the symptoms of pneumonia, but that, on the contrary, they increased the fever. Dr. West gave up the use of blisters entirely, in consequence of the irritation and fever they occasioned, and because of the disposition to sloughing which he observed to follow their use amongst the poor. At one time we thought we had observed great benefit from the use of a blister when other means had failed to produce some moderation of the symptoms after four or five days. If they are used at all, it ought to be with great care, especially in very young or feeble children, whose nutrition is depraved. In children of less than two or three years old, a blister should never remain on the skin longer than two hours. As a general rule, the mother should be told positively to remove it at the end of one hour and a half, even though the surface be still unchanged. A warm bread-and-milk poultice is then to be used as a dressing, and this rarely fails to cause vesication in a few hours. Employed in this way, we have had but once the misfortune to see a blistered surface slough, and this occurred in a child whose skin had been very much irritated by frictions with amber oil and ammonia.

Since the spring of 1845, however, when we were led to make frequent use of mustard poultices and foot-baths in the treatment of the bronchitis and pneumonia of measles, we have rarely employed blisters, but have preferred the employment several times a day of the remedies just indicated. Two parts of Indian meal and one of mustard, for young children, and for those who are older equal parts of each, are to be mixed with warm water, and spread thickly like a poultice on a piece of flannel or rag five or six inches square. This is to be covered with fine muslin, linen, or gauze, and applied first over the back and then the front of the thorax. It may remain from fifteen to forty minutes, or until the child cries or complains, or until the skin is reddened. The mustard foot-baths may be employed at the same time with the poultices. These applications are useful whenever the oppression is very great, and, when resorted to in the evening, they often allay irritability, and dispose the child to sleep. The number of applications to be made in a day must depend on the urgency of the

symptoms. We have employed them from once a day to every two or three hours.

The use of hot linseed-meal poultices, so highly recommended by Dr. Chambers, of London, we have found apparently of much service. The poultices should be spread quite thick on a cloth or flannel as broad as the circumference of the thorax, and deep enough to cover the whole chest, from the collar bones to the hypochondria. The size of the poultice will be determined by the amount of lung-tissue, though we usually have them spread large enough to cover the whole affected side, even if but a portion of the lung be involved. They should be changed several times during the day, and care should be taken that a fresh hot poultice is ready for application before the one in place has been removed. In order to keep them in place, it is often necessary to have a tape stitched on in front, and a tape behind, which can be tied over the shoulder in the manner of a shoulder-strap.

Tonics and stimulants are to be resorted to in cases which manifest undoubted signs of debility. When, therefore, the attack occurs in a feeble child; in secondary cases; when the inflammation remains unresolved after the use of other remedies, and when extensive bronchial respiration persists, though the fever has moderated; or when, in any case, during the acute stage, the child falls into a typhoid state, as shown by pallor of the surface, frequent, uneven pulse, dry tongue, prostration of muscular power, and either incessant jactitation or the listless quiet of exhaustion; attention must be paid to the state of the constitution even more than to the local disease. The vital forces must be sustained and strengthened in order to give time and power to carry on the operations necessary for the removal of the local obstruction. To effect this purpose, we must depend upon the use of food, alcoholic stimuli, and certain tonics. The *food* most suitable for such a condition is milk, animal broths, soft-boiled eggs, and perhaps small quantities of raw or slightly cooked meats. The best stimulants are brandy, given either in the milk or in water, as the child will best take it, and wine and water, or wine-whey. The amount of brandy given may be stated as 3, 4, or 5 teaspoonfuls in the course of 24 hours at 4 years of age. The best *tonic* to give in conjunction with the alcoholic stimulus is, as has already been stated, quinia, which should be administered in the quantity of from gr. iv to gr. vj in 24 hours, given in divided doses. When the exhaustion is marked, especially when associated with great embarrassment of respiration and copious viscid secretion from the bronchial tubes, we should recommend the use of the muriate or carbonate of ammonia, either of which may be given in mucilage, in doses of gr. ij to iij every 3 or 4 hours, at 4 or 5 years of age.

Opium is constantly of great service in the treatment of pneumonia. It should always be used when the patient suffers much, either from the side-pain or from cough, whether this be harassing and exhausting from its mere frequency and persistence, or from its effect in developing the stitch; when there is painful jactitation, an unusual degree of distress and malaise, or marked tendency to morbid vigilance. When the fever is very high, the pulse vibrating, the nerves on a rack, opium is of the greatest

advantage. The mere comfort it gives is a good warrant for its use, but it has long seemed to us to aid in shortening the duration and lessening the severity of the constitutional disturbance.

The choice of the preparation, and the doses and times of administration, must vary in different cases. When used early in the case, to act upon the circulation and allay general irritability, it is best to give it with the febrifuge every two or three hours. When used to control cough, it can be added to the sulphurated antimony in the form of Dover's powder, as already suggested, or to the syrup of ipecacuanha and spirit of nitrous ether, in a liquid form; or when the cough is particularly troublesome at night, as often happens, it can be given with more advantage in a single dose, or two doses in the evening. The preparations we have found most useful are, laudanum, especially the tr. opii deodorata, paregoric, solution of morphia, or Dover's powder. Under six months of age, half a drop of laudanum, from five to ten drops of paregoric, or two or three drops of the solution of morphia, may be given, and repeated twice or three times in the twenty-four hours, according to the effects. From the age of six months to the end of the second year, these doses may be doubled. In the third and fourth years, two drops of laudanum, ten to twenty of paregoric, five to ten of solution of morphia, may be used several times a day. Where the remedy is given every two or three hours, we have found one drop of laudanum quite enough at the ages last mentioned. When the dose is given only at night, from three to five drops of laudanum, ten to fifteen of solution of morphia, and thirty to fifty of paregoric are sufficient as a general rule. After the age of four and five years, the doses must be increased in proportion to the age. In very young children, the doses given at first should always be watched with a good deal of care, and never carried to such a quantity, or continued long enough, to induce constant and heavy drowsiness or stupor. In some instances of very nervous and hyperæsthetic children, in whom there is determined, by the violence of the reaction, a degree of irritability of the nervous centres tending to the tetanic state, the doses must be much larger than those mentioned; but here the physician should see the patient himself at least twice, and sometimes three times in the day, to watch and regulate by the dose the exact action of the drug. We have occasionally seen the cough most harassing and exhausting in its effect, occurring almost with every breath, and lasting for twelve and twenty-four hours. Under such circumstances, a mixture like the following has proved most beneficial in our hands:

℞.—Tr. Opii Deodorat., ... gtt. xxxij.
Vin. Antimon., ... gtt. xxxij.
Ext. Valerian, Fl., ... fʒij.
Syrup. Simp., ... fʒij.
Aquæ, ... fʒiss.—M.

Dose, a teaspoonful every hour or two hours, at the age of four years and upwards, until the cough is controlled.

Paregoric, in the proportion of two drachms to half an ounce, in place of the laudanum, sometimes proves more soothing and comforting.

General Management.—Since the reign of restorative medicine has set in, the general management of the patient has received a degree of attention which it had never attracted before. Under the expectant plan it constitutes, indeed, the chief portion of the treatment. The most important points to be attended to under this head are the diet, drinks, clothing, air, and state of repose.

The patient ought not to be allowed to go entirely without food even in the early days of the disease, neither should there be any effort made to stuff the child with large quantities of nourishment. The appetite is nearly always in great measure abolished, at first, and food is unwillingly taken except in very small quantities. A nursing child must not be allowed to nurse as heartily as usual. If it attempts to do so, it is probably from thirst and not from hunger. Water, therefore, should be offered to it from time to time, and the breast be allowed only every three or four hours for short periods. Weaned children should have only milk, always reduced by the addition of half or a third water, and pure water ought to be given frequently. The thirst in this disease is intense, and the physician should himself see that the patient has water freely. We have seen the most violent and obstinate screaming, and painful restlessness, quieted at once by a copious draught of cold water. In children over two and three years of age, milk and water is still the best food; but when this is refused, thin chicken or beef tea may be given in doses of a wineglassful or a gill every four hours. After three or four days have passed by, the administration of food is a very important part of the treatment. The child should now be induced, by persuasion and even gentle force, to take a little food at least three or four times in the twenty-four hours. As the severity of the symptoms subsides, the food ought to be increased in quantity.

The clothing ought to be such as to keep the body comfortably warm. In winter, which is the season when the disease almost always occurs, thin and soft flannels ought to be worn, and, when the child is very restless, either in the bed or on the lap, a sack made high in the neck, with the sleeves to the wrists, buttoning in front, and consisting of a soft and pliable woollen stuff, ought to be put over the bed-dress.

The room ought to be, if possible, a large one with a high ceiling, well ventilated, warmed by an open fire, and kept at a temperature of 65° to 68°. If the child is very young and delicate, a temperature of 70° is not too high, if only the ventilation be good.

The bed or crib is the proper place for a child with pneumonia. The lap of the mother or nurse is a poor substitute for an even, elastic, and steady mattress. We have long endeavored to keep our little patients in bed. A very young infant must, of course, often be taken up to be nursed, soothed, or cleansed, but, as soon as possible, it ought to be replaced, in the crib. Children a year or two old can generally, with good management, be kept the greater part of the time in bed. Those of three and four years old and upwards ought always to be confined to the bed. A little firmness on the part of the mother will almost always accomplish this end, and it is a highly important one, and well worth even a quarrel

at the beginning of the sickness. We have seen a child three years old kept by a weak and overtender mother and grandmother nursed on the lap for three weeks, until they were exhausted and demoralized, and the child had œdematous feet from their dependent position during so long a time.

Repose and quiet of mind and body, as complete as can be attained, are things of great value, and to secure them a good bed and a cheerful and resolute manner on the part of the nurse are as important for the child as for the adult. It is only in bed, too, that an even temperature and an avoidance of draught can be fully secured. A direction given by some of the French writers, and by Dr. Gerhard, is not to allow very young children to lie for too long a time in one position in bed, or in the nurse's arms, as it is apt to produce a stasis of blood in the dependent portions of the lungs, and thus to maintain or increase the disease. Dr. West recommends, whenever the inflammation has reached an advanced stage, or involved a considerable extent of the lungs, that the patient be moved with great care and gentleness, lest, as he has often seen occur, convulsions be produced.

ARTICLE III.

BRONCHITIS.

Definition; Synonyms; Frequency; Forms.—The term bronchitis is now universally employed to express inflammation of the mucous membrane of the bronchia; frequently it is called catarrh, and catarrhal fever.

It has been stated, under the head of Pneumonia, that many of the cases known amongst us by the popular term catarrh fever, are in fact, cases of pneumonia. We shall on account of this misapplication of names endeavor to draw the distinction between bronchitis and pneumonia with great care.

Since bronchitis and pneumonia have been more carefully distinguished in the mortality returns of this city, bronchitis is found to be the cause of a much smaller proportion of deaths than would have formerly appeared.

Thus, during the seven years ending with 1869, the total mortality from all causes (excluding still-born children) was, at all ages, 105,785; under fifteen years of age, 50,151; and under five years, 43,322. The mortality from bronchitis during this period was, at all ages, 969, or less than 1 per cent. of the entire mortality; under fifteen years, 509, or 1.01 per cent. of the mortality under that age; and under five years, 495, or 1.14 per cent. of the mortality under that age.

It is, however, one of the most frequent of the diseases of childhood, especially during the winter and early spring months. It is said to be more common as a secondary than as an idiopathic disease. Of 115 cases observed by MM. Rilliet and Barthez, only 21 were idiopathic. Of 123

cases, however, that we have recorded, 76 were primary, and the remaining 47 secondary. The diseases during the course of which it is most apt to occur, are pertussis and measles.

We shall describe three forms of the disease: 1, *acute bronchitis* of moderate severity; 2, *capillary bronchitis*, or acute suffocative catarrh; 3, *subacute* or *chronic bronchitis*.

CAUSES.—Amongst the *predisposing* causes of the disease, *age* is one of the most important. MM. Rilliet and Barthez suppose it to be much more common in children over, than in those under five years of age. Of one hundred and fifteen cases observed by them, thirty-seven occurred between the ages of one and five years, and seventy-eight between six and fifteen years of age. It is scarcely fair, however, to compare a period of nine years with one of only four, as is done in the above statements. Of one hundred and twenty cases that we have seen in private practice, in which the age was noted, fifty-four occurred between birth and two years of age; thirty-nine between two and four years; twelve between four and six; six between six and ten; and three between ten and fifteen. Of eighty-one cases under four years of age, of which we have kept an accurate record, eleven occurred in the first half of the first year of life, twenty in the second half, making thirty-one for the first year; twenty-one occurred in the second year of life, nineteen in the third, and ten only in the fourth, showing that the liability is greatest in the first year of life, and particularly in the last half of that year, that it continues very strong in the second and third years, being nearly equal in each of these, and that it then suddenly diminishes. It would seem also that the simple acute, and the acute suffocative forms are most common under six years of age, while the secondary cases occur more frequently after that age.

As to the influence of *sex* on the liability to the disease, it would appear from our experience to be rather more common in girls than boys, since of ninety-nine cases in which this point was noted, fifty-four occurred in girls and forty-five in boys. The fact of its being more frequently a *secondary* than a *primary* affection has already been noticed, though this has not been true of our experience. The diseases in which the largest number of cases occur are measles, pertussis, and typhoid fever. The secondary cases are most common, of course, during the prevalence of the disease whose progress they complicate, whilst the primary cases are most common in the cold months of the year, and especially in the autumn and spring. The reader is referred to the table in the article on pneumonia for a full exhibition of the effects of season and temperature upon the frequency of this disease. Bronchitis is sometimes *epidemic* amongst children as it is amongst adults. It is important also to be aware that there is a strong tendency to attacks of bronchitis in rickety children.

The only *exciting causes* whose effects in the production of the disease seem clearly proved are sudden transitions from a warm into a cold atmosphere, and sometimes the contrary change; prolonged exposure to cold, particularly when combined with moisture; and the inspiration of irritating gases. We believe ourselves, from what we have seen in this city during the last thirty years, that the most fruitful cause of bronchitis, and

also of pneumonia, croup and angina in early life, is the style of dress almost universally used for young children. The dress is entirely insufficient. It consists usually of a small flannel shirt, cut very low in the neck, scarcely covering the shoulders, and without sleeves; of a flannel petticoat, a muslin petticoat, and an outer dress made in nearly every case of cotton. The dress, like the flannel shirt, is cut low in the neck, is without sleeves, and fits very loosely about the chest, so that not only are the whole neck, the shoulders, and the arms exposed to the air, but in consequence of the looseness of the dress about the neck, it is fair to say that the upper half of the thorax is also without covering. In the infant, from birth to the age of six or eight months, the dress is made long, a wise provision so far as it goes, but from the time the skirts are shortened, up to the age of four or five years in boys, when happily the time for boys' clothes arrives, and throughout childhood in girls, the trunk of the body and the arms are dressed, or rather left undressed, as above described. But, not only are the neck, breast, and arms left bare, but in many children the greater part of the legs also is kept uncovered, or at least, short stockings, scarcely rising above the ankles, and muslin or sometimes Canton flannel drawers, not reaching, or scarcely reaching to the knees, leave exposed to the air a large proportion of the cutaneous surface of the lower extremities. Now, in this dress, the child passes the day in a house, the sitting-rooms of which are heated usually to 68° or 70°, but in which the entries, and sometimes the parlors, are frequently at a temperature of 60°, 50°, or even lower, as we ourselves have tested with the thermometer. And not only are the entries and parlors, and indeed all the rooms, saving the one or two in constant use, frequently at the temperature just mentioned, but the air of the nursery itself is often allowed, through the negligence of the servants, and especially early in the morning, to fall to 60° or 58°, or possibly lower still.

That the style of clothing is not correct, is proved by the simple facts that children who are dressed nearly the same in summer as in winter, suffer scarcely at all from colds in the summer season, when the thermometer seldom ranges below 76°, and is usually above that point; and also by the fact that adults have been driven by long and almost forgotten experience, to wear clothing twice or three times as warm as that which they put upon their children. How constantly do we see the strong and fully-developed man comfortably enveloped in a warm, long-sleeved flannel shirt, woollen or thick cotton drawers, and cloth pantaloons, vest, and coat, in the same room and in the same temperature with the little—often puny, pale, and half-naked—child. But it is almost impossible to make people understand that children need as much clothing as themselves. They always insist upon it that, as the child passes the greater part of the day in the house, it cannot require as much clothing as the adult who is obliged to go out and face the weather; forgetting, or refusing to see, that the former wears less than half, or probably not more than a fourth, as much covering as the latter, and that the adult, when in the house, and in the same rooms as the child, finds his one-half or three-fourths warmer clothing not at all superabundant or oppressive.

We have repeatedly had patients to get well of chronic catarrhal and laryngeal coughs, and to cease to have, as before, frequent recurrences of these disorders, under the simple treatment of a long-sleeved and high-necked merino or flannel shirt; long woollen stockings, and stout Canton flannel drawers coming down below the knees; and that, too, after the most patient and assiduous, and sometimes over assiduous trials of drugs, diet, and confinement to the house, had entirely failed of any permanent good effects. The fact is, that though there are some few children who can bear the dress above-described without injury, there are a great many more who, while they wear it, either suffer all winter long from frequently repeated attacks of cold, in the shape of croup, chronic laryngeal irritation with cough, chronic pharyngitis, bronchitis, acute or chronic, or more rarely pneumonia; or, if they escape these direct effects, resulting from the constant and rapid waste of their caloric, they are rendered more pale, thin, and delicate-looking than they would be were their vital forces husbanded by warm clothing, instead of being wasted in the constant struggle to keep up the heat of the uncovered body at the natural point.

Anatomical Lesions.—We shall describe, first, the lesions met with in cases in which the disease is confined to the larger bronchia, the inflammation not extending into the capillary tubes; and next, those observed in cases in which the disease has attacked the capillary bronchia. The former are those which constitute the form designated under the title of acute ordinary bronchitis of moderate severity, while the latter are those to which the term capillary has been applied. Patients seldom die of the first-named variety of the disease alone; but as it often occurs as an accidental complication, or a more or less essential part of different severe and frequently fatal diseases, the morbid alterations which characterize it have been very thoroughly studied and ascertained.

The morbid alterations of *acute ordinary bronchitis* always exist in both lungs, and are confined to the larger bronchia, ceasing on a line with the smaller tubes and the capillary divisions. The most constant alteration is redness of the bronchial mucous membrane, caused by injection of the minute vessels of that and the subjacent tissues, and varying in shade from a rosy to a bright-red or brownish tint. The mucous membrane is sometimes softened, a change which can be ascertained only in the largest tubes, and it sometimes presents a thickened, unequal, and rough appearance. Ulcerations are very rare. The inflamed bronchia contain a more or less abundant viscid, transparent, or opaque yellowish mucus.

In *capillary bronchitis* the alterations of the mucous membrane of the capillary tubes do not always reveal the existence of the disease. That membrane is sometimes pale in the minute ramifications, and exhibits morbid changes only in those of medium size. The alterations of the membrane consist in redness, which is made up either of a number of fine points, seated in the membrane itself, or of arborizations seated both in the membrane and the cellular tissue beneath; it sometimes presents a granulated appearance, and it may be more or less thickened, and its consistence diminished. The bronchia are usually filled and almost obliterated from the secondary divisions to the final ramifications, by a substance

of a yellowish-white or yellow color, non-aerated, and composed of a thick muco-pus. Portions of false membrane are sometimes, not as a rule, but exceptionally, found mixed with the secretions just described, while in other instances false membranes alone are present in certain tubes. The false membrane may exist in the form of patches, or it may constitute a lining to the whole extent of the bronchial ramifications. It is usually soft and but slightly adherent, and the mucous membrane beneath is either very pale, and of its usual consistence, or red, softened, and rough. The different kinds of secretion are commonly most abundant in the bronchia of the inferior lobes.

In a good many of the cases another lesion, dilatation of the bronchia, is also found upon examination. This alteration evidently occurs under the influence of the inflammation; it may affect either the length of the air-tubes, or only their extremities. In the former condition the tube continues of the same size, or becomes gradually larger from one of its early subdivisions, until it reaches the surface of the lung. In the latter condition a section of the lung presents an areolar appearance, from the presence of a multitude of little rounded cavities, communicating with each other and with the bronchia, of which they seem to be a continuation. These cavities are generally central, though they are sometimes found upon the surface of the lung, in which case they are formed of the pleura, lined by the thinned membranes of the dilated bronchus.

The fact of these cavities being true dilatations of the bronchia, has been called in question by Dr. Gairdner (*loc. cit.*, p. 76), who believes, on the contrary, "that almost all the so-called bronchial dilatations, and all of those presenting the abrupt, sacculated character here alluded to, are in fact the result of *ulcerative excavations* of the lung communicating with the bronchia." He supposes them to be the result of the expansion of certain small cavities, frequently met with in the bronchitis of children, and to be described directly under the title of vacuoles or bronchial abscesses, either by ulceration or by the act of inspiration.

In addition to the lesions already described as existing in bronchitis, there is another one, not unfrequently met with, to which we shall call attention, that to which the French writers apply the term *vacuoles*, and which Dr. Gairdner designates as *bronchial abscess*. The latter author states that in the centre of the collapsed lobules of a lung affected with acute bronchitis, there are found, not unfrequently, small collections of pus, varying in size from that of a hemp-seed to double or treble that volume. "These small abscesses present, on section, an appearance so much like that of softening tubercles, as to be very readily mistaken by many persons for these bodies; and the resemblance is all the greater on account of the peculiar limited form of the condensation by which they are generally surrounded, which, when felt by the touch from the exterior of the lung, is exceedingly deceptive. In their interior, however, these little abscesses contain, in the recent state, a very fluid pus; moreover, they are often met with as acute lesions produced by a few days of illness, and without a trace of tubercle in any other organ." When the pus is scraped or pressed out of these abscesses, in their recent form, they are

found to be lined with a fine villous membrane, while in other instances they are not abruptly limited, but the pus appears to lie in contact with the surrounding pulmonary tissue. The bronchia leading to the part of the lung thus affected, are found, when incised, to be much inflamed, their mucous membrane being vascular, thickened, and covered with pus; and some of them can be observed to communicate with the purulent collections, the mucous membrane having been, at the point of communication, destroyed by ulceration, and either stopping short abruptly, or becoming gradually incorporated with the false membrane lining the abscess. Sometimes these abscesses or vacuoles communicate not only with the bronchia, but also with each other, without difficulty; sometimes, according to Dr. Gairdner, they break into one another and form more considerable excavations, but, more commonly, they remain of limited size, preserving perfectly the direction and relations of the bronchial tubes. They occur both in the diffused and lobular form of condensation from collapse of the lung, and both forms may sometimes be seen in the same lung.

The alteration just now described has excited a good deal of discussion amongst medical writers, and has been very differently accounted for. MM. Rilliet and Barthez regard it as a simple terminal dilatation of the bronchia, while MM. Barrier, and Legendre and Bailly, consider it to depend on a purulent breaking down of the vesicles of one or more lobules. MM. Hardy and Behier look upon it as a lesion of a complex nature, partaking both of dilatation of the bronchia and of pulmonary emphysema. Dr. Gairdner, as already mentioned, describes them as abscesses, and states that they "unquestionably arise from the accumulation of pus primarily in the extreme bronchial tubes of the collapsed lobules." This view, which is closely similar to that of MM. Barrier, and Legendre and Bailly, is, it appears to us, much the most reasonable that has been adduced.

MM. Rilliet and Barthez, in their second edition, as has already been stated, in the article on post-natal collapse, describe at great length a state of *congestion* of the lung-tissue, as a most important element in the anatomical alterations of the bronchitic diseases. This congestion usually assumes one of two forms: it may be distinctly lobular, consisting then of disseminated patches, or, as more generally happens, large numbers of contiguous lobules are affected, when it takes the form of generalized lobular congestion. These congested portions of the lung are almost always attended with more or less well-marked collapse of the vesicles, so that there is associated together the conditions of congestion and collapse. It is this combination of bronchitis, with congestion and collapse, which was formerly described by them, under the titles of lobular and generalized lobular pneumonia. The alteration to which the term carnification has been applied, and which not unfrequently coexists with bronchitis, they regard as different from the above, and as consisting in a simple collapse of the lung-tissue, without the active or passive congestion which exists in the first form. The principal causes of this condition are, according to them, debility and catarrh. The signs of catarrhal inflammation are, they state, never scarcely absent. In only four out of thirty-one cases did they

fail to discover them. We have dwelt, in our article on pneumonia, on the lesions of catarrhal pneumonia, or lobular pneumonia as it is now generally recognized; and it is probable that at least in some of the cases described as above by Rilliet and Barthez the condition has really been of that form of inflammation of the pulmonary tissue.

The parenchyma of the lung presents, in bronchitis, different appearances in different cases. It is supple, crepitant, and of a rose-gray color, but does not collapse, especially the anterior portions, when the thorax is opened, as does healthy lung. This imperfect collapse depends either on the fact that the thick mucus and muco-pus which fill and obstruct the bronchia, prevent the contained air from being expelled by the natural elasticity of the lung, or, when no secretions exist to produce this effect, on the loss of the natural elasticity of the organ. Another cause is the existence of vesicular emphysema, a lesion observed to a greater or less extent in nearly all the cases, and affecting usually the summit of the lung, its anterior edge, and also its posterior or lateral edge. In a large number of cases, and particularly in those occurring in young children and in weakly and debilitated subjects of all ages, the tissue surrounding the diseased bronchia exhibits the condition which has already been fully described in the article on atelectasis, under the title of collapse of the lung. The extent and mode of distribution of this lesion, its peculiar and distinguishing characters, its causes and mode of production, and the method of treating it, have been carefully discussed in the article just referred to, and we shall make no further allusion to it, in this place, except to beg the reader, who is not already fully acquainted with it in all its bearings, not to suppose himself master of the subject of bronchitis until he has also fully studied that of collapse, as the two go together so constantly, and the latter is practically so important, especially in children, as to make it essential for him to understand both.

The lesions just described as characteristic of acute bronchitis, are also met with in the *chronic* form of the disease. The dilatation of the air-tubes, however, presents different features. The calibre of the enlarged tube is often much greater, its walls are whitish and uneven, and cry under the scalpel, and beneath the mucous lining may be seen hypertrophied transverse fibres. The mucous membrane itself remains smooth and polished, while the tissues beneath are thickened and hypertrophied.

Symptoms; Course of the Disease; Duration.—Acute simple bronchitis exhibits very different degrees of severity in different cases, being in some extremely mild and benign, and in others so much more severe, as to border closely on the capillary form of the disease. In its mildest form, it occasions merely slight cough and stuffing, a little mucous râle over the larger bronchia, with a total absence of dyspnœa, or of decided fever. In cases rather more severe than this, it begins with a moderately frequent cough, which, dry at first, soon becomes loose, and is neither paroxysmal nor painful. The expression of the face remains natural, with the exception of an appearance of slight languor. The pulse and respiration are but slightly accelerated; the external phenomena of the latter, an important means of diagnosis in infants, remain natural; it occurs without jerk-

ing, the rhythm continues even and regular, and there is no violent action of the alæ nasi. The percussion is not modified. Auscultation reveals in very young children a mixture of mucous and sibilant râles on both sides, which come and go, and are of short duration; in older children, the moist râles predominate, and commonly last several days. These sounds are seated in the larger bronchia. The temper of the child is not much changed; the appetite is not entirely lost; there is neither vomiting nor diarrhœa; and the fever is usually slight. The disease remains nearly stationary, or increases for a variable length of time, after which the cough becomes looser, and in children over five years of age, is sometimes attended with expectoration of frothy or yellowish mucous sputa, whilst under that age there is no expectoration. The fever and other symptoms, with the exception of the cough, now subside; the cough remains some days longer.

In attacks still more severe than this, the symptoms resemble very much those just now described, but they are all more intense. The cough is tighter, more frequent, harassing, and especially it is more painful, as shown by the fact that the child cries and complains, and that a marked expression of pain passes over the face at the instant of coughing. There is more fever, the skin being hot and dry, and the pulse more frequent, rising often to 130 or 140, and in one case to 156. The respiration is hurried, and though not attended with the same labor and anxiety as in the capillary variety, it is evidently oppressed; it counted in three cases, 60, 60, and 62. The temperature is considerably elevated, but not so much so as in pneumonia, rarely rising above 102° or 102.5°. There is more restlessness, fretfulness, and general distress; the appetite is greatly diminished or lost, and infants nurse with less avidity than usual, or refuse to nurse at all for several hours together. In cases of this kind, the physical signs are more decided than in those of milder degree, there being a greater abundance of mucous and dry râles, and generally some subcrepitant râle, and they are heard over a larger extent of surface, usually over the lower half, two-thirds, or even the whole dorsum of the chest. The symptoms are almost always most marked and severe in the after-part of the day and night. Very often the patient will be comparatively easy and comfortable in the morning, but as the day goes on, he becomes more feverish, restless, and fretful; the cough grows more troublesome, more frequent, and tighter; the breathing is quicker and more oppressed; the face is more flushed; the sleep is broken and disturbed, and the child may appear through the night quite ill; and yet as morning approaches, the symptoms moderate, the skin often softens and becomes moist, and the whole aspect of the case shows a great amelioration in the manifestations of the disease.

According to Handfield Jones, this almost invariable tendency to aggravation of catarrhal disorders during the night is due to a lowering of the nerve-power, the vâso-motor nerves partaking of the general debility, and thus allowing dilatation of the arteries, and causing increased hyperæmia of the affected parts with more abundant exudation.

The *duration* of this form of bronchitis is very uncertain; the idiopathic cases last usually from four to seven or eight days, though they may last

from sixteen to twenty-five; the duration of the secondary cases depends, in great measure, on the nature of the diseases during which they occur.

In any of these different degrees of acute simple bronchitis, the patient is liable, especially if it be a weak and debilitated child, or a young infant, to sudden and alarming aggravations of the symptoms. The breathing becomes suddenly either greatly increased in frequency, or excessively labored and oppressed, the surface becomes pale, the expression dull and languid, or distressed, the child is drowsy and inattentive, or uneasy and restless, the hands and feet are coolish, the act of sucking is performed with difficulty, or the child refuses the breast entirely, and it is evident that, from some sudden change in the condition of the lungs, the act of respiration and the aeration of the blood are very seriously interfered with. If this sudden aggravation of the symptoms be unattended with a corresponding increase of the febrile phenomena, as marked by greater heat of skin and augmented action of the circulation, it is altogether probable that it depends on a collapse of larger or smaller portions of the pulmonary texture, and if, on examination, we discover dulness on percussion, distant bronchial respiration, and cessation or greatly diminished abundance of the bronchitic râles, over parts of the chest where a few hours or a day before there had existed all the physical signs of bronchitis, there can be no longer any doubt as to the cause of the suddenly increased severity of the symptoms—it must be owing to collapse.

It must however be carefully borne in mind that it is in the course of bronchitis that catarrhal pneumonia is most apt to occur. The symptoms which indicate this accident have been detailed in the article on pneumonia (page 168): the most prominent being the rapid increase in dyspnœa, the sudden and marked elevation of temperature, the change in the character of cough, the evidences of pain in the chest, and the absence, in most instances, of any positive physical signs of consolidation of lung-tissue. If these symptoms be contrasted with those above stated as indicating the occurrence of collapse of the lung, it will be seen that with care any error in diagnosis may be avoided.

Capillary bronchitis, or *acute suffocative catarrh*, may succeed to the form just described, or appear as an idiopathic affection. Under either condition the general symptoms are more threatening than in the preceding form, and the disease soon assumes all the appearances of great severity. The child is very uneasy and restless, constantly changing its position, moving about in the crib or bed, or insisting upon being changed from the bed to the lap, or from the lap to the bed. In one case that came under our charge the oppression was very great, and the only position in which the child was at all satisfied was resting on the mother's arms, with the front of its chest applied against her breast, and the head hanging over her shoulder. The expression of the face is anxious and disturbed, and its color usually pale or slightly bluish. The temper is irritable or subdued; the child hates to be disturbed, and generally chooses its own position. The respiration is very much accelerated, running up in a very short time to 60, 70, or 80, and is usually more or less irregular, and evidently laborious and difficult. The cough is very frequent, troublesome, and

evidently painful; it occurs in short paroxysms usually, with or without stridulous sound, is at first dry, and after a few days is accompanied, in older children, by whitish or yellowish expectoration. In some instances, the sputa consist of mucus tinged with blood, or of pure blood even, and still more rarely of mucus mingled with small shreds of false membrane. The appetite is entirely lost; the tongue is usually moist and furred white; there is acute thirst, and yet, in severe cases, though the presence of acute thirst is evident from the manner of the child, only very small quantities of water are taken, from the impossibility of suspending the respiration long enough to allow of more being swallowed; the drink is gulped rapidly, suddenly, and with great difficulty, and after a time is refused almost entirely from this cause. In children old enough to talk, the speech is short and abrupt; the patient dislikes to speak, from the fact that the effort obliges him to suspend momentarily the act of breathing. Fever sets in from an early period; the skin is hot and dry, and the face is flushed at first, though it soon becomes pale in most cases, from the approach of an asphyctic state. The pulse becomes frequent, rising soon after the onset to 130, 140, 150, or higher; it is full and hard early in the attack. The resonance on percussion is not modified. Auscultation reveals at first sibilant râle mixed with some mucous râles; but soon a fine subcrepitant râle is heard over all the lower parts of both lungs behind, and approaching sometimes, over the bases of the lungs, the character of crepitus. After a time the subcrepitant râle is heard over the whole, or nearly the whole dorsum of the chest, and to a greater or less extent, though not so well marked as behind, over the anterior regions of the thorax. This râle is audible at first both in inspiration and expiration, and is very distinct, but at a later period, it is heard only in the inspiration, or there is substituted for it a mucous râle, while the subcrepitant râle is now heard only in the forced inspirations during coughing or crying. These râles are fugitive and irregular, disappearing or changing from one to the other after fits of coughing.

Should the case not take a favorable turn, which change would be indicated by a moderation in the symptoms just detailed, and especially by easier and fuller respiration, with diminution of the amount of the subcrepitant râle, and return of the natural respiratory murmur over some parts of the chest, the symptoms look still more alarming. The oppression becomes excessive; fits of dyspnœa occur, in which the child is extremely restless and distressed, tossing itself about on the bed; the respiration runs up to 80, 90, or more, in the minute, and is attended with violent action of the alæ nasi; the pulse grows more and more frequent, rising to 150 or 180, and it loses force and volume; and the face assumes a whitish or slightly bluish tint, looks puffed, and is sometimes covered with perspiration. As the fatal termination approaches more nearly, the pulse becomes small, thready, and irregular; the respiration is uneven, irregular, stertorous, and often slower than before; the cough is smothered and less frequent; the restlessness generally diminishes, and the child sinks into quiet, and often becomes comatose: the paroxysms of suffocation are less fre-

quently renewed, and less violent, and death occurs in a state of quiet insensibility, or is preceded by partial or general convulsive movements.

The *duration* of this form may be stated to be, on the average, between five and eight days. It may, however, end fatally in a much shorter time. In an example that we saw, in a child four months and a half old, death occurred in twenty-six hours from the onset. Dr. Eberle states that it seldom lasts longer than two or three days, and that in very young infants death sometimes occurs on the first day. M. Bouchut gives as the duration in children at the breast, from two days to a week. Dr. West mentions a case that proved fatal in less than forty-eight hours. In the favorable cases that we have seen the duration was seven, eight, and ten days.

Subacute and chronic bronchitis generally follows one of the acute forms of the disease. The character and severity of the symptoms vary very much in different cases. We have known some children to present for several months together, in the winter season, slight bronchitic symptoms, consisting in wheezing and somewhat accelerated breathing, cough, more or less frequent; occasional feverishness, especially at night; some diminution of appetite and loss of flesh; and sibilant and sonorous with mucous râles, heard here and there, but still without severe symptoms during the greater part of the time. Children laboring under this kind of bronchitic irritation are liable to, and generally have, from time to time, more or less sharp attacks of acute bronchitis, in which they present the usual symptoms of that form of the disease. These attacks are very apt to occur coincidently with changes in the weather, and in some patients the liability to them is so great, from the excessive susceptibility of the system to the weather, that no care will prevent them. In some instances, we are very sure that an aggravation of the symptoms of the chronic form constantly occurs whenever the child is about cutting additional teeth, whilst in the intervals between the appearance of the successive teeth, the child remains comparatively well. We believe that the cause of the aggravation, at the moment of cutting the teeth, is to be looked for, not only in the act of dentition itself, but in the circumstance that the liability to cold is greatly increased at that particular moment, probably because the forces of the system are so weakened by the effort of the dentition as to lessen the power of resistance against the disturbing influence of a changing, and particularly of a falling temperature.

Cases of the mild kind of chronic bronchitis that we have just been describing, usually get well under proper medical, and especially under proper hygienic means, after several weeks or two or three months; while in other instances the disorder continues, in spite of every precaution, throughout the winter and spring, and only ceases as the warm summer months arrive. We have known the same disposition to show itself again in the following winter. In other instances again, the frequent attacks of severe bronchitis, together with the effect of a constant slight bronchitic inflammation, ends in the production of an emphysematous state of parts of the lung, and the child exhibits more or less marked asthmatic symptoms, which show themselves whenever a slight increase of the bronchitis occurs, and whenever the digestive system is deranged by imprudence in diet or other

causes. It is particularly in such cases as these that the bronchial affection is apt to be associated with rickets, and we should, therefore, always carefully search for the evidences of this latter disease.

In other examples of chronic bronchitis the symptoms are much more severe. These cases almost always follow an acute attack of the disease. The frequency of the respiration and the attacks of dyspnœa persist; the cough is loose and paroxysmal, and the pulse frequent and small; evening exacerbations of fever take place, and the face and sometimes the rest of the surface are often covered with perspiration. Auscultation reveals tubal blowing, with mucous or loud sonorous râles, which seem to indicate the presence of dilatation of the bronchia. Emaciation makes rapid progress, the face is pale and blanched, the eyes sunken, the nostrils are covered with mucous or bloody crusts, and the lips ulcerated. Strength diminishes progressively; the appetite is lost, and the thirst acute; colliquative diarrhœa appears; and after twenty, forty, or more days, the child perishes in the last stage of marasmus. This form of bronchitis often simulates phthisis very closely, and may last for a long time, even several years. It rarely occurs under the age of five years. The expectoration consists of purulent or pseudo-membranous secretions in variable quantity.

Particular Symptoms—Physical Signs.—The *dry râles* are amongst the most frequent physical signs in bronchitis. They may be sibilant or sonorous; they seldom exist alone, but are accompanied with mucous râles, and diminish as the latter become more abundant. As the dry râles cease to be heard, they are replaced by mucous or subcrepitant râles, or by feebleness of the respiratory murmur. The sibilant râle is often heard over the whole thorax, though it may be confined to the posterior portions. It is not restricted to cases of inflammation of the larger bronchia only, but is also present in capillary bronchitis.

Moist Râles.—Mucous and subcrepitant râles do not exist in all cases without exception, as they may be absent in such as are very mild. They may generally be heard over both sides behind, more rarely over the whole of the chest, and almost always both in inspiration and expiration. They are generally persistent, but are sometimes suspended for a moment and replaced by sibilant râle or feeble respiratory sound.

Feeble respiratory murmur is sometimes observed. It is not permanent, occurs during the interruptions of the subcrepitant or sonorous râle, and does not occupy the whole extent of the thorax, but is limited; it is intermittent, and is not accompanied by diminished resonance.

When dilatation of the bronchia exists to a considerable extent it gives rise to bronchial or even cavernous respiration, and to bronchial resonance of the voice, cry, and cough. The bronchial respiration differs from that of pneumonia by its tone, and by its intermitting character. The *percussion* is generally sonorous.

It has already been stated in the account of the symptoms that it happens not infrequently in severe bronchitis, and also in mild bronchitis occurring in debilitated children, that the respiratory sound suddenly becomes feeble, or even entirely suppressed, over parts of the lung, while in other instances a distant and imperfectly marked bronchial respiration

takes the place of the natural vesicular murmur. These changes are heard either over small disseminated points of the lung, or over large surfaces; they are associated with more or less evident dulness on percussion, and what particularly characterizes them, they are very fugitive, being present at one examination, and absent perhaps at the next. The appearance of these changes in the phenomena afforded by auscultation depends on the occurrence of diffused or lobular collapse of the tissue of the lungs.

The physical signs above described are not invariably present in bronchitis. Cases do occur, though they are very rare, in which auscultation fails to reveal the characteristic signs of the disease.

Rational Symptoms.—The rational symptoms are of the utmost importance in informing us of the degree of severity of the attack.

Cough generally exists from the beginning, being in mild cases more or less frequent, and either dry or loose, while in severe cases it is frequent or very frequent, at first dry and then moist, and very rarely hoarse. In acute capillary bronchitis, the cough has a peculiar character. From the first day it occurs in short paroxysms, lasting from a quarter to half a minute. The paroxysms vary greatly in violence, occur at irregular intervals, and generally continue without interruption to the fatal termination, though they are sometimes replaced by simple loose cough a few days before that event. The cough is rarely painful, so long as the inflammation remains simple. Expectoration is never present in very young children. When it occurs in those over five years of age, it consists, in the mild form, of a sero-mucous or of a frothy and yellowish mucous liquid. In general bronchitis it is sero-mucous at first, becoming after a few days yellowish and more or less viscous; it is sometimes nummular and sometimes amorphous.

In the capillary form, as already mentioned, the sputa consist of mucus tinged with blood, or of pure blood even, and in some rare cases there are mixed with the mucus, shreds of false membrane, which may present the form of casts of the minute ramifications of the bronchial tubes.

The *respiration* varies in its characters according to the extent and violence of the disease. In mild cases, it is not much increased in frequency, being generally between 28 and 40 in the minute. In more violent cases, and particularly when the disease implicates the smaller bronchia, it becomes very frequent. The acceleration is slight in the beginning, but increases regularly as the case progresses; thus it may be 30 at first, and rise afterwards to 50, 60, 80, and even 90. When not very much quickened, it remains even and regular; when more so, it becomes somewhat laborious, and the movements of the chest are full and ample; in severe cases, attended with much dyspnœa, it is often irregular, or assumes the characters to which M. Bouchut has applied the term *expiratory*, that is, the order of the movements is inverted, each respiration beginning with the expiration, leaving a pause between the inspiration and expiration, instead of between the expiration and inspiration. In chronic bronchitis with copious purulent or pseudo-membranous expectoration, the dyspnœa is generally habitual.

Fever.—The fever is slight in mild cases, the pulse rising very little

above its natural standard. The heat is not great, and the febrile movement usually subsides before the termination of the disease. In the grave or capillary form, on the contrary, the pulse is always frequent, and continues to increase in rapidity as the disease advances. It varies between 104, 120, 160, and in very violent cases, rises as high as 200. Early in the attack, it is vibrating, rather full and regular, whilst in fatal cases, it always becomes small, irregular, trembling, and unequal. The skin is generally hot in proportion to the activity of the pulse, except towards the termination, when the extremities often become cool. The temperature does not rise so rapidly nor reach so high a point as in pneumonia. Thus Roger gives as the highest temperature observed by himself in bronchitis 102.2°; while the average in his cases of the acute febrile form was 100.9°. The skin is almost always dry. In very young children it is often pale and cold, and covered with perspiration from the beginning.

The *expression* of the face is unchanged in mild cases, but when the disease is violent and extensive, becomes deeply altered after a few days. The eyes are then surrounded by bluish rings, and the expression is uneasy, anxious, and sometimes, but less frequently, exhibits an appearance of profound exhaustion. The anxiety of the countenance increases with the oppression; the alæ nasi are dilated, the nostrils dry or incrusted, and the lips and face, which are extremely pale or momentarily congested, assume a purple tint, particularly after the paroxysms of cough.

The *decubitis* is indifferent at first, but as the disease progresses, the child lies with its thorax more or less elevated, or is restless and constantly changing its position.

In dangerous cases there is great *distress* and *restlessness* after the first few days, or even from the beginning. In some instances the irritability and peevishness are excessive and uncontrollable, while in others there is heaviness and somnolence, especially towards the termination of fatal cases. Some of the disorders of the nervous system just mentioned are present in all the grave cases.

Digestive Organs.—There is moderate *thirst* and incomplete *anorexia* when the disease is mild, but, when severe, the thirst is generally acute, and the appetite entirely lost. The state of the bowels varies. The *tongue* and *abdomen* present no special characters in idiopathic cases.

Urine.—The great majority of recorded observations of the condition of this excretion in bronchitis, relate to the disease as occurring in the adult. The following summary is taken from Parkes: the condition of the urine in bronchitis varies greatly with the grade of the disease; in the grave forms, it resembles that of pneumonia, the urea being increased, and the chloride of sodium at times entirely absent. The urine has also been quite frequently found to be temporarily albuminous in such cases.

Diagnosis.—The mild form of bronchitis, in which the inflammation is confined to the larger bronchia, is not likely to be mistaken for anything but the early stage of hooping-cough. The diagnosis can be made only by attention to the different characters of the cough, which is more spasmodic and paroxysmal in pertussis, by the absence of fever in that

disease, and by the development of the peculiar symptoms of each, as the case progresses.

The diagnosis between bronchitis and pneumonia is seldom difficult, except when the latter is grafted upon the former, or in cases of partial pneumonia, attended with bronchitis. In well-marked cases of the two diseases, there can be no difficulty. The restriction of the physical signs to one side alone of the chest in pneumonia, the peculiar crepitus of that disease, or when this is not heard, the fineness of the subcrepitant râle, limited to the upper or lower regions of one lung, the bronchial respiration and bronchophony, the dulness on percussion over the seat of disease, the greater sharpness and severity and the different location of the pain, the more acute character of the febrile reaction, as marked by the pulse, skin, and thirst, the more abrupt and higher elevation of temperature, and the kind of expectoration, when there is any, will always enable us to distinguish the two with almost absolute certainty. In cases, however, in which the two are combined, the diagnosis is not so easy, but even here the presence of dulness on percussion, and of crepitant or fine subcrepitant râle, or, when these are absent, of pure metallic bronchial respiration with bronchophony, over limited portions of the lung, will generally render the matter clear.

The *sudden* supervention of dulness on percussion over large portions of one of the lobes of a lung, or over disseminated patches, with feeble or absent respiratory sound, or with muffled and distant bronchial respiration, generally indicates the occurrence of collapse in the part of the lung over which these signs exist; and when these symptoms show themselves without any increase in the severity of the febrile reaction, but rather with a diminution, there is every reason to suppose that they depend, not upon inflammatory condensation of the parenchyma of the lung, but upon simple collapse, from the presence of obstructive secretions in the bronchia.

Dr. Gairdner (*loc. cit.*, p. 6) has called attention to a difference in the character of the dyspnœa in the two diseases, which is, we think, of considerable importance, and which we have often remarked ourselves. In bronchitis, of any considerable severity, the respiration is always evidently labored; it is performed only with the aid of all the accessory muscles of respiration, and in really severe cases it is extremely laborious, the inspiration being long-drawn, exhausting, and inadequate. The dyspnœa of *pure* pneumonia is, on the other hand, quite different. It is merely an "acceleration of the respiration, without any of the heaving or straining inspiration observed in bronchitis, or in cases where the two diseases are combined." Dr. Gairdner states that he has repeatedly seen patients affected with a great extent of pneumonia of both lungs, in whom the extreme lividity and rapid respiration, numbering fifty or sixty in the minute, showed infallibly the amount to which the function of the lung was interfered with, who, nevertheless, lay quietly in bed, breathing without any of the violent effort, or disposition to assume the erect posture, so constantly accompanying the more dangerous forms of bronchitis. In children these differences are even more marked than in adults.

Chronic bronchitis may be mistaken for tuberculosis of the lungs or of

the bronchial glands. The distinction can be made only by careful study of the history of the case, and of the phenomena afforded by auscultation and percussion, which are detailed in our article on tuberculosis.

It is also important that we should not overlook the evidences of rachitis, which, as before stated, very often exist in children who are predisposed to attacks of bronchitis.

Prognosis.—Bronchitis is rarely a fatal disease, so long as it remains confined to the larger bronchia, constituting the acute simple form, of moderate severity. Capillary bronchitis is, on the contrary, a very dangerous affection at all times and at all ages. Even ordinary, simple bronchitis, however, may prove fatal in young infants, and in debilitated children of all ages, from the supervention of collapse of portions of the pulmonary tissue; and it is necessary, therefore, that the prognosis given should always be guarded, when the disease occurs under either of these two conditions. The prognosis differs also in the primary and secondary forms of the disease, since, as might be expected, the danger is much greater in the latter than in the former variety.

We have met with a large number of cases of bronchitis, out of which we have kept more or less copious notes of 123. Of these, 108 were mild, and 15 capillary. Of the 108 mild cases, 65 were primary, all of which recovered; and 43 secondary, of which 2 died. Of the 15 capillary cases, 11 were primary, of which one died, and four secondary, of which 2 died. Of the whole number, 123 in all, 5 proved fatal. The danger from the disease depends very much also upon the hygienic conditions in which the patients are placed. In hospitals and amongst the poor it is much more dangerous than in private practice amongst the easy classes of society. This is shown by the fact that all the cases of the capillary form observed by MM. Rilliet and Barthez and Fauvel, in hospital practice, proved fatal, while of 15 cases seen by ourselves, in private practice, under the most favorable hygienic conditions, only 3 died.

The symptoms indicating great danger are, increase of the dyspnœa; extreme anxiety, small and irregular pulse, coolness or coldness of the skin with clammy sweats, much jactitation, and delirium, drowsiness, or coma. With such symptoms the danger is greater and the fatal termination more imminent in proportion as the child is younger, less robust, and its constitution exhausted by preceding or coincident disease.

Treatment.—The acute simple form of bronchitis is frequently so mild as to need no other treatment than careful attention to the hygienic condition of the patient, and the administration of some simple febrifuge and expectorant. The child ought to be confined to one room, in a mild and uniform temperature, and should be kept quiet until the development of the symptoms shows what is to be the type of the attack. The degree of repose of the body necessary will depend on the presence or absence of fever. We believe that the practice of keeping the body quiet in all febrile disorders, is one of the most important therapeutic means we have. It is long since one of us, having seen his father insist upon putting children to bed for a feverish cold, began to follow the same practice.

Time and experience have made even more clear to us the wisdom of the practice, especially in regard to very young children.

So soon as the attack of bronchitis becomes severe enough to cause fever, whether the fever be continuous or occur only in the afternoon and night, the patient ought to be confined to the lap or bed. Suckling children, and those under three years of age, must be allowed to lie on the lap at times, but even they may be taught, very early, to rest quietly in the crib the greater part of the twenty-four hours. Children over three years old can almost always be taught to stay in their beds by a little management and authority, if only the parent is resolute. If not very sick, they should have a large pillow put up against the head of the crib or bed, and against this they should be placed in a sitting posture, with the bedclothes arranged over the lap; and, in cool or cold weather, with a light flannel sack over the night-dress. Here they ought to be kept all day, allowed to change their position as they wish, and they should be kept as cheerful and happy as possible with toys, books, pictures, readings, tale-telling, or what not. Under such circumstances, a new and interesting toy will often do more good by far than any drug in the materia medica. We have often been surprised, and delighted, too, to find a bronchitis which had been hanging over a young child for several days or a week, getting gradually worse, day by day, under the trotting-about system, begin to mend from the day the child was put to bed, and disappear in two or three days, and that, too, without any change in the other remedies.

The clothing ought to be warm, and yet not sufficient to produce free perspiration, as this, by sudden exposure and evaporation, often induces chilliness. The diet must be simple, and may consist of any of the milk preparations, with or without bread, or bread and butter. Light soups in the middle of the day, or roast potatoes or apples, with bread, may generally be allowed.

As for medicines, in this mild form they are of comparatively little consequence, if the above measures be carried out. In the after part of the day, when fever sets in, we may prescribe a febrifuge of citrate of potash, such as the following, for children of two to four years old:

℞.—Potass. Citrat., ... ʒj.
Syrup. Ipecac., ... fʒj vel ʒij.
Tr. Opii Camph., ... fʒj vel ʒij.
Syrup. Simp., ... fʒss.
Aquæ, ... ad fʒiij.—M.
A teaspoonful every two or three hours.

This should be given until the child sleeps, and occasionally in the night if there be cough and restlessness. At six months of age, the following may be used in the same manner:

℞.—Syrup. Ipecac.,
Tr. Opii Camph., ãã . . . . fʒss.
Spts. Æther. Nitros., vel
Liq. Ammon. Acetat., ... fʒij.
Syrup. Simp., ... fʒv.
Aquæ, ... fʒij.—M.
Give a teaspoonful every two hours.

If the fever is very slight, and the cough only moderately severe, it is often well to use no drug through the day, but to give in the evening, two hours before bedtime, and again at bedtime, some simple expectorant and anodyne. Thus at two or three months of age, three to five drops of syrup of ipecacuanha with five of paregoric, or half a drop to a drop of laudanum; at one or two years, ten drops of the syrup with ten to twenty of paregoric, or two of laudanum; at five to ten years, ten to twenty drops of the syrup, with twenty to thirty of paregoric or five of laudanum. The laudanum is often better than paregoric, as it produces a more decided and lasting impression on the nervous system, and appears to extend its useful control over the symptoms further into the following day.

In this very mild form there is no necessity for giving active purgatives. If the bowels are moved once in the day, or once in two days, it is best not to interfere with them. If, however, the patient be constipated, a little simple syrup of rhubarb, a teaspoonful of castor oil, or an enema, will be quite sufficient. A warm foot-bath, in the evening, containing salt, or, better, mustard, will often assist in moderating the cough and promoting quiet sleep.

When, in this acute form, the symptoms assume greater severity, when signs of reaction are prominent, the dyspnœa considerable, and the cough frequent and harassing, it was formerly quite the custom to employ depletion. In a former edition of this work, it was stated that the abstraction of a few ounces of blood by leeching or cupping, was allowable under these circumstances, but that a large majority of such cases would do perfectly well without bloodletting of any kind. We now believe that such practice is unnecessary in any of this class of cases. Attention to hygienic measures is, however, even more important than in the milder cases. Confinement to the bed ought to be a positive rule in such cases. If the bowels are not freely moved, a dose of castor oil, rhubarb, or magnesia should be given, and the patient then put upon the use of one of the febrifuge mixtures recommended above. When the fever is very high, and the patient over a year old, antimonial wine may be substituted, with advantage, for the syrup of ipecacuanha.

If, as the case progresses, the bronchial secretions become very abundant and the dyspnœa severe, the proper remedy is an emetic. This may be ipecacuanha, either in powder or syrup, or a teaspoonful of powdered alum, to be repeated if necessary, in ten or fifteen minutes. The latter substance is, as we have stated under the head of croup, a very certain, efficient, and safe emetic.

Great benefit may be obtained in all forms of bronchitis, from the more or less frequent application of mustard poultices to the front or back of the thorax, and from mustard foot-baths.

The mercurial preparations, so much recommended by many of the English and by some of our own writers, are, in our opinion, very seldom, if ever, necessary in this, or indeed, in any of the forms of bronchitis in children. It may be known that the occurrence of gastric disturbance with coated tongue, anorexia, and a torpid state of the bowels, may, in some

cases, call for the administration of a single dose of blue mass followed by a mild saline laxative.

MM. Rilliet and Barthez recommend, when the cough and sibilant râle persist after the disappearance of the febrile symptoms, the use of small doses of the flowers of sulphur. We have ourselves known this remedy to prove of service in such cases. About four grains may be given every three hours to a child four years old.

The treatment of the *grave acute* or *capillary form* of this disease brings up again the question of bloodletting. We, like all the rest of the world, have abandoned the practice as a rule, but we think that when, in a case of the kind now under consideration, the age being over two years, the oppression is very great, the right heart laboring, as shown by a congested surface and a throbbing cardiac impulse at the base and left edge of the sternum, and the strength not too much reduced, the abstraction of from two to four ounces of blood from the interscapular space by cups or leeches, would be a useful and legitimate practice. We venture to give this advice from our own past experience, and from the views taught quite lately as to the effect and value of depletion in relieving the overdistended right heart, produced by an obstacle to the pulmonic circulation.

There is no occasion for repeating here what has been said, under the head of pneumonia, in regard to tartar emetic. But if the temperature be very high, and the pulse full and strong, we believe that the small doses of sulphurated antimony (gr. $\frac{1}{12}$) we then recommended, in combination with Dover's powder, every two or three hours, are very useful in moderating the inflammatory symptoms. Should this be followed by nausea or vomiting with exhaustion, they must be suspended at once. The physician, and especially the young and inexperienced one, ought to know that the susceptibility to the action of all antimonials is singularly different in different individuals. We have seen a hearty adult woman thrown into a most violent, and for a time alarming choleraic condition, by two doses of $\frac{1}{12}$th of a grain of tartar emetic each. We saw once a fine hearty boy five years of age, vomit violently, grow pale, weak, and faint away, from two teaspoonfuls of the mel. scillæ compositum, containing in the two doses, the fourth of a grain of tartar emetic. And even twelfths of a grain of the sulphurated antimony will sometimes cause a degree of nausea and prostration in young children which ought not to be kept up, though we never saw it occasion such effects as those just mentioned as following the use of tartar emetic. When, therefore, the sulphurated antimony acts with any undue violence, it ought to be stopped, and we should substitute the citrate of potash mixture proposed for the mild form of bronchitis.

In connection with one of these internal remedies, counter-irritation to the surface of the chest will be found of very great service. Indeed, we doubt very much whether it is not the most important part of the treatment. It may be obtained by applications of dry cups to the back of the chest, or if this be inconvenient or objected to for any cause, by the use of mustard poultices. The poultice ought to be about the size of the hand, or one-half larger, and it should be made of one part mustard to two of Indian meal or flour. It is to be mixed with warm water, covered with

book muslin or cambric, and applied first to the dorsum of the chest; after having reddened at that point, it should be shifted to the front of the thorax. The time necessary for each contact is usually from ten to fifteen or twenty minutes. These applications ought to be renewed once in four hours, when the symptoms are only severe, but when these are urgent, they should be made every two hours. We are in the habit of depending very much, also, on mustard foot-baths. When the oppression is severe, and especially when there is any coolness of the extremities, the use of a foot-bath simultaneously with the mustard poultice will often assist very much in relieving the breathing.

In very young infants, antimony ought not to be employed, in our opinion, and in these, therefore, we need some other remedy. In them ipecacuanha is much safer than antimony, and it is quite active enough. The best preparation is the syrup, of which from three to five drops may be given every two hours to infants six months old. In older children, also, in whom we have been obliged to suspend the antimony, and in those in whom its use has been contraindicated by delicacy of constitution or by feeble health, the ipecacuanha is preferable. The doses must vary with the age. At five years, about ten drops every two hours, in combination with the same quantity of spirit of nitrous ether, is a proper dose. When the child presents a pale surface and a languid expression, and particularly when the skin is very slightly warmer than usual, or coolish, the following prescription has proved a most useful one in our hands:

R.—Liq. Ammon. Acetat., ... fℨss.
Syrup. Ipecac., ... fℨj.
Liq. Morph. Sulphat., ... gtt. xl.
Syrup. Acaciæ, ... fℨj.
Aquæ, ... fℨjss.—M.
Ft. mistura.

The dose of this is a teaspoonful for a child two years old, to be repeated every two hours. Should there be any nausea present, the syrup of ipecacuanha ought to be reduced to half the quantity; and if there be any drowsiness, the morphia must be left out.

In very severe cases of the disease, in which the dyspnœa is excessive, the pulse rapid and small, the skin cool and pale, the jactitation very great, and when there is present extensive mucous and subcrepitant râle, the treatment generally recommended is the frequent employment of emetics, and the French authors usually prefer tartar emetic. For our own part, we would not venture to administer, under such circumstances, so powerful a remedy, and especially so potent a sedative, as antimony, one that we have so often known to cause alarming and dangerous prostration in children laboring under much slighter disorders than suffocative bronchitis. If any emetic be given, it ought to be one of milder action and less perturbing influence than tartar emetic, and we should choose, therefore, either ipecacuanha or alum. The plan of treatment we prefer, however, is to make assiduous use of counter-irritants, and to give internally the spirit of Mindererus and a weak decoction of seneka; or we may combine

with the decoction of seneka, in a suitable form, small doses of the muriate or carbonate of ammonia. Depletion is, in these cases, entirely contraindicated; we may, however, with advantage apply a few small dry cups to the dorsum of the chest in the interscapular space, or over the lower lobes of the lungs.

In the bronchitis of children it often becomes proper and necessary to make use of *stimulants*. In the suffocative form, when the symptoms assume the character described in the last paragraph, small doses of brandy or wine-whey may be administered alternately with the spirit of Mindererus, with great advantage. In milder cases, also, when a sudden increase of the dyspnœa occurs, especially in feeble and debilitated subjects, and when we may suppose, from the character of the rational and physical signs, that collapse of portions of the lung has taken place, it is best to abandon for the time all nauseating remedies, and to make use simply of brandy in doses of from five to twenty drops every half hour or hour, or of wine-whey in dessert or tablespoonful doses, and of counter-irritants, with very light fluid nourishment.

In cases where there is such marked debility, tonics are very useful, and good results may be obtained from the administration of quinia, which was strongly recommended a few years ago, in the form of capillary bronchitis occurring in tropical climates, by Dr. Cameron (*London Lancet*, November 9th, 1861).

In cases of this kind, we have used with great advantage of late years small doses of quinia, prepared as follows:

℞.—Quiniæ Sulphat., ... gr. vj.
Acid. Sulph. Dil., ... gtt. xij.
Syrup. Simp., ... f℥ss.
Aquæ, ... f℥ijss.—M.

Give a teaspoonful every two hours, to children two or three years old.

In older children the proportion of quinia to the dose ought to be doubled. If this should sicken, as it will sometimes do by the disgust its bitterness produces, and the consequent resistance to the doses, it is best to lay it aside after two or three trials, and to administer the quinia in the form of powder mixed with a little extract of liquorice and sugar, or to substitute the following:

℞.—Elix. Cinchon. Flav., ... f℥ij.
Curaçoa, ... f℥ij.
Acid Sulph. Dil., ... ♏xij.
Aquæ, ... f℥ijss.—M.

Dose, a teaspoonful every two hours.

Here, as well as in other conditions calling for the use of quinia, but where it is difficult to administer it by the mouth, we may give it with good effect in the form of suppositories made with cocoa butter, as small as possible, and containing one or one and a half grains of quinia each.

The child ought to be laid on an inclined plane of pillows, and, with the exception of turning it gently towards one side or the other, from time

to time, it should be kept perfectly quiet. These directions are particularly important in very young children, as it is in them that debility and exhaustion of the muscular forces are apt to bring about the state of collapse just referred to.

As an example of the kind of case in which stimulants are useful, and to show also the dangerous effects which antimony sometimes produces, we will quote the following: A girl between seven and eight years old, was attacked while in good health with severe bronchitis. On the second day, when we were called, she was very much oppressed, the skin was hot and dry, the pulse rapid, and the surface pale. We ordered a cupping to the amount of four ounces, with some dry cups besides, over the back, and two drops of antimonial wine with ten drops of sweet spirit of nitre to be given every two hours. On the third day a blister was applied over the sternum. On the fourth day we found the child in the afternoon very pale, dozing or tossing about on the bed, and sometimes rising up on her hands and knees with a bewildered look; she was inattentive, so that it was almost impossible to catch her eye; the eyes were sunken, and the countenance was distressed and anxious; she moaned constantly and looked very ill; the skin was still hot; there was neither vomiting nor purging. The respiration was very much oppressed, and she coughed a good deal, though not so much as before. We suspended the antimony at once, and gave a teaspoonful of brandy in water, directing it to be repeated in three-quarters of an hour; after the second dose a teaspoonful was to be given in a wineglassful of milk and water every two hours throughout the night. On the following morning, the child looked better; she was less pale, and the eyes were not so excavated. The breathing was better. She was still very drowsy, but often waked partially with screaming and affright, and when awake took very little notice. The milk and brandy were continued every two hours. On the afternoon of this day, all the unpleasant symptoms had disappeared; there remained only those indicative of a slight bronchitis, and she was soon quite well. Now it seems to us exceedingly clear that, had the antimony been continued in this case, on account of the hot, dry skin, oppressed breathing, frequent cough, and from the absence of vomiting or purging, the child would have died.

The most important points in the treatment of *chronic cases*, are to insist upon a rigorous and persevering regulation of the hygienic conditions of the patient, and to make use of tonic, balsamic, and expectorant remedies. The child should be carefully and warmly clothed, and, when at home, kept in dry, well-ventilated, and, if possible, airy rooms, at a uniform temperature. The living room of such a child ought to be heated in winter by a wood-stove, or open wood-fire, if that is sufficient to keep up a proper temperature. In our cold winters we have found no plan so good as a well-managed wood-stove. Coal fires cannot be lowered or extinguished at night, as they ought to be, and often keep up, through the day, too high a temperature. They are unmanageable.

These, indeed, constitute the truly important part of the treatment, for without them, there is but little chance that drugs of any or of all kinds,

diet, or any other measures, will be of any real service. The dress and temperature ought to be the first things attended to, and after them, and as a secondary matter, certain medical substances will assist in removing the disease. The child ought to be taken as often as possible into the air in fine weather, and only in fine weather. The diet should be selected with a strict view to the improvement of the strength and vigor of the constitution; the food may consist, if the child be of proper age, of light meats, of potatoes and rice, as the only vegetables, and unless there is some contra-indicating circumstance, of a small quantity of wine with the midday meal. The best wine is port, of which one or two tablespoonfuls may be given in a considerable quantity of water.

Tonics must be administered throughout the course of the disease, or until the appetite and strength shall have improved to such an extent as to make them no longer necessary. The best are quinine, in the dose of a grain morning and evening, to be continued for several weeks; or, when the child is thin and anæmic, small doses of arsenic with iron, as recommended in the article on eczema, and cod-liver oil, in doses of half a teaspoonful to a teaspoonful, three times a day after meals, either pure or in some carefully-made emulsion, will often greatly assist in curing these chronic forms of catarrh.

In one case of chronic bronchitis, which came under our care, the patient recovered under careful regulation of the hygiene, and the use of a decoction of seneka, prepared by boiling a drachm, each, of seneka and liquorice-roots, in a pint of water, to half a pint. The decoction was strained, and a large teaspoonful given three times a day. The remedy was continued during a period of two months; under its use the child grew fat and strong, and recovered entirely from the disease.

Other remedies, proposed by different authors, are the various resinous preparations, the balsams of tolu and copaiba, benzoin, and the sulphurous mineral waters. In cases of long standing, where mucous râles persist throughout the lower part of the lungs, showing an abundant morbid secretion, tannic acid has been found, by several good authorities, of much service. While these means are employed, it is recommended, also, to make use of counter-irritants. If any are used, they ought to be such as will not produce too much inflammation of the skin; as, for instance, weak Burgundy pitch plasters, daily frictions with hartshorn and sweet oil, a simple diachylon plaster, or very mild pustulation with croton oil, or a mixture of croton oil and iodine, such as the following:

℞.—Ol. Tiglii, ... ʒj.
Ether. Sulph., ... ʒj.
Tr. Iodinii,
Alcoholis, āā . . . . . ʒiij.—M.
S. Locally.

ARTICLE IV.

EMPHYSEMA.

Emphysema of the lungs is of quite frequent occurrence in children. It is much more generally met with in an acute form, developed during the progress of some pulmonary disease, than in the chronic form which it so often assumes in the adult. It is probable, however, that in many cases of asthma in childhood, there is an emphysematous condition of the lungs which has been gradually developed at an early period of infancy, in consequence of the respiratory embarrassment attending rachitic disease of the thorax. There is probably in such children a congenital delicacy and weakness of the lung-tissue, and subsequently, if the constitution is re-established, and the deformity of the thorax removed, as it frequently will be, there may be a restoration, to some extent, of the elasticity of the pulmonary tissue, with a corresponding decrease in the evidences of emphysema. It is also highly probable, judging from the frequency with which, in fatal cases of acute pulmonary disease in young children, more or less marked lesions of emphysema of the lungs are found, that this condition is frequently developed to a certain degree in the course of such cases which recover, and that subsequently the lung-tissue regains its normal state.

Anatomical Appearances.—The term emphysema of the lungs, is usually employed to include two conditions essentially dissimilar, and to only one of which it is in reality applicable. One of these is *vesicular* emphysema, which is dependent on dilatation or coalescence of the pulmonary air-cells, without any escape of air into the connective tissue of the lung, and which would, therefore, be more correctly called *rarefaction of lung-tissue.* The use of the term vesicular emphysema is, however, so universal and long-established, that it does not seem desirable to discard it. The other variety is *interlobular* or true emphysema, in which the air escapes from some point into the connective tissue of the lung, and dissects its way between the lobules and under the pleura.

In vesicular emphysema the portions of lung usually worst affected are the apex and the anterior border; it may, indeed, be limited to these parts, or may be present, in varying degrees of intensity, along the base and even over the entire surface of the organ. Usually it is present in both lungs simultaneously, though often much more highly developed on one side than the other.

The dilatation of the vesicles causes marked enlargement of the part affected, and when both lungs are seriously involved, they project forwards, occupying the mediastinal space, with their anterior borders closely approaching each other. The emphysematous portions do not collapse when the thorax is opened; they are pale, dry, and bloodless, and, when pressed with the finger, afford a soft, doughy feeling, with but an imperfect

sense of crepitation. On examining the surface carefully, the dilated vesicles are clearly visible, forming clear, usually round spaces as large as a pin's head or a millet-seed. The effect of this distension upon the surrounding viscera and upon the shape of the thorax are the same in kind, though not so great in degree, as are met with in the adult. The distended anterior portion of the left lung covers more of the heart than normal, and tends to depress this organ downwards and to the right. In the same way when extensive emphysema of the right lung is present, the liver is usually depressed. If both lungs are affected with marked and diffuse emphysema, the thorax is considerably distended, the curve of the ribs is increased, while they are elevated so that their course becomes more horizontal, and the thorax becomes shorter, deeper in its antero-posterior diameter, and more rounded.

The other variety of emphysema—really the only one which strictly merits the name in its usual intention—is the *interlobular*. Here the air makes its escape from a rupture of some air-vesicle or minute bronchiole into the connective tissue of the lung, and then readily makes its way along the bronchial tubes between the lobules so as to reach the surface of the lung. Here it presents itself in the form of minute bubbles of air, of rounded or elongated form, easily recognized by their paleness and transparency, usually arranged in irregular, curving and branching lines, and which can be proved to be in the interstices of the lobules by the fact that they can readily be pressed by the finger from one place to another, or forced to coalesce. When these little bubbles are thickly crowded together they produce an appearance well compared by Rokitansky to froth. Associated with them are often found larger bullæ, where the air has separated the pleura from the surface of the lung; these form flattish, convex prominences above the surrounding surface, and are freely movable. It will be understood that in interlobular emphysema of the lungs, the size of the organ is comparatively little affected, and consequently that little or no influence is exerted by it upon adjacent viscera or upon the shape of the thorax. This condition is comparatively rare, and is not usually associated with marked vesicular emphysema; indeed, the anatomical relations of the two forms are not clearly understood. In cases where the pleura is stripped off from the lung over a considerable space, the membrane may be ruptured and air escape into the pleural cavity, constituting pneumothorax, examples of which accident will be found in our article on this latter affection. In other cases, the air makes its way along beneath the pleura to the root of the lung, or by penetrating into the substance of the organ, and following up the divisions of the bronchi, it reaches the same point. It may then pass into the mediastinal spaces, where the loose connective tissue becomes highly emphysematous, so as to present numerous large vesicles with delicate walls, altogether resembling the appearances seen in animals in the slaughter-house. From the mediastinum the air readily passes upwards into the connective tissue of the neck, where it may first produce a crepitant swelling in the suprasternal, supraclavicular, or inframaxillary regions; and may even extend thence over the surface of the trunk and extremities so as to produce general emphysema.

In the following interesting case, which has already appeared in print,[1] the subcutaneous emphysema did not extend below the clavicle. The minute perforation on the anterior surface of the upper lobe was perhaps due to the inflation of the lungs at the time of the examination, or may have occurred just before death. It would certainly have led to pneumothorax, had it been earlier present:

Case.—*Acute Miliary Tuberculosis: Cough and Dyspnœa: Cervical Emphysema—Interlobular Emphysema—Interlobular Emphysema with Perforation of the Pleura: Emphysema of Mediastinum and Neck.*—John F. was born of a stout, hearty young woman, 17 years of age, who nursed him; and he seemed to thrive until eight days before his death, which took place January 24th, 1868, at the age of four months. The symptoms during his sickness were dyspnœa, occasional dry, hacking cough, and anorexia. A few days before his death subcutaneous emphysema made its appearance over the lower part of the neck in front, spreading over both sides, and altering the entire contour of the neck, but not descending below the clavicles. The post-mortem examination was made fifteen hours after death.

The head was not examined. The subcutaneous emphysema persisted as above described.

On removing the sternum, the mediastinal spaces were found much distended with air, the meshes of the connective tissue in some spots forming vesicles more than one inch in diameter, and suggesting forcibly the appearances often seen in animals in the slaughter-house. The emphysema extended up along the trachea and larynx, and to a considerable distance on either side of the neck. There was not a trace of decomposition of the tissues. The lungs collapsed but slightly; the posterior portions were deeply congested, purplish, and almost non-crepitant, but expanded almost fully on inflation. There was neither pneumothorax nor pleuritic effusion or adhesions. The larynx, trachea, and lungs were removed, and inflated under water, when air was found to escape from the right lung in two places—on the anterior face of the upper lobe, and on the inner surface of the apex. On examining the rupture of the anterior surface of the upper lobe, the opening was found to be very small, and to be seated in the midst of a spot where the pleura was separated from the lung so as to form a large vesicle. There were other smaller pearl-like vesicles studding the surface of the lung. The apex was the seat of numerous miliary tubercles, both in the substance of the lung and immediately beneath the pleura. At one point on its inner aspect there was such a subpleural deposit, half an inch in diameter, which had undergone cheesy change, and in the centre of which there was an ulcerated opening in the pleura. The escape of air through this perforation was prevented by the close apposition of a tuberculous bronchial gland, about half an inch in diameter, which lay immediately on the right bronchus. The other bronchial glands, especially on the right side, were also tuberculous. The left lung presented no perforation of the pleura. At several points, especially along the anterior edge of the lung, there were large emphysematous bullæ, one inch long by half an inch wide, and in the neighborhood were numerous smaller vesicles of the same nature. On incising the lung near these, small clusters of gray miliary tubercles were found. Miliary tubercles were also found on the peritoneal investment of the liver and spleen, and in the substance of these organs and of the mesenteric glands. There were small irregular ulcers in the lower part of the ileum, and numerous small yellowish submucous deposits in the cæcum.

Causes.—Although the vesicular and interlobular forms of emphysema

[1] W. Pepper, On some Cases of Emphysema of the Neck. Philada. Med. Times, August 1, 1872.

are anatomically quite distinct, they may advantageously be considered in connection with each other as regards the mode of their development.

Age.—Vesicular emphysema, though a frequent sequel of acute thoracic diseases in children, cannot be regarded as a disease of childhood in the same sense as the interlobular form. It is true that the delicacy of the walls of the air-vesicles during early life would seem to favor the occurrence of dilatation, but experience shows that it does not favor the development of emphysema nearly so strongly as does the gradual degeneration and weakening of the walls of the air-vesicles which comes on in advanced years.

Interlobular emphysema, on the other hand, is much more frequent in children, and reaches degrees of severity which are scarcely found in later life. So, too, the occurrence of subcutaneous emphysema, in consequence of the rupture of some minute bronchiole or air-vesicle, with the production of subpleural and then mediastinal emphysema, is an accident almost limited to early childhood, since of the recorded cases (about 25) in which it has occurred, four-fifths (20) have been observed in young children. Of these 20 cases of "general emphysema in children," to employ Roger's term[1] (of which 19 were collected by him, and 1 subsequently published by one of ourselves),[2] 6 occurred under the age of 2 years, 10 between 2 and 4, and only 4 between 10 and 15 years of age.

Previous Diseases.—In children, emphysema occurs as a sequel to some other disease, pulmonary or laryngeal. The affections which most strongly predispose to it are hooping-cough, the bronchitis of measles, simple bronchitis, pneumonia, and pseudo-membranous croup. Of all these, hooping-cough is by far the most fruitful cause. It will be observed that the diseases named present the common symptom of severe cough, often attended with impediment to the escape of air, either from spasm of the air-passages, or accumulation of secretion in the bronchi, or mechanical obstruction of the larynx by false membrane.

Mechanism or Mode of Production.—The way in which pulmonary emphysema is developed has been made the subject of frequent and conflicting speculation. Of the two chief theories which have been advanced in explanation, one (the *inspiratory*) regards the overdistension of the vesicles as the result of the excessive operation of the forces concerned in inspiration; the other (the *expiratory*) explains it as caused by violent but impeded expiratory efforts. The inspiratory theory is still upheld by some eminent writers, but clinical observation is leading to its abandonment. In its original form as advanced by Laennec, it was based upon the erroneous notion that the forces of inspiration are greater than those of expiration, and that consequently emphysema might result from mere excessive inflation of the lungs. This has, however, been universally abandoned as of general application, since the discovery of the important fact that in *forcible* breathing the power of expiration is considerably (at least one-third) greater than that of inspiration; though it is probable that in some

[1] Henri Roger, Archives de Médecine, 5ème ed., tome xx, pp. 129, 288, 403.

[2] W. Pepper (*loc. ante cit.*).

morbid conditions of the pulmonary tissues, violent inspiration may of itself be capable of producing emphysematous distension of the air-vesicles.

The form of the inspiratory theory, which is still retained by some authorities, is based upon modifications introduced by Dr. William Gairdner, and is an expansion of the idea that if certain portions of the lungs are, from collapse or other cause, incapable of expansion, the atmospheric pressure will determine excessive dilatation of the remaining portions, in order to prevent the occurrence of a vacuum as the thoracic walls expand. There are, however, such grave objections to this theory, which, it will be observed, rests upon the supposition that the expansion of the thorax and the amount of air inspired remain at the normal point, although portions of the lungs are collapsed or otherwise rendered unable to expand, that we are strongly inclined to regard the expiratory theory as the only one capable of general clinical application. We owe to Sir William Jenner chiefly the satisfactory refutation of the principal argument which was formerly brought against this latter theory, that "the expiratory act is mechanically incapable of producing distension of the lung, or of any part of it. The act of expiration tends entirely towards emptying the air-vesicles by the uniform pressure of the external parietes of the thorax upon the whole pulmonary surface; and even when the air-vesicles are maintained at their maximum or normal state of fulness by a closed glottis, any further distension of them is as much out of the question as would be the further distension of a bladder, blown up and tied at its neck, by hydrostatic or equalized pressure applied to its entire external surface" (Gairdner). A little consideration of the anatomical relations of the lungs to the thorax shows the falsity of this argument. The different portions of the lungs are in contact with surfaces and tissues of very different degrees of resisting power, and while the entire postero-lateral portions are supported by the unyielding ribs, the apices are covered only by soft tissues, and the anterior borders of the lungs are supported externally by the comparatively yielding costal cartilages, while centrally they are able to encroach considerably upon the tissues of the mediastinal spaces. In ordinary free expiration the air is forced out of the lungs by a pressure so moderate and gradual that even the weakest parts of the thoracic walls are sufficiently firm to maintain it. But when the expiratory efforts become more violent, the air is pressed with great force from the central, basic, and lateral portions by the ascent of the diaphragm and the compression of the thorax, while the outward current from the apices and anterior margins is comparatively feeble. If, therefore, from any cause the normal relation between the volume of the expiratory current of air and the calibre of the large bronchi be disturbed, the portion of air which cannot escape will be driven violently into the apices and anterior margins, not only overcoming the outward current of air proceeding from those portions of the lungs, but producing an excessive degree of distension of their air-cells. The strongest possible confirmation of the truth of this view is to be found in the fact that emphysema, both of the vesicular and interlobular form, is found to be developed in the various parts of the lungs in precise correspondence with the degree in which they lack firm external support.

There are two ways in which a disturbance of the above relations may be effected: either by an obstruction in the air-passages, which prevents the free escape of the air, or by the expiratory act being so sudden and violent that the volume of air hurriedly forced from the air-vesicles is too great to pass freely through the primary bronchi. Instances of this latter condition are familiar to all in violent fits of coughing, during which, even when there is no obstruction in the air-passages, the degree of distension of the apices may be appreciated by the bulging of the supraclavicular tissues. The full pulmonary resonance, which is elicited by percussion of this bulging, proves conclusively that it is due to distension of the apex; and it is therefore easily understood how the repeated operation of such a cause may gradually lead to the development of vesicular emphysema, or how in an abrupt, violent, and prolonged expiratory effort, attending a fit of coughing, there may be a rupture of some minute bronchiole or air-vesicle, followed by interlobular emphysema. Undoubtedly, also, the mechanical effects of such overdistension will be greatly enhanced by morbid conditions of the lung-tissue which weaken its elasticity, such as are present in severe bronchitis, especially when associated with constitutional diseases. Far more frequently, too, there is associated some cause of partial obstruction to the escape of air, such as the spasmodic contraction of the air-passages in hooping-cough, the presence of layers of false membrane in the larynx or trachea, or thickening of the bronchial mucous membrane with plugs of viscid tenacious mucus in the tubes.

It is very possible, also, that in some cases interlobular emphysema may be caused by the implication of a minute bronchiole in the progress of the softening of some spot of diseased tissue, so that the air might find entrance to the interstitial connective tissue without any mechanical cause of overdistension and rupture of air-vesicles. Thus in the case reported above (p. 214) there was certainly a very close connection between the position of the patches of tuberculous deposit and the bullæ of subpleural emphysema, so much so that we cannot doubt that the escape of air was in some way favored by their presence. In another case also, where interlobular and subpleural emphysema, followed by pneumothorax, occurred, and which is reported at length in our article on this latter affection (p. 250), it seemed to us that probably the softening of superficial circumscribed patches of pneumonia had opened into minute bronchioles, and thus allowed the escape of air.

Symptoms.—We have already seen that in young children emphysema occurs usually in an acute form in connection with some acute disease of the lungs. Although, therefore, its presence may be suspected in such cases where violent paroxysms of cough have occurred, associated with prolonged, severe dyspnœa, there are scarcely any physical signs by which its existence can be determined. The percussion-resonance will continue clear, or even become somewhat exaggerated, and this fact of the absence of any dulness (due to pneumonia, collapse, or pleural effusion), in a case of hooping-cough or bronchitis, when severe cough has occurred with unusually extreme dyspnœa, is of diagnostic value. The respiratory murmur undergoes no immediate change in its character, and it is not possible,

owing to the violent and rapid respiratory efforts of the child, to detect any diminution in the force of the murmur. Expiration in such cases is, however, often already prolonged and laborious.

The development of acute vesicular or interlobular emphysema, then, is suspected rather on account of the character of the disease from which the child is suffering than from any distinct substantive symptoms of these conditions. Exception is to be made, however, of the rare cases, in which suddenly, in the course of an acute pulmonary disease, a swelling is noticed at some part of the neck, or in the subclavicular space, which on palpation is found to crepitate. This may be regarded as, in all probability, connected with extensive interlobular emphysema. The other chief cause of such subcutaneous emphysema is perforation of the larynx or trachea, and the previous symptoms will enable us to exclude this rare condition without difficulty.

In other cases, however, vesicular emphysema in children assumes the chronic form, more usually found in adults, and will then be attended with the well-known symptoms of this affection. At times, it occurs evidently as a sequel to some acute pulmonary disease, in the course of which it has been developed in the manner above described, and after the original disease has passed away, it persists, either owing to original weakness of the lung-tissue, or to the extreme degree of the dilatation of the air-vesicles. At other times, it is met with as a purely chronic affection, which may begin in early childhood, and gradually increase until the disease is fully developed. In such patients there is probably some congenital weakness and tendency to degeneration of the pulmonary tissues. It is not unfrequently found that there are also evidences of rachitic disease of the ribs in such cases.

Children with chronic emphysema present various degrees of habitual dyspnœa, which is always readily increased by exertion. They are very subject to attacks of bronchitis, during which the breathing is much embarrassed and wheezing, the chest is full of sonorous and sibilant râles, and the cough occurs in severe paroxysms without much expectoration. During these attacks, not unfrequently the child suffers at night from violent paroxysms of spasmodic asthma. Indeed, it may happen that attacks of asthma will be induced in emphysematous children by the most trifling causes, such as changes of weather, indigestion, and the like. The attacks of bronchitis vary greatly in different cases in their relation to season and temperature; in some they occur almost exclusively during the damp, cold weather of fall and winter, while in others they are most frequent and severe during summer and spring, and the child finds more relief during cold weather.

The cough varies much in its intensity and character. During the attacks of bronchitis it is usually very severe, occurring in long spells, at first with a little mucous expectoration, and later, as the attack passes over, with more abundant muco-purulent sputa. In the intervals of the attacks it may continue as an occasional dry and rather wheezing cough, or it may be more troublesome on account of a certain degree of chronic bronchitis being always present, or finally it may altogether subside. After

the disease has lasted a considerable time, however, cough may become persistent, occurring most severely at certain periods of the day, and attended with a considerable quantity of muco-purulent expectoration. In such cases, when emphysema is conjoined with chronic bronchitis, the suspicion is apt to arise that the child is suffering from phthisis, and the positive determination of the diagnosis may indeed be attended with some difficulty. The reader is also referred to the remarks made in this connection on the subject of chronic bronchitis (see p. 200).

In young children under the age of 5 or 6 years, emphysema rarely reaches so great a degree, or persists for so long a time as to induce marked changes in the shape of the thorax, or to seriously affect their nutrition. In children somewhat older, however, when the disease is more severe and chronic, it may be attended with most of the symptoms familiar in the adult. The appearance of such children is apt to be frail and delicate, their muscular system develops slowly, and they become so readily fatigued and out of breath that they avoid play or much exercise. The shape of the thorax becomes gradually altered; the shoulders grow high and rounded, and the chest is prominent and distended in its upper part, while owing to imperfect expansion of the lower lobes, there may be perceptible retraction of the base of the thorax in front, or even a marked depression around the entire base of the chest. Of course, this is likely to occur to a more marked degree if the emphysema is associated with rickets.

The *physical signs* vary greatly with the extent and degree of the emphysema. In cases where it is limited to small areas of the lungs, scarcely any physical sign can be detected; but in partial and more severe forms, the following phenomena can be observed: The respiratory movements are restricted especially in the way of expansion; and during inspiration the movement is chiefly one of elevation effected by overaction of the upper respiratory muscles, and attended with an evident deepening of the depression around the base of the chest. The percussion-resonance is very full and clear, or even tympanitic, though owing to the marked resonance normal in children, it is difficult to determine the degree of its exaggeration. There may be associated some impairment of resonance over the retracted base of the thorax, and especially posteriorly, where there may be congestion of the lung with accumulation of secretion in the air-passages, due to the coexisting bronchitis. The respiratory murmur is weakened, though rarely to the degree noticed in adults; the expiratory murmur is decidedly prolonged and frequently wheezing. Both inspiration and expiration are apt to be accompanied with sonorous and sibilant râles. These, and especially the sonorous râles, are most markedly developed over the posterior parts of the lungs, near the larger bronchi. In some cases, moist râles may also be heard over the postero-inferior parts of both lungs, owing to the presence of an unusually large quantity of secretion in the smaller bronchial tubes. During one of the acute aggravations of the bronchitis, attended with nervous asthma, to which we have above alluded as being so frequent in such patients, a dry sibilant râle, distributed

over the entire thorax, is often the only sound heard accompanying the labored respiration.

In marked cases, there will also be impairment of the resonance and fremitus of the voice, cough or cry. The apex-beat of the heart may be concealed by the distended lung, and the area of cardiac dulness is diminished. As before said, the alterations of the shape of the thorax and the marked physical signs now described are very rarely observed in children under the age of 5 or 6 years, and become more constant and more marked at later periods of childhood.

Case.—A., æt. 8 years, came under observation in the fall of 1873. The daughter of healthy parents, she was nursed until the age of 2 years. She suffered much from occasional diarrhœa for the first three years of life, but then improved in this respect. She cut her teeth without difficulty, and as rapidly as usual; began to walk at usual age. Has always perspired profusely at night, especially about neck and head, and when an infant was very troublesome from constantly kicking off the bedclothes at night. There was no muscular soreness.

At the age of 4 years she had a severe attack of spasmodic croup, and since then has been subject to frequent attacks of bronchitis, often associated with asthma. At first, there were only a few attacks each year, but for the past year they have followed each other with scarcely any intermission. She always suffers more during summer than in winter, and has found relief on several occasions by spending a few weeks during the summer at the seashore. The attacks usually begin as a simple catarrh, with sneezing for a couple of days, followed then by wheezing cough, shortness of breath, and nocturnal attacks of asthma. There is habitually dyspnœa on exertion, and the child has grown to care little for play, and to prefer staying quietly indoors. Lately there has been persistent and severe cough, with muco-purulent expectoration, feverishness, loss of appetite and strength. One year ago alteration in the shape of the chest was noticed. She was very much benefited last fall (when she was seen once by us) by the use of muriate of ammonia in full doses, with a mixture of quinia and arsenic; but after its cessation she has had a return of her troublesome symptoms. At present she is a rather tall and delicate-looking child, with high rounded shoulders. The upper part of the thorax, from above the clavicle down to the fourth rib, is distended. Below that level there is retraction of the anterior chest-walls, and on passing the finger parallel to the sternum there is a quite marked groove about one inch from each side of that bone, caused by incurvation of the ribs along that line. The expansion of the chest is limited. The apex-beat of the heart is at the sixth rib nearly 2″ below line of nipple, being apparently somewhat depressed. Percussion-resonance is exaggerated and almost tympanitic over supra- and infra-clavicular spaces, while over the retracted portions of the chest it is slightly impaired. The vesicular murmur is impaired, and over the superior part of the chest expiration is evidently prolonged. No râles are heard anteriorly, but posteriorly, at the base, and especially about the roots of the lungs, snoring râles are heard.

The case appears to be one of emphysema of the upper parts of the lungs, associated with deformity of the chest, partly due to rickets, partly to the emphysematous distension of the lungs, and attended with a varying degree of chronic bronchitis, with a tendency to spasmodic asthma.

She was ordered careful diet and clothing; salt baths daily; regulated gymastic exercises with her arms; and the following medicines:

R.	Potass. Iodid.,	gr. ij.
	Potass. Bromidi,	gr v.
	Syr. Ferri Iodidi,	gtt. v.
	Syr. Tolutani,	gtt. xxv.
	Aquæ,	ʒss.

Ft. sol. S. t. d.

The use of this was followed by improvement in appetite and strength, and by a marked diminution in the frequency and severity of the asthmathic attacks. As, however, the cough continued quite severe, with abundant loose mucous râles throughout the chest, the treatment was changed to the following:

℞. Syr. Phosphat. Comp., ... fʒij.
Elix. Calisayæ,
Aquæ, āā . . . . . fʒj.—M.

Dose. Two teaspoonfuls in water before meals.

And to relieve the cough:

℞. Ammoniæ Muriatis, ... grs. lxxij.
Syr. Senegæ, ... fʒss.
Tr. Hyoscyami, ... fʒiss.
Ext. Pruni Virg. Fluid., ... fʒss.
Syr. Zingiberis, ... q. s. ad fʒiij.—M.

Dose. A teaspoonful in water three or four times in twenty-four hours, according to the severity of the cough.

Under the use of these remedies, her improvement was rapid and continuous, and for the past year and a half there has been scarcely any tendency to bronchitic attacks. Her frame has developed, and the shape of the thorax has improved so as to confirm the evidence of the physical signs that the emphysema is gradually disappearing.

Diagnosis.—In regard to the detection of the acute form of emphysema at the time of its occurrence, we have already shown that there are no signs sufficiently distinctive, and that if any unusual severity or persistency of dyspnœa rouses the suspicion, we may only assume its presence in consequence of the great frequency with which it is developed in certain diseases.

This is even more true with regard to the interlobular than the vesicular form, except when the sudden appearance of subcutaneous emphysema proves its existence.

If, however, emphysema becomes firmly established, and persists, it becomes attended with the well-marked symptoms already described, and there are then scarcely any conditions with which it can be confounded. In almost all cases, there is associated bronchitis, either in the form of repeated acute attacks, or, more frequently, of a chronic form of varying degrees of intensity. It is therefore necessary to guard against overlooking the evidences of emphysema, and considering such cases as simple forms of bronchitis. In cases where emphysema of long standing is accompanied by severe and chronic bronchitis, it may be confounded with phthisis. Apart, however, from the fact that chronic phthisis is rare in childhood, a careful study of the history of the case, and of the physical signs, will enable us to avoid this error.

Prognosis.—Only in extreme cases of emphysema in children is the prognosis so unfavorable as in this condition in adults. In many cases where there can be no reasonable doubt that it exists to a considerable extent, the lung-tissue regains its contractility soon after the exciting cause of the emphysema has been removed, and all evidences of its existence gradually disappear. Even in more protracted cases, when the disease

persists for some years, and leads to deformity of the thorax, there is ground for hope that, under the influence of the developing constitution and frame, and sustained judicious treatment, considerable relief will be obtained. This is equally true in regard to the tendency to attacks of nervous asthma, which is so frequently associated with emphysema, as it is true of its other symptoms. Children, who, at an early age, suffer severely with such attacks even from the slightest causes, are frequently seen to entirely outgrow the distressing tendency, and to bear any change of climate or vicissitude of weather without inconvenience.

The prognosis of mediastinal and subcutaneous emphysema dependent upon the interlobular form, is of course controlled entirely by the nature of the primary disease. It undoubtedly of itself aggravates the dyspnœa caused by the original pulmonary disease, but still very rarely reaches so extreme a degree as to endanger life. It must be borne in mind, however, that it is very frequently associated with pre-existing lesions of the lungs, which, either from their character or their extent, are almost necessarily fatal. Thus, of the 20 cases before referred to as on record, in only 4 has this accident been followed by recovery. It must, therefore, be regarded merely as a serious complication, but one which would not justify an altogether unfavorable prognosis in an otherwise curable condition.

Treatment.—The treatment of cases of acute pulmonary disease, in the course of which it is suspected that emphysema has occurred, cannot be much modified on account of this complication. As it is, however, closely dependent, in such cases, upon the frequent and violent cough, the most important indication is to allay this by suitable antispasmodics and sedatives. At the same time, as the increased dyspnœa which is caused by the development of the emphysema must seriously add to the exhaustion of the patient, the utmost care must be exerted to sustain the vital powers, and to discard every depressing element from the treatment.

The same remarks, which are used above with special reference to vesicular emphysema, apply with equal force to the interlobular form when it becomes complicated with mediastinal and subcutaneous emphysema. The only chance of recovery in such cases, is to be found in sedulously supporting the system until the primary disease (if of a curable nature) has passed away, and the effused air has been gradually absorbed. This absorption may be, to some extent, hastened by gentle frictions on the emphysematous parts with the hand. In cases where the extent of the external emphysema is such as to threaten life, minute punctures may be made in the distended skin, and the escape of the air favored by gentle pressure with the hands towards the point of puncture.

The most important field for medical treatment is, however, to be found in those cases where emphysema, whether acute or not in its incipiency, has passed into a chronic or persistent form. The indications for treatment which here present themselves, are mainly to relieve the chronic bronchitis, which is almost invariably associated with emphysema, if it has not been its chief cause; to eradicate any rachitic tendency which often coexists, and, so far as possible, to counteract its results; to guard against and relieve the acute attacks of bronchitis often accompanied with

nervous asthma, from which such children suffer; and finally to favor, so far as lies in our power, the restoration of the dilated lung-tissue to its normal condition.

There are several considerations of a general character, which will be found to have an important bearing upon these requirements.

Change of climate, when it can be judiciously made, is often attended with excellent results, particularly as regards the bronchitic irritation and the attacks of asthma. We have known children who suffered most severely from these conditions, which were aggravated by any trivial causes so long as they remained in their native place, but who on removal to other climates, received marked relief and gradually outgrew the disease. It is not at all necessary that this change should be to a distant spot; often the most convenient, dry, elevated, inland locality will answer excellently.

The clothing of such children should be carefully studied and regulated. Without being so heavy as to oppress, it must be at all times warm enough to thoroughly protect; and at the same time there should be a suit of flannel or silk (consisting of an undershirt with long sleeves, and long drawers coming down to the ankles), of varying thickness to suit the season, worn throughout the year, to protect the surface of the body from the chilling effects of sudden vicissitudes of temperature.

As further means to secure activity of the circulation and function of the skin, the use of salt baths (of a temperature to suit the season), and followed by brisk rubbing with a coarse towel, are to be recommended.

In no condition of the system is the use of gymnastic exercise more to be insisted upon. We should select those exercises with light dumb-bells or Indian clubs, which will tend to strengthen the muscles of respiration, expand the lower portions of the chest, which, as we have already pointed out, are apt to be retracted, with some incurvation of the ribs, from the coexistence of rickets at an earlier age. As children in whom emphysema assumes the chronic form are usually over the age of 6 or 7 years, such exercises can be readily carried out

Very recently several forms of apparatus have been devised for enabling the respiration of air of different degrees of condensation or rarefaction to be employed with accuracy. The one which we have ourselves employed is known as Waldenburg's apparatus, having been designed by this eminent physician, who also has been chiefly concerned in introducing this new method of treatment. In the case of emphysema, the patient is caused to expire into a receiver containing rarefied air. It is evident that this will exert an increased suction power on the air in the lungs, and thus will favor the emptying of the air-vesicles and the contraction of the chest to its normal limits. Undoubtedly in children, this method, which we have used with good results in adults, should be employed with caution; but it is especially in young persons, when the elasticity of the ribs and of the lung-tissue is greater, that the most positive effect may be hoped for in causing a restoration of the chest to its normal size.

The selection of the diet should be made with care. It will often be found that all the symptoms are aggravated by any digestive disturbance, and we have seen, as is indeed frequently the case in emphysema of

adults, violent paroxysms of nervous asthma induced by indigestion. As the digestion in such children is apt to be weak, this point requires the greater care.

As regards medication, the most important remedies are such as will affect the constitution favorably.

We should recommend the use of cod-liver oil in properly graduated doses, and, especially where there are evidences of rachitic disease, the compound syrup of the phosphate or the lacto-phosphate of lime may be advantageously associated in the form of emulsion. If iron is not thus administered in the form of the phosphate, the oil may be given alone, and iron should be taken separately in some other combination, as in the following:

℞.—Potassii Bromidi,	℥ij.
Potassii Iodidi,	gr. xlviij.
Syr Ferri Iodidi,	f℥ij.
Syr. Tolutani,	f℥vj.
Aquæ,	f℥ij.

Ft. sol. S.—A teaspoonful thrice daily in a little water.

The dose here directed is for a child of about 8 years of age.

We have also found the prolonged use of arsenic for its constitutional effects of much value in some cases.

Cough should be relieved, so far as possible, without the use of opiates and nauseating expectorants. Among the drugs which we have found most useful in controlling it, as well as in relieving the chronic bronchitis upon which it usually depends, are the iodide of potassium, which may be advantageously combined with the potassium bromide, as in the above prescription, the bromide of ammonium, and the muriate of ammonia. If the cough be very troublesome, especially at night, tincture of hyoscyamus and minute doses of morphia may be occasionally associated. It may, however, become necessary to substitute for these, or to combine with them, other alterative and stimulant expectorants, such as seneka or copaiba.

The use of quinia, and, at times, of strychnia with it, is indicated throughout a large part of the treatment for the useful influence of these drugs upon the digestion and general nutrition, and especially upon the tonicity of the muscular system.

The acute attacks of nervous asthma which are apt to occur from time to time must be relieved at the moment by the prompt use of relaxing emetics, hot mustard-water foot-baths, the inhalation of ether or of the smoke of stramonium cigarettes. The frequency of these distressing attacks will, however, be greatly influenced by the persistent employment of the general treatment above sketched.

Finally, it must not be forgotten that despite the obstinacy and severity of the symptoms of emphysema in some cases, and the positive alterations of the shape of the thorax, there is always reason to hope that if we can succeed in removing the element of chronic bronchitis, and in favoring the

expansion of the lower lobes of the lungs, so as in these ways to relieve the strain upon the upper portions of the organs, the distended vesicles will gradually regain their elasticity, and as the thorax enlarges with advancing years, all symptoms of the disease will pass away.

ARTICLE V.

PLEURISY.

Definition; Frequency; Forms.—Pleurisy consists in inflammation of the pleural serous membrane.

Idiopathic pleurisy is a rare disease under five years of age, and especially in the first and second years of life. After the age of five years it becomes more frequent. We have met with 28 cases of pleurisy, of which we have kept notes. Of the 28, 26 were idiopathic, and 2 secondary; one of the latter occurring during hooping-cough, and the other being accompanied by pneumonia, though the pleurisy was the predominant disease. Secondary pleurisy, on the contrary, or that which occurs in the course of other diseases, is common at all ages. M. Bouchut met with it in 23 out of 68 autopsies of new-born and suckling children. Of the 23, 9 accompanied acute pneumonia, 6 tubercular pneumonia, 5 entero-colitis, and 3 different other diseases. This form of the affection is rarely detected during life, being masked by the concomitant malady.[1]

We shall describe two forms of the disease, the *acute* and *chronic*.

Predisposing Causes.—As to the influence of *age*, it has already been stated that idiopathic pleurisy is rare between birth and five years of age. It is certainly rare, during those years, in comparison with pneumonia, and especially with bronchitis, for we find that while we have met with but 15 cases of pleurisy of all kinds under five years of age, we have seen 28 of pneumonia under that age, and 105 of bronchitis under six years of age. Of 28 cases of pleurisy that we have seen, 26 were idiopathic, and of these one occurred at the age of three months; three between 1 and 2 years of age; one between 2 and 3; four between 3 and 4; eight between 4 and 5; three between 5 and 6; two between 6 and 7; three between 7 and 8; and one between 13 and 14. Of the two secondary cases, one occurred at six weeks of age, and one between 4 and 5 years. Secondary pleurisy is said, by the best authorities, to be most frequent between one and five years of age, being, in this respect, just the contrary of the idiopathic form of the disease.

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1 In this as well as in some other places, the figures remain as they were in some of the previous editions, although a very much larger number of cases have fallen under our observation. But as it has been impossible, owing to the pressure of other duties, to make records of any large proportion of them, and as the general results have not been materially affected, we have allowed the figures to continue unchanged in this edition.

Pleurisy is said to occur more frequently in boys than girls. Of 26 cases, in which we noted the sex, 19 occurred in boys and 7 in girls. The idiopathic form is most apt to occur in vigorous and hearty subjects, while the chronic and cachectic forms attack those who are feeble and delicate. It is often, as already stated, a secondary affection, occurring particularly during pneumonia, and, after that disease, during rheumatism, scarlet fever, and Bright's disease. *Season* is another predisposing cause. It is most common during winter and spring, especially the latter.

The *exciting causes* are very obscure in most cases. The only ones which seem to have been ascertained with any certainty, are exposure to cold and sudden changes of weather. It has been said to follow external violence. In one of the cases that came under our own observation, the child had struck the affected side severely against a pointed stick on the day of the attack.

Anatomical Lesions.—The serous membrane may retain its natural characters, or as happens in most instances it may present the different appearances indicative of inflammation. These are more or less minute and abundant injection and punctuation, and spots or patches of an ecchymotic appearance, observable particularly at the points where the formation of false membrane has taken place. Another change produced in the pleura by inflammation is the loss of its natural polish, which is replaced by a more or less granular and rough appearance. In chronic cases it becomes whitish or opaline in color, and thickened. It is very rarely softened.

In addition to the lesions of the pleura itself there are various diseased products of secretion which require notice. These may be either solid or liquid. The solid products are the false membranes which exist so generally in all serous inflammations. They are found both upon the costal and pulmonic pleura. In their recent state they are of variable size and thickness, being in some cases very soft and deposited in small points; in others, more extensive, but thin, like paper; and in others again thicker (one or two lines in thickness), firmer, and decomposable into several layers. The outer layers are yellow, elastic, and soft, while the inner ones are red, more resisting, and marked with vascular arborization. When examined some time after their formation, the false membranes are found to have been converted into cellular adhesions, which may be either very loose, or they may fasten the lung tightly to the costal pleura. The adhesions are generally, however, thin, transparent, and in the form of loose bridles. After a length of time, the false membranes come to present the appearances of true serous tissue, and like that, are susceptible of inflammation.

The fluid found in the pleural cavity usually consists of transparent or turbid serum, holding albuminous flocculi in suspension. Sometimes, but more rarely, it consists of purulent serum, and still more rarely of pure pus. The liquid generally occupies the lowest portion of the thoracic cavity, but is sometimes circumscribed at various heights, or between the lobes of the lung by abnormal adhesions, or by some part of the lung which has been rendered incompressible by inflammation.

The lung presents various alterations from its healthy condition. It is

pressed backwards towards its root to a greater or less extent. The tissue of the organ is generally found in one of two conditions: either hard, not crepitating, impenetrable to the finger, and presenting a smooth surface when cut into, a state of things which has been expressed by the term *carnification*, and which is a mechanical effect of pressure; or else the lower lobe, which is in contact with the fluid, is large, heavy, fleshy, rather hard, not so easily penetrable by the finger as in simple hepatization, yielding under pressure only a small quantity of blood, and but slightly retracted towards the spinal column. The latter condition depends in all probability on an effusion which has occurred after, or coincidently with hepatization.

In some cases, in which the effusion is but small, or where it has been absorbed, the lung is found to be elastic and crepitating. Whatever the amount of effusion may be, the lung can always expand to its normal size if the fluid be absorbed, unless it has been too firmly bound down by false adhesions.

Pleurisy, whether complicated with pulmonic disease or not, is much the most frequently confined to one side. In idiopathic cases, it is more common on the right than left side; when it accompanies pneumonia, it is, on the contrary, more common on the left than right.

Symptoms.—In describing the symptoms, we shall treat first of the physical, and then of the rational signs, and of the course of the disease. The *physical signs* are exceedingly important, as they often constitute, especially in young children, the only means of recognizing the disease. The *pleural friction-sound* is less important than some other physical signs, as it is by no means constantly heard in children under five years of age, and only during the absorption of the fluid, as a general rule, in those above that age. *Bronchial respiration* may commonly be detected from an early period in the attack. It is however to be carefully distinguished from the true, sniffling, superficial bronchial breathing due to pneumonic consolidation of the lung. In pleurisy, with effusion, the bronchial respiration is evidently transmitted from the bronchi of the compressed lung and from the trachea. Indeed, it will sometimes be found that, in a case where distinct bronchial breathing is heard over the seat of the effusion during noisy, hurried breathing, it will be lost and replaced by feeble respiratory murmur, if the child breathes quietly and without making any noise in the throat. At first the bronchial respiration is usually heard during inspiration, but afterwards it exists both during inspiration and expiration, or in the former alone. In a majority of the cases it is heard over the posterior portion of the thorax, and upon one side only. At first it is audible over nearly the whole height of the affected side, while later in the disease it can be perceived only at the inferior angle of the scapula or in the interscapular space. Its duration is variable; it may disappear in a few days, or last for a much longer time. In favorable cases it is usually replaced by feeble vesicular respiration, more rarely by friction-sound, and sometimes by pure respiration. This sign is almost always present at all ages in acute cases, but is often absent in those which are slow and tedious. In suckling children it is not constant, but intermits

occasionally, so that it may be heard at one and not at the next examination. *Ægophony* can rarely be detected in children less than two years old. Under that age, there is heard instead of it resonance of the cry, especially in the region beneath and on a line with the spine of the scapula. It is intermitting, like the bronchial respiration. In children over two years old, ægophony can often be distinguished by careful examination, but never, of course, unless the quantity of effusion is considerable. It is heard at an early period of the attack, and chiefly in acute cases, and must be sought for in the lower portion of the interscapular space, and the inferior dorsal region. It coexists almost invariably with bronchial respiration, lasts but a short time, disappearing after one, two, three, or four days, and it is intermitting. In older children, it is sometimes replaced by diffused resonance of the voice, as it is by resonance of the cry in infants. In a case that occurred to one of ourselves, in a girl between six and seven years old, and in which the disease became chronic, the voice was not purely ægophonic, but reedy and quavering, from the fifth to the tenth day. After that date the effusion became so great that all sound was suppressed.

Feebleness or absence of the respiratory murmur seldom exists at the beginning of acute cases, but in the subacute or chronic form is generally present from the invasion. In the latter class of cases feeble respiration is noticed first over the inferior portion of the dorsal region, but as the effusion increases, it is heard also in the upper and anterior regions, and becomes more and more marked, until at length no sound whatever is audible; the respiratory murmur is suppressed. In acute cases, on the contrary, the absence of the respiratory sound is observed at variable periods of the attack; when noticed soon after the invasion, it is generally coincident with distant and transmitted bronchial respiration, which, heard at first over the whole or the inferior three-fourths of the dorsal region, becomes afterwards perceptible only in the interscapular space, or at the inferior angle of the scapula, while the respiration is feeble or absent over the lower portions of the lung. In acute cases the feeble respiration remains limited to the dorsal region, and disappears after a few days,—in from five to eight, according to our experience; while in chronic cases it extends over a larger surface, and continues for several weeks, or even months.

Percussion.—This means of diagnosis is very important in all cases of the disease accompanied by effusion of liquid, unless the quantity be exceedingly small. When, on the contrary, the inflammation results merely in the production of thin false membranes, percussion furnishes no useful information.

Percussion is of no assistance, however, at the moment of invasion, as it is not until the period at which effusion takes place that the resonance of the thorax begins to be altered. In acute cases, the resonance is generally duller than natural, though seldom entirely dull, on the second, third, or fourth day. As the effusion augments, the dulness increases over the region occupied by the fluid, until at length all resonance ceases, and the sound is perfectly flat. The degree of dulness can be properly appreciated only

by comparing the two sides together. The degree, extent, and duration of this sign will depend, of course, upon that of the effusion. In children, as in adults, the sounds afforded by percussson vary with the position of the patient, which influence, of course, the situation of the fluid in the pleural cavity.

In regard to the physical signs of pleuro-pneumonia, it may be stated that when a pleuritic effusion takes place in a child laboring under pneumonia, it happens, as a general rule, that the bronchial respiration occasioned by the inflammation of the lung increases in intensity, though in some few cases it is diminished or suppressed. MM. Rilliet and Barthez lay down the following principle: "That *when a pleuritic effusion occurs in a child affected with hepatization of the inferior portion of the lung, all the abnormal sounds which were perceptible over the diseased point are considerably exaggerated, and the sonority disappears.*"

Inspection of the thorax affords no assistance at the invasion of the disease, nor generally in acute cases which last but a short time, and in which the amount of effusion is small. When, however, the effusion is large, it may be observed, upon close examination, that the movements of the affected side during respiration are more limited than those of the opposite one, and that the intercostal spaces are more projecting than natural, in consequence of distension by the fluid within. At the same time *mensuration* will show that the side on which the effusion exists is larger than the other. The difference may amount to one-third or two-thirds of an inch. In acute cases in which the quantity of liquid is small, mensuration will of course show no difference.

Palpation is an important means of diagnosis, especially in making the distinction between pneumonia and pleurisy. In the former disease, the vibration of the thoracic walls during either crying or speaking, is augmented; whilst in the latter it is diminished, or when the effusion is considerable, ceases altogether. This sign is important, both in infants and older children.

Another very important sign, which should always be looked for, is *displacement of the heart* towards the healthy side by the pressure of the effusion. There is large effusions on the left side; we have found the heart pulsating below the right nipple. The value of this sign is particularly great in children, as it can be determined with accuracy even if their agitation or timidity renders other means of physical exploration difficult.

Rational Symptoms; Course; Duration.—Acute pleurisy is comparatively rarely met with, as already stated, in children under six years of age, except as a secondary affection. In idiopathic cases it begins with severe pain in the side, cough, some difficulty of respiration, increased frequency of the pulse, loss of appetite, thirst, bilious vomiting, sometimes headache, and in rare instances delirium. The *pain* in the side or *stitch* is almost always present in acute cases, occurring in healthy children, while in those which are slight, or which occur in weak and debilitated subjects, or very young children, it very often cannot be detected. Sometimes, however, its existence may be ascertained in very young children by tenderness of the side shown during the act of percussion. When present in

young children, it can always be detected by watching the face of the child and observing its gestures during the act of coughing, and during full inspirations, as in those made in crying, after sudden movement, or in the act of gaping. In an infant of thirteen months old, who was attacked with pleurisy of the right side, causing effusion of thick yellow pus into the right pleural sac, and which ended fatally within a month, only the blindest observer could fail to see that every act of coughing was acutely painful, for the child uttered each time a short, sudden cry, which was hushed as soon as given, while at the same moment there passed across the face an expression, amounting almost to a grimace, of suffering, which was unmistakable. The pain is aggravated by coughing, by full inspirations, by change of position, and by percussion. The seat of pain is almost always in front, but it may extend irregularly over the whole of one side to the arm, or it may be confined to the false ribs, or less frequently to the neighborhood of the nipple; it generally lasts from three to six days, though it sometimes continues longer. This symptom was complained of in most of the cases that we have seen. In some it was very acute and severe for one or two days, while in others it was slight, not well defined, and very transitory. In one, the child said there was no pain, but a sensation of weakness in the side when she coughed. In another, the pain was severe for a few hours, but was relieved by a sinapism, and was not felt again, though the attack resulted in a very large effusion into the side. In a third it lasted a week, and in a fourth only two days, though in both the effusion was extensive, and required several weeks for its absorption. In a fifth case it continued for five days. In the last, the effusion was very slight. It was aggravated in all these cases by coughing, by the act of respiration, especially when this was deep, and by motion.

Cough exists in nearly all idiopathic cases, and generally from the onset, though sometimes not before the second or third day. Usually frequent and dry, it commonly retains these characters in acute cases, for four or six days, and then diminishes rapidly. In more tedious cases it continues for a longer time, but moderates in violence after some days. In secondary cases it has no special characters. It was present in all but one of the cases seen by ourselves. Its character varied very much. In some it was frequent, teasing, and very painful. In others it was rare, scarcely troublesome, and only slightly painful. In all it was very dry, this constituting one of its most marked features, and giving it a very different character from the cough of bronchitis, and also, though somewhat less distinctively, from that of pneumonia. It continued almost entirely dry throughout the disease, except in a case which became complicated after a time with slight bronchial inflammation, and, in that, it became loose. There is generally no *expectoration;* if any, it consists of a small amount of whitish, frothy, seromucous fluid.

The *respiration* is usually accelerated in acute cases, but remains natural in other respects; the dyspnœa, however, is slight, as a general rule, compared with that of pneumonia. The difficulty of breathing is commonly in proportion to the earliness of the age, and to the extent and rapidity with which the effusion takes place. In the acute cases that came under

our own observation, the breathing was usually about 36, 38, 40, and 48, but in one case it rose to 68 for a single day. It was not labored, and appeared to be difficult only from the fact of its being more or less painful. In a case of double pleurisy that came under our observation, it was most laborious, and dreadfully painful, as was also the cough. In the cases attended with but slight pain, there was no dyspnœa. It usually subsided after two or three days, when large effusion took place, converting the case into the chronic form.

The *fever* is not usually very great, and seldom lasts more than a few days, or a week. In some few cases, however, that we have seen, the febrile reaction has been very high. In one, in a child between three and four years old, the pulse rose to 172 on the first day, though the respiration was but 36; the skin was very hot and dry, and there was very great drowsiness and inattention. In other cases the pulse was 140, 128, and 124. The acceleration of the pulse usually lasts three or four days, after which it falls, so that by the end of a week it is seldom over 70, 80, or 90. The *heat* of skin is not very great in most instances, and generally subsides rapidly and disappears after a few days. Thus during the first few days of the attack, the temperature may rise to 103° or 104°; but it soon falls, and, during the remainder of the case, usually fluctuates between 100.5° and 102°. When the case is complicated with pneumonia, the elevation of temperature is even more marked and persists for a longer time. In acute secondary attacks, the febrile symptoms are more marked, as a general rule, than as has just been described, because of the existence of the concurrent disease.

The *countenance* presents no particular characters, except that an expression of pain passes across it occasionally when the child coughs, or takes a deep breath. It is seldom deeply flushed as in pneumonia. The alæ nasi are dilated only during the continuance of the difficulty of respiration.

The *decubitus* is generally dorsal or indifferent. In two cases observed by us, in which the effusion was large, the number of inspirations was always from three to five greater when the child laid on the sound, than when on the affected side.

Headache is often present during the first few days, in children over six years of age, and is sometimes very severe.

Convulsions are said to occur sometimes at the onset in very young children. The *strength* is not usually much diminished, except during the acute period. The *appetite* is diminished and the *thirst* acute, but neither of these symptoms is so marked as in pneumonia. The *tongue* is usually moist, and sometimes covered with a coat of whitish fur; the *abdomen* is natural.

Bilious vomiting is said to occur in more than half the cases. The *stools* are generally regular, or there is some constipation.

The Character.—The cough, pain, fever, and difficulty of breathing continue for several days, after which all but the cough generally disappear, while that commonly persists in a mild form. In acute cases, the appetite now begins to return, the thirst moderates, and auscultation reveals only

feebleness of the respiratory murmur, with slight dulness on percussion. The general symptoms cease soon after this, and the patient is entirely convalescent in from one to three weeks, though feeble respiration and diminished resonance sometimes persist for a longer period.

Urine.—The urine in pleurisy has the so-called febrile characters, but usually not in any degree approaching to the urine in pneumonia, the water being less diminished, and the urea less increased. In cases where there is rapid effusion into the pleura, the chlorides are lessened or almost wanting; and reappear as the effusion is absorbed. Albumen is scarcely ever present.

CHRONIC PLEURISY may follow the acute form, or occur as an idiopathic disease. In the former case, the acute symptoms diminish after a variable length of time, but the fever does not cease entirely, and often recurs towards evening and assumes a hectic type. In the latter case there is usually a very moderate degree of fever at first, which soon subsides and then disappears, or there is none at all; the pain is generally, though not always, vague, uncertain, and attracts but little notice. In one case that we attended, the cough was frequent, rather dry, and very painful for the first few days, after which it became looser and ceased entirely, though the inferior two-thirds of the right side were filled with effusion for a period of two weeks afterwards. In a second, in which the whole of the left side was occupied by the effusion, there was no cough whatever. In a third, there was a very slight, infrequent cough during the first day, but after that, though the effusion occupied the right side up to the spine of the scapula, there was none through the day, and merely a little hacking at night. In a fourth, in a girl between four and five years old, there was considerable fever during the first week, but literally no local symptoms whatever, so that the case was mistaken for one of bilious fever by another physician. When it came under our notice, some obscurity in the symptoms led us to examine the chest, where we found an effusion occupying the lower third of the right side. The fever was now diminishing, and soon disappeared, but the effusion increased, without pain, and with only an occasional cough, until it filled up three-fourths of the side. It then stopped, and after several days began to recede. At the end of about six weeks the child was quite well again, and continues so to this time, about three years. In a fifth case, in a boy, between five and six years old, the attack was extremely obscure. There was very slight fever, almost no cough, indeed none except upon some exertion being made, and then scarcely noticeable, and no severe pain. In fact, the child complained of no pain whatever, but upon being asked, referred to an uneasy sensation in the inferior lateral region of one side. The tongue was coated, and the symptoms were rather those of some bilious derangement, than of anything more serious. It was not until after four or five days of attendance, that a careful examination of the chest showed the existence of a slight effusion in the right side. This gradually increased until it reached nearly up to the clavicle, and then slowly disappeared again.

The above are mentioned as illustrations, chosen from the very considerable number of cases we have met with, of the great irregularities in

the mode of development and general symptoms of chronic pleurisy, and of the danger of errors of diagnosis in consequence.

The respiration is somewhat accelerated in all cases, and when the effusion is very large, and especially when it is purulent and attended with violent hectic fever, it is sometimes excessively labored and difficult. In some of the cases that we have seen, however, even when the effusion has been very large, the breathing has not been difficult. In one case it was between 40 and 50 during the first two days, after which it fell, as the effusion took place, to 30. In a second it was 45 at first; at the end of a week it was 38; at the end of the third week, as the effusion was being absorbed, it had fallen to 28, soon after which the recovery was completed. In a third it was so slightly disturbed that we did not at first suspect any disease of the chest. On the fourteenth day, the effusion reaching then nearly to the spine of the scapula, the breathing varied between 40 and 28 during sleep, but during the waking state there was no visible oppression.

The effusion is usually large, excepting in the very rare cases where it is circumscribed by adhesions. The side is evidently enlarged, the increase of size being visible to the eye, and readily ascertainable by mensuration. In addition, the tissues of the affected side seem tense, and the intercostal depressions are obliterated. The heart is pushed by the effusion towards the healthy side, so that the apex beat is considerably displaced; and, if the right side be affected, the liver is pushed downwards so that its border can be detected by percussion one-half inch or more below the margin of the ribs. On careful inspection it will be seen that, while the respiratory movements of the healthy side are free and even much exaggerated, the side of the thorax on which the effusion exists is almost motionless during respiration. Percussion yields marked dulness over the seat of the effusion. If the pleural sac is not entirely full up to the clavicle, it will be found that, on changing the position of the patient's body, the upper line of percussion-dulness varies its position on account of the gravitation of the liquid. Quite frequently, if the effusion be large, a slight sense of fluctuation may be obtained by palpation of the intercostal spaces.

Upon auscultation, the respiratory murmur is often suppressed. At other times, a distant and transmitted bronchial breathing may be heard over the seat of the effusion. This can, however, be distinguished from the clear, sniffling, superficial bronchial breathing of lobar pneumonia.

In those cases of chronic pleurisy in children, the effusion is very apt to be purulent, constituting empyema or pyothorax. There are then, in addition to the symptoms and signs of pleural effusion, the evidences of marked hectic fever. The child emaciates, grows pale, and has fever in the latter part of the day, followed by night-sweats. In some cases where the effusion has been at first serous, and later becomes purulent, the development of empyema is clearly indicated by a return of elevated temperature, which now persists with very marked morning remissions and evening exacerbations.

The course and modes of termination of chronic pleurisy differ much

in different cases, chiefly in accordance with the character of the fluid. In a large proportion of cases where the effusion is serous, absorption gradually takes place under the influence of treatment in from one to five months, and the patient recovers with a contraction of the side, which eventually disappears as the compressed lung expands. Where, on the contrary, the effusion is purulent, absorption is impossible, and unless paracentesis of the chest is performed and the pus drawn off, it will be spontaneously evacuated by ulceration through some point of the chest-wall or by an opening into the lung, or the child must die, worn out by the interference with breathing and by the persistent hectic fever. When an external opening forms, it is most frequently in front and in the third or fourth intercostal space. We have, however, met with cases where the opening occurred low down in front or on the postero-lateral aspect of the chest. When an opening forms into the lung, the occurrence is usually announced by a sudden and copious expectoration of pus. The following abstract from our record of the case may be given, as showing the course of empyema when a spontaneous cure takes place by the evacuation of the fluid through an opening in the walls of the chest. This case occurred in a very hearty boy, of between four and five years of age. He was taken sick in the country, with what was supposed to be an attack of typhoid fever. After many weeks of violent illness, an abscess showed itself in the neighborhood of the left nipple. This, at the end of two months, discharged, and the patient began to improve. At the end of three months, he was brought to town, and we saw him. We found a fistulous orifice, discharging occasionally considerable quantities of pus, just below and inside of the left nipple. The left side was very much contracted, and the lung was retracted into the upper part of the chest. He was put upon cod-liver oil, wine, and nutritious food, and gradually improved. He was soon removed to the country, and we did not see him again, but have since heard that he had entirely regained his health.

Diagnosis.—Pleurisy may be confounded with pneumonia or hydrothorax. From the latter affection it is to be distinguished by the absence of pain in that disease, by the existence of the effusion on both sides of the thorax in many cases, and by the fact that hydrothorax generally follows as a consequence of some previous disease, particularly the eruptive fevers or nephritis.

The distinction between acute pleurisy and lobar pneumonia is more difficult than that between pleurisy and hydrothorax, and in some instances is subject to considerable doubt. It may generally be arrived at, however, by attention to the differences laid down in the following table, which is taken from the *Bibliothèque du Médecin Practicien :*

ACUTE IDIOPATHIC PLEURISY.	ACUTE IDIOPATHIC PNEUMONIA.
Frequent after six years of age; rare under that age.	Frequent after six years of age; more rare under that age, but much less so than pleurisy.
Begins with dry cough, sharp thoracic pain, bronchial and metallic respiration during inspiration, either on the first day	Begins with cough, slight thoracic pain, and crepitant or subcrepitant rhonchus; at a later period there is bronchial

ACUTE IDIOPATHIC PLEURISY.	ACUTE IDIOPATHIC PNEUMONIA.
or later, and more rarely with obscurity of the respiratory sound.	respiration during the expiration and bronchophony.
Modification of the physical signs by change of position.	No modification under like circumstances.
Fever and acceleration of the respiration usually moderate. Rapid diminution of these symptoms from the fourth to the seventh day.	Fever violent; considerable acceleration of the respiration. Diminution of these symptoms less marked, less rapid, and not before the sixth or ninth day.
Expectoration absent or very slight.	Expectoration mucous; sometimes sanguineous; very rarely rust-colored.
No rhonchi.	Rhonchi preceding, following, and often accompanying the bronchial respiration.
Absence of vibration of the thoracic parietes during speaking or crying.	Augmentation of vocal resonance very sensible in older children, and in a less degree in all.
Course of the disease irregular; rapid disappearance in some cases, prolonged duration in others. The bronchial respiration is substituted or masked by feeble respiration.	Course of the disease regular; steadily increasing in most cases, and then diminishing from the sixth or ninth day. Bronchial respiration more disseminated.

In some cases, especially in young children, where the onset of pleurisy is very sudden and acute, the general febrile disturbance may entirely mask the local symptoms, and lead to the belief that some one of the exanthemata is about to develop itself.

Thus we have met with cases where, in the midst of full health, the child has been seized with violent fever; extreme restlessness alternating with stupor; repeated vomiting; great frequency of pulse; acceleration of respiration; but with little or no cough and no complaint of pain in the side. In one instance of this kind, the heat of skin, rapidity of pulse, and frequency of the vomiting were so marked that for twenty-four hours we suspected the approach of scarlet fever, and not until the second day were we able to satisfy ourselves of the nature of the attack by observing that the act of respiration was evidently painful, and by detecting the physical signs of plastic pleurisy over the right apex posteriorly.

In two cases, one at the age of 3 months, the other at 1½ years, we have observed most excessive and almost tetaniform reflex irritability, so that the slightest movement of the child's body, or the attempt to examine the chest, would provoke violent startings and spasmodic contractions of the entire body. In both of these cases a fatal result followed, and post-mortem examination revealed the presence of localized empyema.

The chronic form of pleurisy with extensive effusion may be easily distinguished by the history of the case, by the physical signs which we have carefully detailed, and by attention to the character of the general symptoms.

Prognosis.—Acute pleurisy is rarely a fatal disease in healthy subjects. When it occurs as a complication of some other malady, on the contrary, it is much more apt to terminate unfavorably. The degree of fatality in secondary cases will depend, of course, in great measure, on that of the

primary disease. Pleuro-pneumonia is a more dangerous disorder than either alone. Of 5 cases of primary pleuro-pneumonia, observed by Rilliet and Barthez, 2 died; while of 10 secondary cases, 8 died.

Of the 28 cases of pleurisy that we have seen, 5 died. The 5 fatal cases were all primary; 4 of them occurred in infants, 2 at 6 weeks, and the others at 13 and 18 months respectively, and the fifth was a case of double pleurisy in a boy between 4 and 5 years old. Of the 23 children that recovered, one was between 1 and 2 years of age; one between 2 and 3; three between 3 and 4; while eight were between 4 and 5 years of age, and the remainder over that age. In our experience, therefore, the mortality was, as might have been expected, much greater in those cases occurring at a very early age.

Chronic pleurisy is generally a serious, and sometimes a fatal disease, though since the more frequent and more skilful use of paracentesis many cases are cured which would formerly have proved fatal.

TREATMENT.—The *hygienic treatment* in this, as indeed in all the diseases of children, is of the utmost importance, and ought to be regulated by the practitioner himself. In all forms of the disease, the child should be carefully protected from cold, and in the acute form, kept at rest, and, if possible, in bed. The diet must be very strict, and should consist for a few days of the preparations of milk. After the fever has disappeared, bread and milk, vegetable soup with a few oysters boiled in it to make it agreeable, and gradually rice, potatoes, and at last small quantities of meat, may be allowed. In the chronic form the diet ought to be nutritious, but regulated with equal care as to quantity and material. In that form the patient should be taken into the air if the weather be mild and dry, and in winter the chamber ought to be well aired from time to time.

Bloodletting.—In acute cases occurring in vigorous children over five years of age, marked by intense fever and pain in the side, and which are seen soon after the onset, local depletion may be employed. The amount of blood to be taken should not exceed two or three ounces; and this should be withdrawn by small cups applied over the seat of inflammation. In younger children, as well as in all whose constitutions are not robust, it is better to limit ourselves to the use of a few dry cups.

Depletion in any form ought to be avoided in most of the secondary cases, unless the symptoms are very acute and the child strong and vigorous; also in all chronic cases, after the febrile symptoms have been dissipated, and in feeble, delicate children.

Antimonials—Febrifuges—Opiates.—A moderate use of the antimonials is of great service in the acute stage of the disease. Small doses of antimonial wine and sweet spirit of nitre, or fractional doses of sulphurated antimony, as recommended in the article on pneumonia, will generally cause the fever, dyspnœa, and cough to subside rapidly. Large doses are unnecessary in any case, and are liable to be injurious in all.

In cases in which antimonials ought not to be used, as where they are opposed by some idiosyncrasy, in children of low vital force, and in the secondary form of the disease, we have found a citrate of potash mixture, containing ipecacuanha and opium, and digitalis, when the heart is much

excited, very useful. The quantity of opium must be proportioned to the pain. When this is severe, the doses must be full. The good effects of this remedy in serous inflammations are now generally acknowledged. At two years of age, one drop of laudanum in the above mixture, every two hours; or half a grain of Dover's powder, with the twelfth of a grain of sulphurated antimony, every two hours, until a decidedly tranquillizing effect is obtained, may be used. When positive drowsiness has been brought about, the doses ought to be given at longer intervals—every three or four hours.

Mercury.—In former years mercury was constantly employed in conjunction with bloodletting. In our last edition we opposed its use as unnecessary in acute cases, but stated that there was high authority for employing it in cases of the acute form tending towards the chronic, and in confirmed chronic cases; adding, however, that we had not found it necessary even in these. We find, now, that Dr. West, of London, still speaks highly of it. He says (*loc. cit.*, p. 303): "After depletion, our chief reliance is to be placed on calomel, which should be freely given in combination with opium or Dover's powder; and an attack of pleurisy thus treated will often be cut off in thirty-six or forty-eight hours." Dr. J. Lewis Smith, of New York (*loc. cit.*, p. 279), does not even mention mercury in his remarks on treatment. Dr. Thomas Hillier (*Diseases of Children*, Amer. ed., 1869, p. 87) says: "Formerly I gave mercury to all cases of primary pleurisy, but this practice I have discontinued, except in the form of an aperient. Instead of it, salines, such as acetate of ammonia, nitrate of potash or soda, the citrate of potash, and nitrous ether, are given."

The experience we have had, since we last wrote, has not at all increased our faith in this remedy. We believe that as time goes on, and knowledge grows, there is good reason to think that the good effects formerly ascribed to calomel in such a variety of diseases, were largely due to the medicines given with it, and particularly the opium (without which it was not often used), the ipecacuanha, the salines, and even the antimonials.

The remedies employed by ourselves, after the disappearance of the acute symptoms, when the effusion has taken place, and especially if there seems any tendency for the case to pass into the chronic form, are either iodide of potassium in syrup of sarsaparilla, according to the following formula:

℞.—Potass. Iodidi, ... gr. xvj ad xxxij.
Syrup. Sarsap. Comp.,
Aquæ, āā, ... f℥j.—M.

Dose, a teaspoonful three times a day;

or the syrup of the iodide of iron, of which from thirty to sixty drops should be substituted for the iodide of potassium in such a mixture as the above. The iodide of potassium is preferable in the early stage, and may have the acetate of potassa associated with it. After a time, and especially in anæmical and delicate patients, the iodide of iron should be substituted.

Under this treatment, combined with the application of a Burgundy pitch plaster to the side, or some other form of counter-irritant, the effusion has usually disappeared in from two to eight weeks, though diuretics may have failed to make any impression on the cases.

Diuretics are highly recommended in the treatment of cases in which effusion has taken place. Those chiefly employed are squills, digitalis, and nitre. The squill is given alone, or in combination with digitalis, and by some with calomel, or with both. The dose of the powder of squill or digitalis, is about a quarter of a grain every two or three hours. The squill may be used also in the form of syrup or oxymel, and the digitalis in tincture. These two substances may be employed in the following formula:

℞.—Acet. Scillæ, ... ʒij.
Tinct. Digitalis, ... gtt. xxx.
Aquæ Fluvial, ... ʒiv.—M.

Of this a teaspoonful is to be given three or four times a day to children two years old.

Purgatives ought to be used during the acute stage of pleurisy to an extent sufficient to keep the bowels soluble, and to act as mild evacuants. In chronic cases, on the contrary, they are particularly recommended as evacuants, in order to deplete the bloodvessels, and thus hasten the absorption of the effusion. So far as our experience goes, this treatment is unnecessary, as diuretics and alterative tonics are generally sufficient, without a resort to violent remedies, which must irritate the intestinal mucous membrane, always extremely susceptible in children, to a dangerous degree.

Tonics are often necessary in chronic, and sometimes, after the febrile symptoms have subsided, in acute cases occurring in feeble and delicate children. The most suitable are quinine, in the dose of a grain morning and evening, small quantities of port wine, and the preparations of iron.

External Remedies.—Blisters are very generally employed, in the acute form, to relieve pain and dyspnœa, and, in the chronic, to hasten the absorption of the effused liquid. We did not apply them in the cases under our charge, having succeeded very well without; but would not hesitate to make use of a small one, applied for a not longer period than two hours, if the pain and oppression persisted. In chronic pleurisy the application of a large Burgundy pitch plaster, made rather weaker than what is used for adults, and large enough to cover nearly the whole side, would be preferable to blisters. We are also in the habit of painting the chest-wall, over the seat of the effusion, with dilute tincture of iodine, every day, or as frequently as the irritability of the skin will permit. The following mixture is of about the proper strength for a young child:

℞.—Tr. Iodinii, ... ʒiij.
Chloroform, ... ʒj.
Alcoholis, ... ʒiv.—M.

Paracentesis.—Of late years, the operation of paracentesis, in cases of

pleurisy, both acute and chronic, has been performed so frequently, and with such encouraging results, that it may now be considered to occupy an assured position among the remedies for certain conditions of this disease. It appears desirable, therefore, to discuss somewhat in detail the circumstances in which it is applicable, the indications which call for it, and to a certain extent the mode of its performance. In doing this, we shall avail ourselves freely of the admirable and exhaustive discussion of this operation by the lamented Trousseau (*Clinique Médicale*, tom. i, pp. 619–698), to whose practice and teaching it was in great part due that paracentesis thoracis was first generally recognized as a justifiable operation for the relief of excessive pleuritic effusions.

In acute pleurisy he recommended the operation more frequently than most authorities consider necessary. Whenever, indeed, the effusion becomes so excessive as to almost entirely fill the pleural sac on the affected side, displacing the adjacent viscera seriously, whether the patient presents intense dyspnœa or not, he advises its performance. The reasons urged by him for this practice were, that although ordinary cases of acute pleurisy almost invariably recover, yet when such excessive effusion exists, it may prove fatal in more than one way. It has not very rarely happened that, from the obstruction to respiration, conjoined with the embarrassment of the heart's action due to its twisting and dislocation, death has occurred suddenly; and we have met with the records of several cases in children which had this unfortunate and unexpected termination.

Again, in these cases of excessive serous effusion, if the fluid be not removed either by absorption or paracentesis, there is great danger that the case will be converted into one of empyema, not from the actual conversion of the serum into pus, but from the altered condition of the secretion from the pleural surface.

But even when the fluid does not become thus converted into pus, but remains clear and serous, absorption is very slow, and the patient may perish from exhaustion and hectic fever. During the long time necessarily occupied in the absorption of the fluid also, the pleurisy really becomes less and less curable, since the lung contracts such close and dense adhesions as prevent it from ever fully expanding again. Finally, if any tuberculous diathesis exists, the long course of the pleuritic attack favors very greatly the development of phthisis.

The chief objections which have been urged against the performance of paracentesis in these acute cases are that the effusion will form again rapidly, requiring repeated punctures and exhausting the patient; that the operation prolongs the duration of the case; and that there is danger of converting the serous effusion into a purulent one.

In regard to the first of these, however, experience has shown that in many cases a single puncture is sufficient, and that even when the fluid does reaccumulate, it is rarely to such an extent as to demand a repetition of the operation.

There is, again, no reason for supposing that the puncture, if properly performed, can in any way tend to prolong the case. In regard to the last objection, the cases recorded sufficiently show that if care be taken to

prevent the admission of air, there is not much reason to apprehend the conversion of a serous into a purulent collection, unless the constitutional condition is so impaired that in all probability the case would have passed into one of extensive empyema, had the operation not been performed at all. Indeed, it is proved by the direct experiments of Nysten and Hewson, that air injected into the pleural cavity does not the least harm to the serous membrane.

Since the recent introduction of the greatly improved apparatus for performing paracentesis, also, this source of danger is to a great extent removed. By means of Bowditch's instrument, or better still, by one of Dieulafoy's aspirators, the effusion can be withdrawn through a canula so fine that its puncture scarcely creates the slightest irritation, and at the same time with entire exclusion of air. In this manner, paracentesis has been performed repeatedly of late years, even in the acute stage of pleurisy, without being followed by any of the unfavorable results formerly so much dreaded.

In view of the various risks incurred in cases of excessive hydrothorax, Trousseau thus sums up his remarks upon the operation: "Whenever auscultation and percussion reveal the presence of a very large effusion, whether its formation has been attended with acute symptoms or not, which interferes seriously with respiration, even though dyspnœa is not marked; and when this effusion tends to increase, despite the active employment of local and general remedies for nine or ten days, the operation is indicated." He especially directs attention to the fact that the mere amount of dyspnœa must not be taken as a guide, since this may be absent, although there are at the same time evidences of grave interference with the oxidation of the blood. If, however, during the existence of such an effusion, spells of suffocative dyspnœa should ensue, or syncopal attacks, the operation is urgently called for.

In the *London Hospital Reports* for 1865, these views are warmly advocated and powerfully supported by Dr. Fraser, who believes that the operation should be more generally employed than at present.

We have already alluded to the fact that occasionally an extensive effusion will remain serous for a long time, but in the majority of cases, and especially in children, it sooner or later becomes transformed into pus. Indeed, so frequently does this occur, that West expresses his conviction that in every case of idiopathic pleurisy in childhood, in which fluid is poured out in considerable quantity, the effusion is either originally purulent or becomes so very speedily. In these unfortunate cases, where there is little or no disposition to absorption, where marked hectic fever and exhausting night-sweats soon set in and rapidly debilitate the patient, and where the most favorable result that can be hoped for is that the pus will either evacuate itself externally, or open into the lung and be expectorated, the operation of paracentesis should be undoubtedly performed.

It is evident, indeed, that paracentesis must here have many advantages, since in cases where the pus discharges externally spontaneously, it is almost invariably about the fourth intercostal space, and outside of the nipple, at a point therefore which renders it impossible for the pus to freely

evacuate itself, and which thus tends to keep open the fistula for a very long time. Again, it not rarely happens in these cases that the fistula does not lead directly into the pleural cavity, but that the pus has burrowed in the thoracic walls, leading to denudation and necrosis of the ribs or sternum.

The termination by the establishment of a pulmonary fistula, and the evacuation of the pus through the bronchial tubes, is a comparatively favorable one, but yet the case is apt to be more tedious, and certainly the lung-tissue must be much more seriously affected than when a free exit is given to the matter by the operation of paracentesis. In these cases, of course, the effusion will almost certainly form again, and either require repeated punctures, or a fistula will be established, through which pus will discharge almost daily.

In addition to the advantages afforded by relieving the system of this source of irritation, and giving the lung a chance to expand, paracentesis enables us also to introduce medicated fluids into the thorax, and thus to modify the diseased pleural surface. We will detail below the injections which appear to us most useful for this purpose.

Although, even under the most favorable circumstances, empyema is a most dangerous and not rarely fatal affection, numbers of cases are on record in which life has been undoubtedly saved by a recourse to this operation, and it has been noticed that the proportion of success is much greater in cases of children than of adults. Thus, out of 46 cases in childhood, 13 of which occurred in West's practice, no less than 35 terminated favorably, there being one death in every 4 cases.

In a recent paper by M. Guinier, of Montpellier (*Bull. de l'Acad. de Méd.*, t. xxx, p. 645; *Bien. Retrospect of New Syd. Soc.*, 1865–6, p. 152), the particulars of 31 cases from different authors are recorded. The patients were of all ages up to 14 years; as many as 16, however, were in their 7th, 8th, or 9th year. In one of his own cases, a rapid recovery was effected in a case of extensive sero-purulent pleural effusion in a nursing child one year old. The mortality was about 1 in 6; and in no instance does the operation appear to have done any harm, but, on the other hand, seems to have relieved suffering and retarded death even in the fatal cases.

One reason of this greater success in early life possibly is, that the much greater mobility of the chest-walls in children allows a rapid contraction of the thorax to occur after the pus has been withdrawn, so that the chest-wall comes in contact with the lung, which, in such cases, is always bound down by dense and strong adhesions; whereas, in adults, the more unyielding character of the thorax maintains a space between the two layers of pleura for a much longer time. On the other hand, it must be evident that this same greater mobility of the chest-walls will enable an excessive pleural effusion to be tolerated more readily, and with less injurious effect upon the thoracic organs, than can occur in the comparatively rigid adult chest.

The great deformity of the thorax which ensues upon empyema in childhood is rarely permanent, but as the lung slowly expands, the thoracic walls gradually regain their normal shape, the depression of the shoulder

disappears, and in the course of a few years at the farthest, scarcely any trace of distortion or contraction remains.

Our own opinion in regard to the propriety of this operation, and the indications for its performance, is as follows: In ordinary cases of pleurisy in children, with moderate effusion, it is unnecessary. When the effusion is very extensive, and causes marked displacement of the heart, distension of the affected side, and severe disturbance of breathing, the question of operating should always be raised, and if, after consultation with the parents, it is determined upon in case of necessity, all preparations for its performance should be made, and we should hold ourselves in readiness to perform it immediately on the appearance of urgent symptoms. Still so long as there is no reason to dread that the case is passing into the stage of empyema, we should recommend a faithful trial for several weeks of the internal remedies, especially digitalis and iodide of potassium, and of the local use of repeated applications of dilute tincture of iodine. In many cases where the effusion has been thus extensive and of quite long standing, we have thus obtained speedy and complete cures, without deformity of the thorax. If, however, positive reduction in the amount of effusion did not soon begin to show itself, we would unhesitatingly operate. Finally, in all cases where the symptoms lead us to conclude that the effusion is more or less purulent, the duty of immediate operation is an imperative one.

In regard to the performance of the operation itself, it may be said to present no difficulty whatever. All the sources of difficulty, and particularly the entrance of air, have been obviated by the improved means of operating lately introduced.

The procedure originally recommended by Trousseau is as follows: The patient being placed near the edge of the bed in a semi-recumbent posture, his body steadied by an assistant, a small incision is made through the skin in the sixth or seventh intercostal space, a little outside the line of the external border of the pectoralis major. An ordinary trocar, the canula of which is protected by a valve of goldbeater's skin, thin gutta-percha, or a piece of animal membrane of any kind, is then placed in this wound and thrust boldly into the pleural cavity, the precaution being taken of grasping the instrument so that not more than one inch shall be free, to avoid all possibility of wounding the lung.

It is preferable, we think, if a simple trocar and canula be used, that a piece of narrow india-rubber tubing should be attached to the end of the canula, and that the trocar should be passed through from the outside of the tube close to the canula, so that after the puncture into the chest has been made, the trocar may be withdrawn, when the little hole in the elastic tube will close and prevent any entrance of air. The free end of the india-rubber tubing should be carried under the surface of some water placed in a vessel intended to receive the effusion as it escapes. Thus we can simply but surely effect the withdrawal of the fluid without permitting the entrance of air.

These methods of operating have been almost entirely abandoned since the invention of Bowditch's syringe, and better still, of Dieulafoy's aspi-

rator. The latter instrument consists of a syringe, to be attached to the canula after its introduction through the chest-wall and the withdrawal of the trocar, and so constructed that by turning a valve, a vacuum is created in the barrel when the piston is drawn out. The valve being again turned, the fluid is sucked from the chest into the barrel of the syringe until this latter is filled. A still further turn of the valve establishes a communication with a lateral outlet; the piston is pushed home and the syringe emptied. The vacuum is then renewed, and so the operation is continued until the effusion has been withdrawn so far as desirable. Another improvement in the details of this operation, which has a great influence upon the degree of irritation caused by it, is the use of a very small canula for making the puncture.

It is necessary that the thrust given to the trocar should be fearless and quick, since if it be pushed in a hesitating way, the point may push before it the layers of false membrane which probably coat the pleura, and the effusion will not be reached. Should this accident occur, an attempt may be made to break through the false membrane by a probe introduced through the canula, or a second puncture must be made in a different place.

Different opinions exist in regard to the advisability of withdrawing the entire effusion at once, but experience has, we believe, shown that no unfortunate results need be apprehended from so doing. The last portions of fluid which escape are apt to be stained with blood, probably from rupture of the delicate new-formed vessels of the false adhesions.

The dressing of the wound should be as simple as possible, consisting merely of closing the incision by a piece of adhesive plaster, over which a pledget of lint may be secured by a bandage round the thorax.

Almost the only unpleasant symptom which follows the removal of the fluid is spasmodic cough, which often comes on in severe, and at times painful paroxysms. Syncope is scarcely ever noticed, if the patient be kept in a state of absolute rest after the operation. The internal remedies, especially the diuretics, should be continued, and Trousseau recommends, what we have also found useful, that the side should be painted with tincture of iodine.

When we have reason to believe that the effusion is purulent, which as we have already remarked, is very frequently the case in childhood, there are some points of difference in the operation. Thus we can have no hope that the effusion will not form again, and either require a second operation, or, as frequently happens, cause the cicatrix of the first puncture to re-open. Again, before the case is brought to a successful termination, it is often necessary to employ some medicated injections to alter the character and secretion of the pleural surfaces.

It is doubtful, therefore, whether the admission of a small quantity of air is very objectionable, although West believes that it almost always converts the previous healthy pus into a highly offensive sero-purulent discharge. The ill effects of this can be overcome by the injections to be recommended below; but, on the other hand, care must be taken not to admit so much air as would interfere with the expansion of the lung. It

is adviable on the whole, however, to perform the first puncture with the same care, and to employ the same dressing as in the case of serous effusion. But if a second puncture is required, or if the first one re-opens, the wound should be enlarged so as to admit a good-sized canula, which should be allowed to remain. This canula should be of silver, curved so that its extremity may not come in contact with the gradually expanding lung; and its shield should be furnished with a ring of caoutchouc, placed between the instrument and the skin, to prevent excoriation.

After the pus has been withdrawn, the pleural cavity may be washed out through the canula with tepid water, and then there may be injected about an ounce of a mixture of 1 part of tincture of iodine to from 4 to 7 parts of tepid water, effected by the aid of a little iodide of potassium.

The canula should then be closed by a cork, and not disturbed for twenty-four hours, when the accumulated pus should be withdrawn, and a second injection practiced. In the first injections it is better probably to allow the iodine solution to run out again; but after we have assured ourselves of its effect, it may be allowed to remain. Throughout the continuance of the treatment the pus should be allowed to escape at least once every day, though as the secretion diminishes the iodine injections may be practiced only at longer intervals, as once in two, three, or four days. The effects of these injections are usually very beneficial; they correct the fetor of the discharge, diminish its amount, and never, so far as we are aware, are productive of pain or increased inflammation. In cases where they appear to have lost their good effects, other agents may be substituted, as weak solutions of carbolic acid, chlorinated soda, or aromatic wine.

In cases which terminate favorably, the discharge diminishes gradually, though often very slowly, the chest contracts, and finally there is nothing left but a fistula, which for a short time discharges a few drops of serous pus before healing. As an example of the tolerance to this treatment shown even by young children, and of the good results finally obtained in many desperate cases, we would refer the reader to the extraordinary case recorded at length in Trousseau's *Clinique Médicale* (t. i, pp. 650–52), where, in a boy of 6 years, the canula was allowed to remain for eleven months, during which time medicated injections were constantly employed. The amount of pus discharged in all is estimated by Trousseau as not less than 80 pounds, and yet perfect recovery finally ensued, and at the date of the report the child's health was excellent.

Another method of operating in cases of empyema, which, following the example of Dr. H. Lenox Hodge of this city, we have performed with entire success, consists in passing a large curved needle with a stout handle, armed with fine rubber drainage-tube, into the chest through the soft tissues in an intercostal space, and bringing it out through the next interspace above. The needle is then unthreaded and withdrawn; the drainage-tube remains; the spot is covered with a poultice or a wad of oakum; discharge occurs freely through the tube; and it is easy to conduct any subsequent treatment, such as above recommended.

The following case is abstracted from the hospital record, as illustrating the excellent results of this mode of treatment:

Empyema of right side of 8 months duration: paracentesis: introduction of a drainage-tube, followed by entire recovery.

E. A., a healthy boy of 12 years of age, was attacked in February, 1875, with severe pleurisy on right side. The acute symptoms subsided in 7 weeks, but left him weak and short of breath. On admission to the Hospital of the University of Pennsylvania, the physical signs indicated an effusion on right side reaching up to clavicle, and it was evident from general symptoms that it was purulent in character. On October 13th, 1875, the day of admission, he was tapped by Dr. Pepper in the seventh interspace on line of anterior border of right axilla, and f℥xxx pus were withdrawn. A considerable amount still remained, and on October 22d, the effusion having reformed, a fine rubber drainage-tube was introduced around the seventh rib by means of a large curved needle. A wad of oakum was applied over this and secured in position by a bandage. The amount of discharge was at first very large, but steadily diminished. The chest contracted, the lung expanded partially, the heart returned to its normal position, and in February, 1876, he was discharged cured, the discharge having ceased and the opening closed after the withdrawal of the drainage-tube. The general treatment consisted of cod-liver oil, quinia, syrup of the iodide of iron, nutritious diet.

In October, 1876, one year after this operation he was carefully examined. The chest was found to have returned to its healthy symmetrical state, and all traces of the previous disease had disappeared.

During the course of such cases, every attention must be paid to sustaining the child's nutrition by abundant nourishing food, stimulus, if needful, bitter tonics, iron, and cod-liver oil.

We subjoin the following case to illustrate the remarks we have made upon the treatment of pleurisy, and to show the importance of faithfully employing suitable internal remedies before resorting to paracentesis, in cases where the effusion is serous and not so excessive as to seriously embarrass respiration.

Case of chronic pleurisy of the left side, beginning with acute symptoms; extensive effusion, with displacement of the heart to the right of the sternum: recovery.—The subject of the case was a boy four years old, of delicate stature and appearance, but enjoying good health. We saw him first at 1 P.M on February 12th. He was perfectly well the day previous, slept soundly during the night, and rose apparently in good health in the morning. He ate his usual breakfast but complained afterwards of feeling unwell. Soon after this he complained of headache, of soreness and weakness in the knees in going up stairs, and then of violent pain in the left side beneath the armpit.

At the time of our visit, he was in bed, in the following condition: pulse 130, full and strong; skin warm and moist; headache; sharp, severe pain at the præcordia, extending backwards under the armpit, and aggravated by motion, crying, and by deep inspirations; respiration quick and jerking. No cough at all; absolutely none. Abdomen natural; neither vomiting nor diarrhœa. Tongue slightly furred and moist. Action of heart violent; impulse strong and felt over a large space; sounds loud and strong; to the left, and beneath the nipple, a soft murmur with the second sound. Percussion dull over a larger space than natural.

Behind, percussion dull over whole of left side; natural on right side. Respiration natural on the right side; feeble and indistinct, without bronchial sound, on the left.

Ordered a teaspoonful, each, of extract of senna and syrup of rhubarb, to be given

immediately; to have a warm bath in the evening, and to take one of the following powders every two or three hours, beginning in the evening:

℞.—Pulv. Opii et Ipecac., ... gr. iij.
Potass. Nitrat., ... gr. vj.
M., et div. in chart. no. vi.

February 13. Passed a restless night. Better to-day. Pulse 130; softer; skin moist. Impulse of heart less violent. Pain not so severe. Respiration still quick, and when the child is excited or irritated, it becomes jerking, while at other times it is quiet. Physical signs as before, except that the murmur, with the second sound of the heart, is no longer heard. Ordered three ounces of blood to be drawn by leeches from the left side; powders to be continued so as to allay restlessness and pain.

February 14. Has had a better night. Pulse less frequent. Respiration 30, and without jerking; no cough at all; makes no complaints of pain. The appetite is returning.

February 15. Better in all respects; no fever nor pain; no cough. Physical signs as before.

The case went on until the 27th of March, when we paid our last visit, making the whole duration of the case over six weeks. During the last two weeks of February, there were no acute symptoms. The fever had disappeared entirely. The respiration continued, however, from 28 to 30 during all that time. The effusion occupied nearly the whole of the left side, which was manifestly larger than the right, and the intercostal spaces were protruded. Behind, there was total flatness on percussion, from the spine of the scapula downwards, and in front from a short distance beneath the clavicle. The respiratory murmur was absent in the lower three-fourths of the dorsal region, and feeble above. In front, respiration was heard only above and just beneath the clavicle. In the course of this period the heart was gradually forced over to the right side of the sternum, so that at last its impulse was felt, not to the left, but to the right of that bone. The cardiac sounds were loudest and most distinct in the same region. The displacement was so remarkable that the mother discovered it herself, as we had avoided telling her to save her from anxiety. The new position of the heart did not seem to produce any inconvenience in addition to that occasioned by the pleuritic effusion. During the last two weeks of March the child was kept in bed; his diet was milk and bread; a large Burgundy pitch plaster was kept on the side, and he took internally, vinegar of squill and tincture of digitalis.

Finding that the effusion remained stationary under this treatment, we prescribed a grain of iodide of potassium three times a day, in a teaspoonful of compound syrup of sarsaparilla. The diet was changed at the same time. He was allowed small quantities of meat every day, and was taken from bed and placed in a chair by the window. Under this treatment he gradually improved, so that by the 27th of March, when we paid our last visit, the effusion had in great measure disappeared, and he was able to play about the room all day. The side was slightly contracted; the respiration was pure and vesicular, but rather more feeble than on the left side; the heart had returned to its natural position.

We examined this child six years later, and found him to be in excellent health. Excepting a slight contraction of the left side, there was no perceptible difference between that side and the right.

ARTICLE VI.

PNEUMOTHORAX.

In this condition there is an accumulation of air in one or both pleural cavities. The source of this air is either from without, when there is an opening through the chest-wall; or from the bronchial tubes, when there is perforation of the pulmonary pleura. There are a certain number of cases recorded, in which it is supposed by the authors that a secretion of gas has occurred from the pleural surface, or that it has been directly developed from the decomposition of some inflammatory effusion in the pleural cavity; but the evidence upon which the possibility of such occurrences rests is insufficient, and for clinical purposes, at least, it may be assumed that where pneumothorax exists, there has invariably been some communication established between the pleural cavity and the atmospheric air. It is, therefore, to be regarded not so much as a distinct disease, as a complication of many other pathological conditions. There are peculiarities, both as to the cause and symptoms of this condition as it occurs in childhood, which render a separate account of it desirable. It is, however, certainly comparatively infrequent in children, owing in part to the rarity of the injuries and wounds, which often cause traumatic pneumothorax in adults; and in part to the fact that the diseases, especially empyema and tuberculosis with the formation of vomicæ, which are the most frequent causes of it in adults, are either less frequently attended with this complication in children, or are of comparatively rare occurrence.

Anatomical Appearances.—Pneumothorax may be found to exist on both sides, but as a mere pathological condition which, of course, must have produced death immediately. It is nearly always limited to one pleural sac, and before the thorax is opened, the affected side is observed to be distended, with prominent intercostal spaces. The percussion-phenomena, which will be hereafter described, persist, and it is sometimes possible by rapidly moving the body, while the ear is placed in contact with the chest, to develop a succussion-splash. If a small opening be made through an intercostal space, the compressed air will often be heard escaping with a hissing sound, and occasionally the current has so much force as to extinguish a lighted candle held near the opening. The air which escapes is usually, but not always, of offensive odor, in consequence of being tainted by the decomposition of the pleuritic effusion which is apt to coexist. If the entrance of air has followed a penetrating wound of the chest, or a compound fracture of the ribs, the familiar appearance of these lesions will be found. More frequently it has depended upon perforation of the pulmonary pleura, in consequence of some morbid action, and we may then detect the spot of perforation, and study its characters, by filling the chest with water and blowing through a tube into the trachea, when a stream of air-bubbles will be seen to rise through the fluid from the point of aperture,

unless this has been obstructed by layers of false membrane. The lung itself will be found more or less extensively collapsed, according to the nature of the lesion which has caused the perforation. It can rarely be inflated completely in consequence of the free escape of air through the pleural opening. The adjacent movable viscera are displaced by the pressure of the gaseous collection, even to a greater extent than in many cases of hydrothorax. The position of the perforation in the pleura varies, but is most frequently found at some part of the middle lobes, or the adjacent parts of the upper and lower lobes. We have, however, found two points of rupture in one case, both seated near the apex. The opening itself is usually rounded, or occasionally lenticular; in size it varies from one to three lines in diameter. The edges of the pleura are thin, and often softened and discolored. There may be but a single point of perforation, or several may coexist, either grouped closely together over an abscess of considerable size, or scattered over the surface of the lung (as in the case on the following page), each opening corresponding to a distinct abscess.

The condition of the lung varies exceedingly, and, of course, presents the appearances proper to the lesion which has caused the pneumothorax. Thus there will be found in about the following order of frequency, the appearances, elsewhere described in their appropriate places, of tuberculosis of the lungs (either in the form of softening subpleural miliary formations, or of small superficial vomicæ); of small superficial abscesses resulting from lobular pneumonia; of circumscribed apoplexy or gangrene of the lung; or of vesicular and interlobular emphysema with subpleural bullæ. In most cases, there are evidences of pleurisy associated, and the pleural cavity contains a variable quantity of fluid, either turbid or bloody serum, or ichorous pus; and, at the same time, the surfaces of the pleura may present patches or organized layers of lymph. Of course, these appearances will be most marked in cases where the perforation of the pleura has resulted in consequence of a previous empyema. In other cases, the fluids found in the pleural sac have in part escaped from the lung-tissue through the perforation, and are in part due to the pleuritic inflammation superinduced. The irritation caused by the mere admission of air into a healthy pleural sac is not always sufficient to excite inflammation, and thus in rare cases, where pneumothorax results from the rupture of an emphysematous bulla, the pleura may present no inflammatory exudation whatever. But in the great majority of cases, either from the fact that pleurisy coexists, or that there is an escape of pus from the lung at the time of perforation, the pleura presents the appearances above described. It occasionally happens that, owing to the previous existence of pleuritic adhesions over a part of the lung, the escaping air is circumscribed, and produces only a local pneumothorax. In such cases, of course, all the alterations of the thorax, as well as the attendant physical signs, are limited to the seat of the gaseous collection, and may, indeed, be associated with the evidences of chronic pleurisy, with retraction of the remaining parts of the chest. In still other cases, although the pleura has been perforated, the escape of air is entirely prevented by the existence of adhesions of the pleura over the point of rupture; or, as

in the interesting case reported on page 221, by the close apposition of enlarged bronchial glands.

The following case, which, owing to the absence of any clinical history, possesses chiefly an anatomical interest, may be given, as showing the usual conditions of a pneumothorax dependent upon pneumonia:

Case.—*Partial Suppurative Pneumonia: Superficial Abscesses, with Subpleural Emphysema: Perforation of the Pleura: Pneumothorax: Miliary Tuberculosis.*—Mary McC., aged 13 months, died February 11th, 1868, after a short illness, during which the most marked symptoms were dyspnœa and cough, with occasional vomiting. At the autopsy, there were all the physical signs present of pneumothorax of the left side. The *right* lung was found congested and partially collapsed, but admitted of complete inflation. In the posterior part of the fissure between the upper and middle lobes, the upper lobe presented a separation of the pleura from the lung to the extent of half an inch in diameter. On the apposed portion of the lower lobe there was a similar large bulla. The lung-tissue immediately subjacent to these cavities was consolidated to a distance of an eighth of an inch. On cutting into the bullæ, they were found to be distended with air and dark sanious pus, and their cavities presented minute trabeculæ and septa, consisting of bronchioles and the remains of ruptured air-vesicles. There evidently was no gangrene of the lung-tissue, so that it appeared that these lesions had resulted from a combination of patches of suppurative pneumonia of the superficial layer of the lung with subpleural emphysema; and it seemed reasonable to conclude from the unusual relations of the emphysematous bullæ, that they were due to the process of softening, which had opened a connection between some of the terminal bronchioles and the subpleural connective tissue. There were scattered miliary tubercles in the upper lobe.

The *left* lung presented two similar but larger bullæ (fully one inch in diameter), in exactly the corresponding position between the upper and lower lobes. There was a small perforation of the pleura in the one in the upper lobe. Two other similar but smaller cavities were found on the surface of the lower lobe, in each of which the separated pleura presented a perforation about one-sixth of an inch in diameter. There were traces of localized pleurisy in the neighborhood, but no adhesions; and a considerable pneumothorax had resulted, causing collapse of at least one-half of the lung.

The bronchial glands, spleen, and kidneys contained miliary tubercles. There was no decomposition of the tissues.

Causes.—Although, as already stated, pneumothorax is a comparatively rare disease in children, it will be found, when present, to occur most frequently in young children (under the age of 5 years), and especially in those of feeble constitution. The causes which directly lead to its development vary greatly in their relative frequency, as compared with the causes of pneumothorax in the adult.

Thus we find that the most fruitful cause of pneumothorax in children is unquestionably tuberculosis of the lungs. In adults this condition leads to perforation of the pleura usually only after the production of a vomica; but in children, excavation of the lung-tissue to any extent is rare in tuberculosis, and when it does occur is quite constantly associated with such close adhesions of the neighboring pleural surfaces, as would effectually prevent the escape of any air into the pleural cavity, even in event of a perforation of the walls of the cavity. It is found, therefore, that pneumothorax more frequently results from the softening of small

superficial tubercles, which involve the pleura and lead to its softening and perforation.

The next most fruitful cause of pneumothorax in children is probably pneumonia, when it passes on to the stage of suppuration with the formation of a superficial abscess, which seems most likely to happen when the inflammation occurs in a localized and circumscribed form. The three cases with which we have ourselves met were all due to this cause. It is probable that this unfortunate termination is much more frequent is secondary pneumonias (especially those following such diseases as measles, or, as in one of our cases, severe remittent fever), and, in a number of the cases, miliary tubercles have been found associated, as in the instance quoted above by us. In such cases the plastic exudation formed on the pleural surface is often too small to prevent the escape of air after the perforation has occurred.

Gangrene of the lung and the softening of superficial patches of pulmonary apoplexy, are mentioned by several authors, particularly by Rilliet and Barthez, as following next in order of frequency. But, according to our own observation, empyema, with consequent ulceration of the pleura and communication with the bronchi, although not so frequent a cause of pneumothorax in children as in adults, yet furnishes more cases than either of the former rare conditions. Occasionally, also, when the purulent fluid in empyema has discharged itself externally by an ulcerated opening in an intercostal space, air has found entrance to the pleural cavity, and produced a pyopneumothorax.

Finally, pneumothorax has been known to follow the rupture of a subpleural bulla in cases of interlobular emphysema. It is especially in such cases that the collection of air may be found without any coexisting liquid effusion. It is probable, however, that were life to be prolonged after such an occurrence, some pleural inflammation would be established, and lead to serous effusion.

In most cases the actual perforation of the pleura is the result of the progress of the pulmonary disease which has ultimately involved the serous membrane in its course; but it is probable that the rupture may be at times precipitated by any violent effort, particularly by a fit of coughing or severe vomiting.

Symptoms.—In some cases where the antecedent disease is a very grave one, and the strength of the child is greatly reduced, the supervention of pneumothorax is with difficulty detected, and death occurs from the sudden increase of obstruction to the respiration before an opportunity is afforded for careful examination.

The occurrence of the perforation is often marked by an abrupt and decided increase of the dyspnœa which has already existed in consequence of the preceding disease. It will, however, be readily understood that this increase in oppression is not of such constant occurrence in children as in adults, owing to the fact than in the former all acute diseases of the chest are apt to be attended with an extreme degree of dyspnœa. So, too, the sharp lancinating pain usually complained of by adults at the time of the development of pneumothorax may be latent, or only revealed by

increased agitation, and more hurried, shallow breathing. In some of their cases, Rilliet and Barthez observed a cough which they considered peculiar, and described as "short, frequent, jerking, painful or convulsive, and sharp or piercing;" and a similar cough has been noticed by other observers.

In cases where death does not occur very quickly, and where a careful examination of the chest can be secured, the physical signs of pneumothorax are much more characteristic than the general symptoms. The affected side is distended, and its intercostal spaces bulge slightly. The respiratory movements are overactive on the opposite side to atone for the marked impairment of motion of the affected one. Percussion over the seat of the pneumothorax gives either merely exaggerated resonance, or a tympanitic or amphoric sound. Frequently this morbid resonance will be found associated with dulness upon percussion in some parts of the thorax, owing to the coexistence of consolidation of the lung or of pleuritic effusion. It may also happen that if the distension of the affected side be extreme, the tympanitic resonance will grow more or less flat, owing to the overtension of the thoracic walls. According to the condition of the lung and the character of the opening in the pleura, the respiratory murmur may be absent, or be present as metallic bronchial breathing, or more frequently as pure amphoric breathing. The vocal fremitus has generally been found decidedly diminished. Metallic tinkling has been detected in several instances; it was observed by Barrier to be most distinct during the effort at coughing. We are not aware that a splashing sound, such as can so frequently be developed in cases of pneumothorax in the adult, by succussion, has yet been observed in children.

The adjacent movable viscera are found to be displaced by the pressure of the gaseous accumulation, especially in left-sided pneumothorax, where the dislocation of the heart to the right is very marked. Of course, if the pneumothorax be circumscribed, the above physical signs will be limited to the same spot.

It will thus be seen that the symptoms of this condition in children closely resemble those which it presents in the adult; but that in many cases it is impossible, owing to the great agitation of the child, to fully demonstrate their existence.

Course; Prognosis.—The course of pneumothorax in children is usually a rapid one. Occurring, as it does, as a complication of some serious pre-existing disease of the lung, it so increases the respiratory embarrassment as to generally induce death in from a few hours to a few days. In rare instances only is life prolonged for a few weeks. The prognosis, although regarded by Rilliet and Barthez as, on the whole, less unfavorable than in the same condition in adults, is still exceedingly grave, both from the serious character of the condition itself, and from the grave nature of the diseases (tuberculosis, secondary pneumonia, gangrene of the lung, interlobular emphysema) in whose course it occurs as a complication. Rilliet and Barthez observed one case where recovery ensued after the positive signs of pneumothorax had persisted for twenty days in

a boy 3 years of age. They regarded the case as originally one of pneumonia.

We have also observed a case, in a boy 11 years old, during an attack of secondary pneumonia, complicating a severe bilious remittent fever, where complete recovery ensued, though after a most violent illness; and it would indeed seem that, with the exception of the comparatively rare traumatic cases, the prognosis of pneumothorax in children is most favorable when it occurs in this connection.

Steffen (*Klinik d. Kinderkrankheiten*, bd. i, p. 137, *et al.*) expresses this opinion also, and places as the next most favorable variety that which is associated with empyema. Although it might be expected that pneumothorax resulting from the rupture of emphysematous bullæ would be of favorable prognosis, on account of the trifling amount of pleural inflammation which often attends that lesion, the fact is that this condition of the lungs themselves is so serious that a fatal result has followed in all cases so far recorded.

In regard to the *diagnosis*, it is quite true that the occurrence of pneumothorax in the course of one of the thoracic diseases which we have seen it may complicate is apt to be overlooked, either owing to the want of symptoms definite enough to arouse suspicion of the development of some new lesion, or to the difficulty of securing a careful physical examination of the chest. When, however, this physical exploration is made with the frequency and care which are demanded in every case of acute thoracic disease, especially when threatening symptoms exist, the characteristic physical signs will be determined, and can scarcely be attributed to any other than the true cause.

Treatment.—The management of pneumothorax must be considered always with reference to the primary disease which it complicates, and its occurrence must not be allowed to interfere with the prosecution of the treatment necessary for this. As it is evident, however, that this additional lesion will still further tax the vital powers, and as the only chance of recovery lies in maintaining life till the cause, if curable, is removed and the air absorbed, we would advise that all remedies capable of reducing the strength or disturbing nutrition should be discarded, and that by every means the system should be sustained. In addition, we should recommend the moderate use of sedatives—either in the form of the preparations of opium or hyoscyamus, associated with bromide of ammonium if the cough be very severe and paroxysmal, to quiet agitation and excessive dyspnœa, and to relieve the cough. Great relief will also be obtained by strapping the affected side with strips of adhesive plaster, overlapping each other, and reaching from the spine to the sternum, so as to restrict the mobility of that side to a great extent, and also to exert a considerable pressure upon it.

If the distension of the affected side and the pressure on the surrounding organs be great, and the evidences of impeded circulation and oxidation of the blood are threatening, recourse may be had to puncture through an intercostal space with a very fine trocar. Although the results of this operation must be regarded as palliative rather than curative in most

cases, yet as the paracentesis itself is attended with no danger, its performance is to be recommended whenever the signs of pressure from the accumulation of air in the pleural sac become alarming. It is especially in cases where there is a liquid effusion associated with the gas (constituting a hydro- or pyopneumothorax) that paracentesis will afford most relief. In one case of this kind, Hennig performed paracentesis, evacuating a large amount of purulent liquid and gas, with very great relief to the symptoms of oppression. The child, a boy of 4 years of age, lived four weeks after the operation, and then sank from exhaustion.

ARTICLE VII.

HOOPING-COUGH, OR PERTUSSIS.

Definition; Synonyms; Frequency.—Hooping-cough is characterized by a hard, convulsive cough, occurring during expiration, and accompanied by long, shrill, and laborious inspirations, which are called hoops. The cough occurs in paroxysms, which are terminated by the expectoration of tough phlegm, and often by vomiting.

The disease is known by various other names, of which the most common are tussis ferina, chincough, and kincough. The *frequency* of the disease is exceedingly variable, as it occurs both in the sporadic form and as a widely-prevailing epidemic. Some idea of its frequency may be gained from the facts that, during the five years from 1844 to 1848 inclusive, there were 390 deaths from it in Philadelphia, under 15 years of age, out of a total mortality of 31,162. During the five years from 1864 to 1868 inclusive, there were, out of a total mortality of 76,354, 543 deaths from hooping-cough; a proportion considerable smaller than that during the first period of five years above mentioned. The irregularity is even more strikingly seen by comparing single years with each other: thus, while in 1867, there were but 65 deaths from this cause, there were no less than 208 in 1862.

Causes; Age.—It occurs generally in children, and may be met with in the first weeks of life; indeed, Watson in his lectures, mentions a case where the mother, during the last week of her pregnancy, lived in a house where the disease was prevalent, and her infant hooped the very day it was born. Of 208 cases in children, in our own private practice, 26 occurred in the first year of life, 147 between the ages of 1 and 7 years, and 35 between 7 and 12 years. To be more explicit, we will state that of 188 cases in which the age was accurately noted, 11 occurred in the first six months of life; 9 between 6 and 12 months; 30 in the second year; 17 in the third, 32 in the fourth, 17 in the fifth, 30 in the sixth, 16 in the seventh, 13 in the eighth, 8 in the ninth, 3 in the tenth, and 1 in the eleventh and twelfth years of life each. Of 130 cases in children, col-

lected by M. Blache, 106 occurred between 1 and 7 years of age, and only 24 between 8 and 14. Of 29 cases observed by MM. Rilliet and Barthez, there were 26 between 1 and 7 years, and 3 between 8 and 12. It is stated by MM. Blache, Rilliet and Barthez, and Valleix, to be most common in girls. Of 208 cases observed by ourselves, 106 occurred in boys, and 102 in girls. Some writers have asserted that certain *constitutions* and *hereditary influence* predispose to the disease. So far as our own experience goes, it has seemed to attack indifferently those who were simultaneously exposed to it. The fact of its being propagated by direct *contagion* is proved beyond doubt by numerous observations. We have rarely known one child in a family to be attacked without its extending to all the others not protected by having had the disease previously. That it often appears also in the form of an *epidemic*, is established by the testimony of many writers, so that at present no doubt is entertained upon this point.

Symptoms.—It is customary to describe three stages of hooping-cough. The first is called the stage of invasion, or the catarrhal stage; the second the stage of increase, or the spasmodic stage; and the third the stage of decline, which is characterized by an amendment of all the symptoms.

First Stage.—The great majority of the cases begin with the ordinary symptoms of simple catarrh. These are coryza, sneezing, slight injection of the conjunctivæ, and dry cough. The cough rarely has any peculiarity in the beginning which will enable us to distinguish it from that of an ordinary cold, though some persons have asserted that they could recognize it. We have often listened with great care to the sound of coughs which parents supposed might be hooping-cough, but were always obliged to confess our inability to determine, until time gave them more decided characters. In addition to the symptoms enumerated, there is generally more languor, lassitude, drowsiness, and irritability, than are commonly present in simple catarrh. In a small proportion of cases the first stage is wanting, and the disease assumes its peculiar features from the first. The duration of this stage is very uncertain, and is ascertained with difficulty. Our own experience would fix it at about two weeks as the average, though it may last undoubtedly a much shorter or longer period. The earliest period at which we have known the distinctive hoop of the disease to be heard was in three days. In another case it was five days. We have also known it to appear at a later period than usual. In a good many instances it has been as late as three weeks, but very rarely later.

Second Stage.—At the beginning of this stage the disease has assumed its peculiar convulsive and paroxysmal character. It consists of violent fits or paroxysms, or as they are often called, kinks of cough, recurring after longer or shorter intervals. Just before the paroxysm the child seems restless, anxious, and irritable, or else keeps perfectly quiet and evidently tries to retard its approach. When it begins, the child, if lying down, rises up suddenly, or if playing about runs to take hold of some fixed object, by which to support itself during the accession. The cough is dry, spasmodic, and sonorous, and occurs in a succession of short, rapid expirations, by which the thorax seems to be emptied of all its air with violent efforts. It is followed by one or two long and deep inspirations, which are accompanied

by the peculiar hoop to which the disease owes its name, and which is caused by the drawing of the air rapidly and forcibly through the narrowed glottis, which is spasmodically closed. During the fit the face becomes deeply suffused or even purple, and swollen; the eyes are watery, and the countenance is expressive of great anxiety, and after the fit is over, of fatigue and exhaustion. The latter symptoms are, as M. Valleix remarks, the signs of partial asphyxia, and are the result doubtless of the complete expulsion of air from the thorax, and a consequent partial suspension of the function of hæmatosis. There is almost always an expectoration of colorless ropy fluid, often accompanied by vomiting, at the close of the fit of coughing, and the patients usually appear weak and languid for a short time, after which they return to their play.

In very severe cases there are other symptoms in addition to those just mentioned. *Hæmorrhages* from the mouth, ears, nose, lungs, and beneath the conjunctivæ, are not unusual. We have ourselves seen several instances of epistaxis, one of effusion into the eyelids, a few of extensive subconjunctival ecchymosis, and we are well acquainted with the history of another case, in which there was bleeding both from the nose and ears. In one case, in a girl between five and six years old, that occurred to one of ourselves, in which the paroxysms were violent, the spells were accompanied in the latter half of the fourth and in the fifth week, by a discharge of a good deal of blood from the mouth. This took place particularly during the night-spells, so that in the morning the basin would contain several teaspoonfuls of blood. It was not from the nose. It was bright in color, pure, except that it was intermingled with sero-mucous expectoration, but it was not intimately blended with the sputa, nor was it streaked through the mucus as it sometimes is in the pneumonia of children. On one occasion it was seen to fly from the mouth in a little spirt, as though from a vessel. The child was lively and well all this time, playing about, eating well, strong, not thirsty, without pain, not oppressed between the spells, and sleeping naturally between the paroxysms at night. The only altered physical sign was slight dulness on percussion over the upper part of the right lung behind, with some subcrepitant râle at that point, but without bronchial respiration. After lasting twelve days, it ceased; the child got well gradually, and continues strong and hearty to the present time. In another case, in a girl two years of age, which came under our own observation, a species of syncope, a state of insensibility without convulsive movements, accompanied by great paleness, occurred after many of the paroxysms.

We have met with general *convulsions* in 12 cases, 5 of which proved fatal. In 2 other cases, both occurring in infants under six months, the paroxysms of cough were accompanied by the most violent struggling and oppression, and by deep blueness of the hands and feet, like that of severe cyanosis.

In some instances, after the paroxysm is apparently over, the child will begin within a few instants to cough again, and may in this way have several fits in such rapid succession as to make an almost continuous paroxysm. It is quite common for this to happen twice, and in one case which we saw,

it occurred three times on several occasions. The ordinary *duration* of a paroxysm or kink, is from a quarter to three-quarters of a minute, though it may last as long as two minutes, or according to some even longer. In a case that occurred to ourselves, one paroxysm lasted the extraordinary period of fifty-five minutes. That it was really a paroxysm of the disease, we are quite sure, as it chanced that we reached the house shortly after it began, and witnessed the greater part of it ourselves. The number of accessions in twenty-four hours is very irregular. It depends chiefly on the stage and violence of the attack. During the height of the disease, we have generally found them to number about 40. In some rare cases, however, they are much more numerous, and amount to 70 or 80. They are generally most frequent in the course of the third or fourth week, after which they remain stationary as to frequency for several days, or for two or three weeks, and then decline gradually. The paroxysms may occur spontaneously, the child being often disturbed from sleep by their sudden occurrence, or they may be excited by various circumstances, such for instance as contrarieties, a fit of crying, change of position, eating, violent exercise, and imitation. We have frequently seen an attack brought on by the sight of another child in a paroxysm of the disease. The duration of the second stage may be stated to be about 30 or 40 days in most cases.

Third Stage.—It is impossible to fix a precise limit from which to date the beginning of this stage. It is generally, however, said to commence from the time when the disease is evidently on the decline. The paroxysms now grow less frequent and less violent, the cough reassumes some of the catarrhal features which it had at first, and gradually loses its peculiar spasmodic character. The child's general health improves, the appetite becomes vigorous, the strength is invigorated, the sleep again becomes sound and tranquil, and the disease disappears. The *duration* of this stage is uncertain, like that of the two others. MM. Rilliet and Barthez state it to be short in uncomplicated cases (ten to fifteen days), and are of opinion that when it has been supposed to have lasted several weeks or months, it has been the result of some complication, as chronic dilatation of the bronchia, tubercular disease, etc. It happens not unfrequently, however, that after the disease has apparently ceased, all the distinctive characters of the cough recur, if the child chance to take cold within a few weeks or even longer after its disappearance.

In cases of pertussis unaccompanied by complications of any kind, there are no marked *general symptoms.* There is seldom any fever, the appetite continues good, and with the exception of occasional languor and fatigue, and irritability of temper, the child appears to be well.

Urine.—No accurate analyses of the urine in pertussis appear to have been made. Gibb and Johnson, however, state that they have found sugar in variable quantities in almost every case. This question appears well worthy of full investigation, since, if this statement is confirmed, it would link itself in the most interesting manner with the other evidences in this disease of irritation of the pneumogastric nerves, which are at least somewhat concerned in the glycogenic function of the liver.

The *total duration* of the disease, in simple cases, may be set down at from

one to three months. We have never known a case to last so short a time as a month, and have rarely found the whole duration much within three months.

Complications.—Though it has happened to us, on several occasions, to meet with children who have been very ill from the violence of the disease under consideration in its uncomplicated condition, we have never known a case to prove fatal except in consequence of some kind of complication. It is exceedingly important, therefore, that the various accidents apt to occur in the course of the disease should be carefully considered.

Convulsions.—This complication is not a rare one, since it occurred in 5 of 29 cases observed by MM. Rilliet and Barthez, and in 12 of 208 observed by ourselves. It is one of the most dangerous accidents liable to occur in the course of the disease. Of the 7 cases reported by the authors quoted (5 of their own, and 2 belonging to M. Papavoine), 6 died. Of our 12 cases, 5 died. In all that we have seen, the convulsions were general, extremely violent, and accompanied by insensibility in the fatal cases to the last, and in the favorable ones, during from a few minutes to half an hour. In two of the fatal cases the pertussis had lasted nearly two months, and was accompanied by extensive bronchitis. The fatal event took place within twenty-four hours from the supervention of the spasms. The subjects were eight and nine months of age respectively. In the third case, the convulsions came on in the seventh week of the disease, in a child who had been laboring for a number of days under bronchitis. They ended fatally in seven hours. In the fourth they occurred in a child in the second year of its age, at the end of about four weeks, proved fatal in two days, and were caused by bronchitis and collapse of the lung-tissue. In the fifth case they occurred likewise in a child in the second year of life, were attended with violent laryngismus and contraction, and proved fatal in the third week of the disease.

One of the favorable cases occurred in a child five months old, who had been attacked with bronchitis three days before the occurrence of the convulsions, which came on during the height of a severe paroxysm of coughing. The convulsive movements were general, and continued for about half an hour, after which the child was drowsy or irritable for some hours longer. The hooping-cough continued to be severe for two weeks after this, as many as 42, 46, and 48 paroxysms occurring every day. At last, however, perfect recovery took place. The second favorable case was that of a girl between two and three years old, in whom a convulsion occurred in the third week of the disease, before the paroxysms had become violent, and evidently in consequence of an attack of fever dependent upon dentition. The seizure lasted only a few minutes, was followed by drowsiness for a few hours, but on the following day all the unpleasant symptoms had disappeared. In a third case, in a boy between two and three years old, a violent convulsion occurred at the end of the second week, at the beginning of an attack of pneumonia. The child remained very ill, and nine days afterwards had another convulsion, which was much slighter than the first. After this he gradually recovered. In a fourth case, in a girl between two and three years old, a slight but well-

marked convulsion occurred at the onset of an attack of bronchitis, which took place at the beginning of the third week of the hooping-cough. The bronchitis proved to be very severe, but there was no return of the spasm, and the child recovered. In a fifth case, in a boy nine months old, a severe fit occurred in the sixth week, just after the child had been brought home from an expedition to procure his daguerreotype. It lasted fifteen minutes, and was attended with total insensibility, and purple discoloration of the face, but in half an hour after, the patient was nursing well, and was entirely conscious. There was no return of the convulsions, though the disease was very severe after this attack. In the sixth case, also in a boy nine months old, a slight convulsion occurred during one of the paroxysms in the fifth week, but was not followed by any bad consequences.

Amongst the complications ought to be ranked, we think, though this has not generally been done by writers, an excessive degree of the laryngismus which constitutes one of the natural and essential features of the disease. In some children, in fact, and especially in those of a nervous temperament, and in the anemical and debilitated, and, likewise, in certain epidemic types of the disease, this laryngismus assumes a degree of severity which is not only distressing but positively dangerous. In one case that occurred to ourselves, in a child who had suffered many months before from laryngismus and contracture, the occurrence of hooping-cough reproduced the laryngismus, and after a few weeks caused death almost instantaneously, at the beginning of a paroxysm, as the child was sitting upon the floor, where it had been placed only a few moments before to play, it having presented before this no very threatening symptoms. In another case, in which we could detect no other complication, the spasm of the glottis was so very violent, that after a few days the spells were attended with convulsions, and very soon ended fatally. In a third, this symptom was so violent that in many of the spells the child ceased for the time to breathe, seemed to faint, became entirely unconscious, and had to be fanned and carried to an open window to be revived; this patient ultimately recovered. In a great many cases, this symptom, without other complication, has been most distressing, and has required particular treatment.

Collapse of the Lung-Tissue.—The recent discoveries in regard to the pathological change in the pulmonary tissue called collapse, and especially a consideration of the causes by which collapse is produced, might well lead us to suppose that pertussis, and especially the bronchitis of pertussis, would be very apt to become associated with collapse. Late researches accordingly show that of all the lesions met with in hooping-cough this is much the most frequent and important. Dr. Graily Hewitt, of London, in a lecture on the pathology of hooping-cough, read before the Harveian Society of London, in 1855, shows "that the catarrhal inflammation of the bronchial tubes, which occasions hooping-cough, is, in fatal cases, attended almost universally with collapse of the lungs." He states that his observations were made upon nineteen subjects, whose age varied from four years to one month, the average being eighteen months. "In

all, the state of the lungs was carefully noted. The chief lesion found after death was collapse of the lung-substance. The following is a statement of the degree to which this pathological condition manifested itself in the different lobes of the two lungs.

"In the *right lung*, portions of the upper lobe were found collapsed in six cases, and in four more to a less degree. The middle lobe was collapsed, wholly or in part, in sixteen cases. The lower lobe was more or less affected with collapse, in eighteen cases. In the *left lung*, the upper lobe presented the same lesion in fifteen cases, the whole of the anterior tongue-like prolongation being in most of the cases affected. The lower lobe was collapsed more or less in eighteen cases. In seven of the cases, the portions collapsed were also congested, in some to a high degree.

"The test of MM. Bailly and Legendre, viz., the inflatability of the portions of the lung thus affected, was used in almost all the cases; and on that and other grounds, it was determined, that the particular part of the lung in question was collapsed and not hepatized.

"It will be at once perceived, that the occurrence of collapse was almost universal; all the cases, with the exception of one, in which there was extensive tuberculization of the lungs, presenting a greater or less amount of lung-substance affected in this manner."

We have had but few opportunities of testing this matter for ourselves by post-mortem examinations; but in one case to which we were called in consultation, that of a boy not quite a year old, this lesion was shown, by autopsy, to be present to a great extent. The child had had the disease during three months with considerable severity. He was thought to be doing well, until he was taken one day a long drive into the country. After the ride he seemed very much fatigued, and that night was seized with very great dyspnœa, increased violence of the coughing spells, and after a short time with general convulsions. We saw him on the following day. He was breathing very rapidly and with much effort, there was a good deal of subcrepitant râle through the chest, the skin was cool, and about the mouth had a cyanotic tint, and he was unconscious. The same symptoms persisted through the day with occasional convulsive seizures, and on the following day he died. At the autopsy, there was found very extensive collapse of both lungs, as proved both by the anatomical appearances, and by inflation. There was no pneumonia, and very moderate bronchitis.

Bronchitis has always been supposed to be the most frequent complication of hooping-cough, and there can be no doubt that it is one of the most important. The recent discoveries of the existence and nature of collapse have shown, however, that many of the fatal cases, hitherto ascribed to bronchitis, or to bronchitis and pneumonia combined, must have been cases of collapse, so that large allowances must be made for all statistics collected before the discovery of the true nature of the last-named lesion.

There is, as has already been stated, a certain amount of pulmonary catarrh in every case of hooping-cough. This is a normal element of the disease. To constitute a complication there must be a true bronchitis, an inflammation of the bronchial mucous membrane, sufficient to produce the

ordinary symptoms of that disease. This exists in a great many cases; MM. Rilliet and Barthez found it to exist either alone or combined with pneumonia in half of the fatal cases. Of the 208 cases observed by ourselves, it existed to a greater or less extent in 42. In 28 of these it was mild or only moderately severe, and of these all but one recovered. In 14 it was severe and very extensive, or else capillary, and of these 6 died. Of the fatal cases, it was in several no doubt attended with collapse of the lung-tissue. In fatal cases, it has often been found accompanied by continuous dilatation of the smaller bronchia.

Pneumonia, according to the authors above quoted, is about as frequent as bronchitis. When, however, the fatal termination took place soon after the beginning of the disease (18th, 26th, or 27th days) it was not generally present. After these periods, on the contrary, it was almost always observed. As these authors, however, include under the title of lobular pneumonia, many cases of bronchitis with collapse, it is clear that a large number of their cases of supposed pneumonia ought to have been ranged under the head of bronchitis. For our own part, we have met with only five well-marked cases of pneumonia. Two of these occurred in girls of seven and nine years old respectively, one in a girl between one and two years of age, a fourth in a boy between two and three years old, and a fifth in a boy in his ninth year. They all recovered. The degree of danger from this complication is in proportion to the earliness of the age at which the disease occurs, and to the extent of the inflammation.

Emphysema undoubtedly follows or accompanies hooping-cough in some cases. In a considerable proportion of fatal cases the lesions of vesicular, and, less frequently, of interlobular emphysema are discovered. These will be found described in full in our article upon the latter affection, where we have also alluded to the rare occurrence of emphysema of the subcutaneous tissue of the neck, and even of the entire body, as a consequence of the free escape of air into the connective tissue of the lung, and thence into the mediastinal spaces. It is therefore probable that, in cases of pertussis which end favorably, but in which the paroxysms of cough have been severe, a less degree of emphysema occurs, which in most instances speedily passes away after the disappearance of the primary affection. Indeed, as nearly all the children whom we have attended with hooping-cough, continue under our charge, and as only in a very few cases do any symptoms of emphysema persist, we must conclude either that it less frequently attends pertussis than would naturally be supposed, or else that the lung-tissue soon regains its elasticity, and the overdistension of the air-vesicles disappears. In some instances, and especially in those where chronic bronchitis follows the attack of hooping-cough, all the symptoms of emphysema may gradually develop themselves.

Vomiting is a very frequent incident in pertussis, but ought not to be regarded as a complication, unless dependent on some disease of the digestive organs, or symptomatic of cerebral disease. Where it occurs in simple cases, or in those complicated with bronchitis or pneumonia, it has always seemed to us to be advantageous.

Tuberculosis and *scrofula* are not infrequently found to follow hooping-

cough, in cases where a marked predisposition to these conditions exists. The tuberculous affection is most apt to take the form of pulmonary or bronchial phthisis. These sequelæ are frequently observed in hospitals, and among the ill-fed and feeble children of the poor, but are comparatively rare among the better classes of society.

Diagnosis.—The diagnosis of pertussis is difficult only during the first stage of the complaint. It is impossible, indeed, to distinguish, during that stage, between it and simple mild laryngitis, or the mild catarrhal attacks which are so common in our climate. After it has once fairly entered upon the second stage, it is scarcely possible to confound it with any other malady. MM. Rilliet and Barthez state, however, that acute bronchitis with paroxysmal cough is not unfrequently mistaken for pertussis, and we recollect perfectly having made this mistake ourselves, in a little girl, five years of age. The cough assumed so exactly the features of pertussis, that after waiting a few days we announced, authoritatively, the presence of pertussis. Only three or four days after this we were forced to take it all back, for the whole thing had disappeared, bronchitis, pertussis, and all. The patient was entirely well. But the mistake need seldom be made, if it be recollected that in acute bronchitis with paroxysmal cough, the invasion is sudden; that there is violent fever, great dyspnœa, and the physical signs of bronchitis; that the hoop is generally wanting, or feebly marked, and that the disease is violent and rapid in its course; all of which circumstances are widely different from what occurs in pertussis.

The same authors assert that tuberculosis of the bronchial glands gives rise to a cough which may be mistaken for pertussis. The following table extracted from their work will show the differences between the two disorders:

PERTUSSIS.	TUBERCULOSIS OF THE BRONCHIAL GLANDS.
Often epidemic, attacking several children at once; transmissible by contagion.	Always sporadic; non-contagious.
Three distinct stages, of which only the second is accompanied by kinks.	No distinct stages.
Kinks attended with hooping, ropy expectoration, and vomiting.	Kinks generally very short, without hooping, ropy expectoration, or vomiting.
Pure respiration in the intervals between the kinks.	Physical signs of tuberculosis of the ganglions; but, in certain cases, absence of these signs.
In the intervals between the kinks, respiration and pulse natural, so long as the disease is simple.	Accessions of asthma in some cases, with the kinks; continuous febrile movement, with evening exacerbations, sweats, progressive emaciation, etc.
Voice natural.	Voice sometimes hoarse.
Course generally acute.	Chronic course.

We would add that we have known the paroxysmal cough attendant upon the development of miliary tubercles in the lungs to simulate hooping-cough so closely as to render it very difficult to distinguish them. In

one case where this resemblance was very great, the circumstances rendered the diagnosis additionally difficult. The patient, the eldest of three children, had a perfectly well-marked attack of hooping-cough in his fourth year. Two years later, his little brother and sister contracted the disease in a marked form. Nearly at the same time, the eldest boy, then about six years of age, was attacked with severe paroxysmal cough, recurring in kinks, often inducing vomiting, and occasionally terminating with a sort of hoop. Physical exploration of the chest yielded only negative results. Still our suspicions were aroused by the facts that a previous attack had occurred, that the hoop did not become so perfectly developed as in true hooping-cough, and that there were progressive emaciation and weakness to an unusual degree. In the second month of the cough, the symptoms of tubercular meningitis appeared, death ensued, and, at the autopsy, in addition to tuberculosis of the membranes of the brain, the lungs and spleen were studded throughout with numerous miliary granulations. In the meantime, the two younger children passed successfully through the stages of hooping-cough and entirely recovered.

Prognosis.—Pertussis is rarely a dangerous or fatal disease so long as it remains simple. Of the 208 cases observed by ourselves, 143 were simple, all of which recovered. Nevertheless even the simple disease does sometimes terminate fatally, from the excessive violence of the paroxysms of coughing.

The danger in hooping-cough, which is considerable, depends, therefore, almost entirely on the complications which are so apt to occur, for which reason the physician should watch with the closest attention, in order to prevent their occurrence, and that he may recognize and treat them in their earliest stages. The most dangerous complication is convulsions, and after that bronchitis and pneumonia. So long as the child seems well and lively, and without fever or dyspnœa, in the intervals between the fits, there is nothing to be feared. But if, on the contrary, it becomes languid and irritable, with indisposition to take food, feverishness, and some increase of the rate of respiration, the practitioner should be upon his guard. A very early age and natural delicacy of constitution, are unfavorable circumstances in the disease. Some form of complication occurred in 65 of the 208 cases observed by ourselves. Of the 65, 12 died.

Five of the 12 fatal cases ended with convulsions. Of these 5 cases, the convulsions were caused by bronchitis and collapse of the lung in 4, the fatal result being the consequence, in fact, of the lung complication. One of the cases was independent, apparently, of disease of the lung (though, as no post-mortem examination was made, this cannot be asserted positively), but seemed to be the result of the violent laryngismus, with contracture and general convulsions, such as will be described in the article on laryngismus stridulus. Two of the cases occurred in children of eight and nine months old, respectively, and proved fatal in twenty-four hours after the setting in of the convulsions. Two others occurred in children in their second year, and the fifth occurred in a boy between three and four years old, and caused death in seven hours.

Of the remaining seven fatal cases, one was the result of collapse of

the lungs, supervening suddenly upon a mild bronchitis, in a twin child between two and three months old. The second was caused by tubercular disease of the lungs, in a child between three and four years old, and the remaining five by bronchitis, associated, to a greater or less extent, in all probability, with collapse of the lung. Of the last-mentioned five cases, one occurred in a child between five and six months old, and was rapid in its course; two occurred in children between one and two years old, one being rapid and the other lingering in its course; one occurred in the third year of life, and was attended with severe diarrhœa from teething, as well as with bronchitis and collapse; and the fifth occurred in a child in its fourth year, and was slow and gradual in its course. To sum up, it may be stated that of the 12 fatal cases, 10 were the result of bronchitis and collapse, 1 of tuberculosis of the lungs, and 1 of laryngismus stridulus.

Nature of the Disease.—There is no essential anatomical lesion in pertussis, except, perhaps, slight inflammation of the bronchial mucous membrane. In most of the cases, the membrane lining the larger and smaller air-tubes, and very rarely that of the trachea, is reddened and perceptibly thicker than natural, and the tubes contain a considerable quantity of frothy mucus, or a thick, viscid, and tenacious phlegm.

As to the nature of the disease, it seems to us very clear that it ought to be regarded as comprising two elements of morbid action, one of which consists in slight inflammation of the respiratory mucous membrane, and the other of disordered action of the respiratory system of excito-motor nerves. It is neither a pure neurosis nor a pure inflammation, but partakes of the characters of both, and much more of the former than of the latter. The authors of the *Compendium de Médecine Pratique* (t. ii, p. 526) regard it as a neurosis, on the following grounds: "1. In the greater number of cases the respiratory apparatus presents no kind of alteration, or else the lesions are so multiplied or variable, that they are surely not the real origin of the disease. 2. The clearly remittent course of the symptoms, and the total absence of fever, unless some complication is present, are not observed in ordinary or even specific inflammations. 3. The cessation or sudden return of the paroxysms, under the influence of moral emotions or change of place, belong to a disorder of innervation, and not to inflammation, which commonly passes through certain stages before it is resolved. 4. The complete return to health, the integrity of all the functions in slight cases, the resistance which it opposes to treatment, the uselessness of antiphlogistics, and the success obtained from narcotics and antispasmodics, are all so many circumstances peculiar to hooping-cough and to many of the neuroses."

It has, however, so many points of resemblance to the various constitutional diseases, as its undoubtedly contagious nature, the facts that it runs a definite course, and that one attack protects the system against a second, that it also probably depends upon a morbid state of the blood, due to the introduction of some specific poison which possesses the peculiar power of irritating the pneumogastric nerves.

Treatment of Simple Pertussis.—Hooping-cough, like all other diseases, varies greatly in its degree of severity. It is sometimes an affair of

no consequence scarcely, the patient passing through its stages without suffering, and without any injurious consequences whatever to the general health. We have known a large family of children to pass through the disease without other treatment than attention to a prudent hygiene, and with no other medicine than a few doses of a mild cathartic, given to relieve some uncomfortable gastric symptoms. We have known one child in a family where the disease was prevailing at the time, to have the cough for only five weeks, and to hoop only on two or three occasions, and to lose neither appetite nor spirits for a moment. Such cases evidently need no interference, and a wise physician will, in such, order no drugs. His business will be simply to direct that the child be guarded against cold and against imprudences in diet.

In other instances the disease assumes, from a very early period, or sometimes not until later, a character of a very different kind. Without any complication whatever, the natural symptoms of the disease develop in great intensity. The spells of coughing are very frequent, very violent, and very long-continued. Instead of some twenty spells or less in twenty-four hours, as is the rule in mild and moderate cases, the patient will average two or more every hour, having fifty or sixty spells in the day. The laryngismus, instead of being slight, will be violent and distressing, so that in lieu of three, four, or five hoops in a paroxysm, there may be fourteen or fifteen, and these so shrill, acute, and prolonged, as greatly to exhaust the poor little patient. Or the laryngismus may be so intense as to close for a few seconds the glottis, and arrest entirely the respiration, giving rise to the most painful attacks of struggling and suffocation possible to behold. Or the vomiting may be so frequent as seriously to interfere with the nutrition of the child, and thus cause threatening and even dangerous debility. In certain families, and in certain epidemic types of the disease, it assumes these severe features, and such cases must take the same rank in this disease that grave cases of scarlet fever, measles, or variola, take in those affections.

Cases of this latter kind imperatively demand treatment, and they are, we are happy to state, susceptible very generally of great and striking alleviation, by the use of proper means,—means, too, which in themselves are very safe.

At one time we were very much disposed, we confess, to avoid all interference so long as we saw no complication in the case, under the supposition that the disease in its simple form was always safe, and might be trusted to the efforts of nature. More enlarged experience has taught us, however, that the very violence of the disease, even in its simple form, was a source of danger; and that, moreover, such severe cases were much more liable than milder ones to complications, while a proper treatment, instituted so soon as the disease began to show these severe characters, has almost always, after a few days' perseverance, brought about and maintained a most evident amelioration of the symptoms, thus keeping within due bounds a development which might otherwise have gone on to a disastrous termination.

Bloodletting.—Depletion is very rarely necessary in simple pertussis.

The only cases in which it can be called for are those occurring in sanguine children, where the laryngismus is so extreme and the paroxysms so violent as to lead to great engorgement of the right side of the heart, and even to endanger the brain by overdistension of the veins. Under these circumstances, we might resort to venesection merely for the mechanical relief afforded, as recommended under similar conditions in pneumonia. In such cases only then, a small bleeding, or the application of a few leeches to the temples or behind the ears, may be proper; but even these may generally be safely treated by reduced diet and by a few doses of saline cathartics, without a resort to the more powerful and more permanently exhausting means of depletion. As for the treatment of simple pertussis by repeated venesections, in the hope of curtailing its duration, or under the idea of their being rendered necessary by the violence of the malady, it seems to us forbidden by the present state of medical knowledge, which informs us that the greater number of the cases do not endanger life so long as they remain simple, however violent they appear to be. Of the 143 simple cases treated by ourselves, depletion was not used in any, and all recovered.

Narcotics and Antispasmodics.—Of the various remedies of this class which have been more or less extensively employed, the most important are belladonna, opium, and hydrocyanic acid. Assafœtida and, of recent years, several of the bromide salts have also been much used with apparent success.

Belladonna is highly recommended by several German authors, by MM. Rilliet and Barthez, who state that it is beyond contradiction the one most deserving of confidence, by Trousseau and Pidoux, and by numerous English and American writers. MM. Trousseau and Pidoux employ the following formula:

℞.—Pulv. Belladonnæ, ... gr. iv.
Extract. Opii Aquos., ... gr. iv.
Extract. Valerianæ, ... ℥ss.

M. et div. in pil no. xvi.
S. One to four in the course of the day.

If the child dislike the pilular form, they give it in syrup, according to the following formula:

℞.—Extract. Belladonnæ, ... gr. iv.
Syrup. Opii,
Syrup. Flor. Aurantii, āā . . . . . f℥j.—M.

Of this, from one to eight teaspoonfuls are to be given in twenty-four hours.

We have ourselves used belladonna in a very large number of cases of hooping-cough, and with such unquestionable benefit, that we regard it as one of the most valuable remedies for this disease in our possession.

We have certainly never seen it cut short the course of the disease as it has been asserted to do, but we have almost invariably found it to moderate the laryngismus, shorten the paroxysms and diminish their number

and probably also shorten the duration of the attack. We have not, however, been in the habit of prescribing such large doses of belladonna as those quoted above (gr. $\frac{1}{4}$); but have usually given it in combination with alum or with bromide of ammonium, in the dose of $\frac{1}{24}$th of a grain of the extract, every four hours, to a child of one year old. The formula which we employ will be found in our remarks upon the use of alum.

Belladonna has also been largely used, especially by Dr. Fuller, in combination with sulphate of zinc, and with excellent results. This latter author states that he has observed a remarkable tolerance of belladonna in children, so that, beginning with quite large doses, the amount may be rapidly, though carefully, increased until the quantity taken exceeds out of all proportion the corresponding doses which will be tolerated by adults. Even when given, however, in the comparatively small doses of $\frac{1}{24}$th or $\frac{1}{12}$th of a grain, it is necessary to watch for any symptoms of the toxic action of the drug, so that its administration may be suspended or the amount diminished.

Opium is confessedly a very valuable remedy in the disease, not as a curative, but as a sedative and palliative. When the cough is frequent and fatiguing, especially if the patient have an irritable and nervous constitution, some opiate preparation is of the utmost service in moderating the frequency and violence of the paroxysms, and in allaying irritability and restlessness. It is best given in the evening, and in combination with ipecacuanha.

Hydrocyanic acid has been employed by various observers, and is highly spoken of by some. Its poisonous properties, however, have deterred many, and amongst them ourselves, from resorting to it. Inasmuch as there are other and safer means for conducting the disease to a favorable termination, it seems to us useless to venture upon so potent a preparation as this.

Since the discovery of the powerful antispasmodic properties of the various bromides, they have been much used in the treatment of this disease. The *bromide of ammonium* has been recommended, especially by Gibb and G. Harley, as a pharyngeal and laryngeal anæsthetic, to diminish the spasm of these parts, while, at the same time, the alkali acts by rendering the secretion from the bronchial mucous membrane more free and readily expectorated. The *bromide of potassium* acts in the same way, and is productive, probably, of equally good results. We have used both of these salts frequently, especially in combination with belladonna, and have observed a marked reduction in the severity and number of the paroxysms of cough in many of the cases. We have, also, used *assafœtida* in a number of instances with decided benefit, both in relieving the general restlessness and in moderating the number and severity of the paroxysms. The doses in which we have given it are either two or three grains in pill, or a teaspoonful of the mistura assafœtidæ, three or four times a day to a child of four years old.

Emetics and *Nauseants* are amongst the most important remedies in the treatment of hooping-cough, since they exert a powerful influence upon the disease, and unless carried to excess, are not in themselves likely to be

injurious. Some authors recommend the administration of an emetic every day or every other day, while others give them according to the necessity of the case. Believing that frequently repeated emetic doses are unnecessarily severe, and productive of too much fatigue and exhaustion, we have preferred in the simple disease to give only small doses of ipecacuanha from time to time, so as to moderate the violence of the cough. Tartar emetic is never necessary, and ought to be avoided, on account of its disposition to irritate and inflame the gastro-intestinal mucous membrane, and because of its exhausting effects on the general economy. The syrup of ipecacuanha is the preparation we have almost always used. From ten to twenty drops, given three times a day to a child three years old, will very generally moderate the severity of the paroxysms.

Purgatives are necessary in the simple disease only when constipation is present. The mildest ought to be preferred, in order to avoid irritation and exhaustion. Castor oil, magnesia, or syrup of rhubarb are the best.

Particular Remedies.—Of the different specific remedies that have been employed, none have attained and maintained so high a reputation in this city as the *carbonate of potassa*, which, in the form of the cochineal mixture, is constantly used both by physicians and as a domestic remedy. The beneficial effects of this drug are equally recognized abroad, as may be judged from the language of Niemeyer, who, when speaking of its use in hooping-cough (*op. cit.*, vol. i, p. 101), says, "Its effect in shortening the fits of coughing is often surprising." The following formula is the one generally administered:

℞.—Potass. Carbonat., ... ℈j.
Coccii, ... ℈ss.
Sacch. Alb., ... ʒj.
Aquæ Fontis, ... fʒiv.—M.

Give a dessertspoonful three times a day to a child a year old. Believing the carbonate of potash to be the active agent in the mixture, we have generally left out the cochineal and used the potash alone, dissolving it in equal parts of syrup of gum and water. We have frequently employed this remedy, and believe that it, with alum and belladonna, are the most useful agents we have to keep down the violence of the disease. We have given it in the dose of a grain three or four times in the twenty-four hours, to children one and two years old, for several weeks at a time, without witnessing any injurious effects from it.

Alum was first highly recommended as a remedy in pertussis by Dr. Golding Bird (*Guy's Hospital Reports*, April, 1845). He states that in the second or nervous period of the disease, when "all inflammatory symptoms have subsided, and when, with a cool skin and clean tongue, the little patient is harassed by a copious secretion from the bronchi, the attempt to get rid of which produces the exhausting and characteristic cough, alum will be found to be of much value." He adds, that he "has not yet met with any other remedy which has acted so satisfactorily, or afforded such marked and rapid relief." From reading Dr. Bird's remarks on alum, and prompted by our knowledge of its admirable qualities in the

treatment of croup, we were formerly led to make trial of it in the disease under consideration, and we believe we may say that it has exerted a more decided influence in moderating the violence of the disorder, than any that we have ever made use of. We have administered it in 139 cases, beginning in the course of the second stage. In nearly all it was beneficial, and in some the effects were strikingly useful, the improvement being more rapid than we had ever seen to result from other remedies, or to occur when the disease has been allowed to pursue its natural course. In a boy, between five and six years of age, who had been coughing violently for two weeks, the paroxysms diminished so much in intensity and frequency, after he had taken the remedy two days, that he was not once disturbed at night (though before he had always been waked several times), and the spells which occurred during the day were much less severe. After continuing the remedy for ten days, the disease had subsided so much that its employment was suspended. Soon after, however, the paroxysms again became severe and troublesome. The alum was resumed, and with the same results as at first. In another family in which there were three children all of whom had been taking syrup of ipecacuanha and carbonate of potash for some days, without any good effects, the alum was given and acted as in the case first referred to. The nights were comparatively quiet, and the spells occurring through the day very much moderated. We may repeat that, so far as our experience in the above 139 cases goes, the effects of alum have been more decided and satisfactory than those of any other remedy. We have never known it to produce ill-consequences, either at the time of its administration or subsequently, though we have given it to children from two months to seven years of age, and have continued its use from one to six weeks at a time. It, like all other remedies, sometimes fails, however, to do any good, and when we have found this to be the case, we have substituted belladonna or carbonate of potash, either alone or combined, and it is curious to observe how, in some instances, the latter remedies will succeed where the other fails. Nothing but a trial will show which is the most proper in any individual case. Of late years we have usually given the alum and belladonna together, and have been much pleased with the results. If administered in large doses, alum produces vomiting. It does not constipate, but on the contrary, is apt to induce diarrhœa, when continued for some time. Dr. Bird gives from two to six grains every four hours. His formula is as follows:

℞.—Aluminis, ... gr. xxv.
Ext. Conii, ... gr. xij.
Syrup. Rhœados, ... ʃʒij.
Aquæ Anethi, ... ʃ℥iij.—M.

Give a medium-sized spoonful every three hours.

To children under one year, we give from half a grain to a grain, three or four times a day; and to those over that age, two grains every four or six hours. The formula we have employed is the following:

℞.—Aluminis, ... ℈ijss.
Syrup. Zingib., Syrup. Acaciæ, Aquæ Fontis, ãã, . . ʃ℥j.—M.

When this is prepared with good syrups, it tastes very much like lemonade, and is not at all unpleasant, so that children take it without difficulty. The dose is a teaspoonful three times a day, or every four or six hours.

As above said, however, we now generally employ a combination of alum and belladonna, and have obtained better results from it than from any single remedy we have ever used. For a child one year old we use the following formula:

℞.—Ext. Belladonnæ, ... gr. j.
Aluminis, ... ℥ss.
Syr. Zingib., Syr. Acaciæ, Aquæ, āā . . . . fℨj.
M. et ft. sol.

Dose, a teaspoonful four times in the twenty-four hours: in the morning, at noon, bedtime, and once in the night, if the cough be troublesome.

Among other remedies which have been highly recommended, but which we have never found it necessary to resort to, may be mentioned the following:

Sulphur is much used by some German authorities, who greatly commend its effects both at the beginning and throughout the course of the disease. It may be given in powder diffused in milk or syrup, or in emulsion, in doses of three grains, two or three times a day, to children from two to four years of age.

Subcarbonate of Iron has been successfully employed by Dr. Steyman and by Lombard, of Geneva.

Dilute Nitric Acid, first recommended by Arnoldi, of Montreal, has been highly praised, especially by Gibb.

Conium has also been frequently used, both alone and as an ingredient in formulæ containing some of the other remedies here mentioned, and appears to alleviate the violence of the paroxysms, though to a less marked degree, we believe, than belladonna.

Inhalations.—In was noticed in France, some years ago, that children suffering with hooping-cough, who lived in the neighborhood of gas-works, were rapidly cured; and the plan has been recently tried with success, of sending patients with this disease to inhale the fumes arising during the purification of gas, which contain ammonia, vapor of tar, and several volatile oils. Dr. Bertolles (*British Med. Jour.*, Nov. 5, 1864) states that "the register of the gas-works at Ternes, shows that during the previous six months, 901 patients have been subjected to the vapor treatment, of whom 219 were cured and 122 relieved." M. Commerege (*id. loc.*) has also reported the effects observed in 142 children who were brought under the action of the gases in the gas-works at St. Maudé; and believes that the treatment produces excellent results at all stages of the disorder. In general, twelve séances, each of which should be of two hours' duration, are required for the cure. We have ourselves known of quite a number of instances among the children of the poorer classes in this city, where patients, suffering with hooping-cough, have been allowed to inhale the fumes from the gas-works, and have experienced positive benefit.

Tonics.—In a number of cases that have come under our notice, the patient has grown pale and weak in the course of the disease, and this without any local complication, but from the disturbance of the digestive system that often exists to a greater or less extent, from the great frequency of the vomiting, which prevents them from taking a sufficient amount of nutriment, and from the exhausting effect of the violent muscular exertion undergone during the paroxysms. In such instances, when there has been no fever, or merely a little evening febricula, we have employed tonics with much advantage, and never to the injury of the patient. We have generally made use of Huxham's tincture of bark, either alone, in doses of from ten to twenty drops three times a day, or in connection with the syrup of the iodide of iron, or half a grain of the metallic iron (Pulv. Ferri). When the appetite has been very feeble, we have found that quinine, in the dose of a grain three or four times a day, at the age of three or four years, has restored it more rapidly than any other remedy we have used.

Local Applications.—*Revulsives.*—The milder revulsives are useful in certain complications of pertussis, and as palliatives. To make them the chief basis of the treatment, however, which has been done by some, is a mistake. In order to produce a decided impression upon the disease, it would be necessary to resort to the more powerful remedies of this class, such as moxas, issues, tartar emetic ointment, blisters, etc., the use of which is not warranted by the nature of the disorder.

When the laryngismus has been severe, we have known the use of a belladonna plaster, 2 by 3 inches, applied over the larynx and worn for several days, to afford relief.

Topical applications to the interior of the larynx of solutions of nitrate of silver have been used by several practitioners, as by Gibb and Eben Watson, and apparently with much benefit. The strength of the solution should vary according to the stage of the disease, being much reduced during the early acute period.

In cases occurring in older children, where the spasmodic irritability of the larynx is extreme, we may employ with advantage the inhalation, by means of the atomizer, of the vapor of water, or of weak alkaline solutions, to which minute quantities of morphia may be added.

Before concluding our remarks upon the treatment of simple hooping-cough, we wish to state that cases of the disease occur not unfrequently of so mild a form, as to need absolutely no treatment other than the proper degree of attention to hygiene; and that others again, more numerous than those just mentioned, will be met with, in which the only treatment necessary is the use, for a few days or weeks, of some mild expectorant and opiate at night to lessen the severity of the paroxysms, or of moderate doses of alum, belladonna, or carbonate of potash.

In infants particularly it is proper to give as little medicine as possible, allowing the disease to go on without interference so long as it progresses safely. In a good many mild cases, small doses of paregoric and syrup of ipecacuanha, constitute the only remedies we have found necessary in the cases of infants. When, however, the paroxysms become numerous and

violent, exhausting the strength of the child and distressing its nervous system, we must make use of some remedy to allay the severity of the attacks. We have found the alum and belladonna formula recommended above safe and effectual. At the age of two and three months, we have usually given from half a grain to a grain of the former, combined with $\frac{1}{24}$th grain of extract of belladonna, three times a day, taking care to suspend it for a day or two if it caused troublesome vomiting or purging, and then resuming it in diminished dose. Or we have made use of a quarter or half a grain of carbonate of potash, also combined with the twenty-fourth part of a grain of the extract of belladonna, three or four times a day.

Treatment of the Complications.—If any of the diseases which have been mentioned as apt to occur during the course of pertussis should arise, the treatment which is proper for them in their idiopathic form must be adopted without regard to the hooping-cough, with the following reservation: that care must be taken not to use means of too powerful and exhausting a nature, or such as have a tendency to irritate the organ with which they come in contact. For, it must be recollected, that after the complication is cured, the patient has still the original disease to go through with, and therefore requires all his strength; and moreover, the various organs of the body are predisposed, by the very fact of the existence of the original malady, to assume diseased action, should any irritation in the shape of a violent remedy be applied to them.

The cases of *bronchitis* which came under our observation were treated in the simplest manner. The children were put to bed, the diet carefully regulated, the bowels gently opened with castor oil or syrup of rhubarb, and small doses of syrup of ipecacuanha or antimonial wine, with sweet spirit of nitre, were administered every two hours. Mustard poultices were applied once or twice a day to the interscapular space, and mustard foot-baths used every night, or more frequently, if the dyspnœa were considerable. If the bronchial secretions were very profuse, and the cough troublesome, the decoction or syrup of seneka was given in connection with occasional doses of laudanum or paregoric.

The treatment of *collapse of the lung* should be that which is recommended in the article on that subject, modified, of course, as may be rendered necessary, by the existence of the hooping-cough. A mild emetic, if the patient seem strong enough to bear one; counter-irritants, and especially sinapisms or mustard poultices applied to the chest, nutritious food, and mild stimulants, as brandy, wine-whey, tincture of bark, quinine, or aromatic spirit of ammonia, must form the principal means of treatment.

The complication of *pneumonia* should be treated somewhat differently. At the present time we should advise the use either of the combination of sulphurated antimony and Dover's powder, or of one of the alkaline mixtures, recommended in the article on pneumonia, in conjunction with external applications and the use of the foot-bath; and should not resort to bleeding, whether local or general, unless the indications, elsewhere laid down as calling for depletion in pneumonia, should be present in a marked degree. Indeed, in such cases, the early use of moderate stimulation and

of full tonic doses of quinia is apt to be indicated on account of the tendency to depression.

When *convulsions* occur they must be treated according to the cause which produces them, and the constitution and present state of the child. If the patient be strong and sanguine, and not exhausted by previous sickness, the treatment should consist of depletion by leeches to the temples, or behind the ears; of cold applications to the head; the warm bath; large doses of bromide of potassium by the mouth or by enema; cathartics or purgative enemata; and revulsives in the form of sinapisms, or of a small blister to the nucha. If, on the contrary, the patient is of delicate constitution, or exhausted by long illness, and especially when the convulsions are the result of extensive collapse of the lungs, occurring spontaneously or supervening upon bronchitis, we must be content to resort to warm baths, revulsives, antispasmodics, and anodynes, stimuli, and stimulating enemata.

Of the 12 cases of convulsions that came under our notice, 5 proved fatal. Two of the fatal cases occurred in children who had long been laboring under bronchitis, probably associated with collapse, that had baffled all treatment. Death took place within twenty-four hours from the appearance of the convulsions, which were in fact the result of the diseased condition of the lungs. No treatment further than the warm bath and sinapisms, was resorted to. In the third case, the convulsions came on in the seventh week of the disease, in a child who had been laboring for a number of days under severe bronchitis; they ended fatally in seven hours. The treatment employed at the beginning of the fit was a warm bath, an enema, and mustard plasters. After a few hours, solution of morphia with fluid extract of valerian were given by enema, cold was applied to the head, and a blister to the nucha. In the fourth case, which occurred in a child in the second year of its life, they were caused by bronchitis and collapse, and proved fatal in two days. The treatment consisted in the use of warm baths, counter-irritants, alum, and small doses of brandy. The fifth case likewise occurred in the second year. This was one in which all the symptoms of laryngismus stridulus—prolonged laryngismus, contracture, and general convulsions—were added to those of the primary disease. It was treated with belladonna, opium, assafœtida, and warm baths, but all to no effect.

Of the favorable cases, one occurred in a boy five months of age, on the third day of a severe attack of bronchitis. The child was immediately placed in a warm bath, and large sinapisms applied over the front of the chest and upon the extremities, when the convulsions ceased. After this he was treated with half-grain doses of alum, repeated every three or four hours, mustard foot-baths, and poultices, and small doses of wine of opium. On the sixth day of the attack, the third after the convulsive seizure, there having been no return of the convulsions, the bronchitis subsided with copious sweats and cold hands and feet, for which small quantities of brandy and water and wine-whey were used. The recovery was perfect. A second case occurred in a hearty boy nine months old, and seemed to depend on congestion of the brain, brought on by a severe fit of coughing.

In this instance a venesection to a small amount was performed, the child was placed in a warm bath, and cold applied to the head. No return of the spasms took place, and the child recovered without difficulty. In another case the convulsion was caused by an attack of fever depending on dentition, and was treated by lancing the gums, by a warm foot-bath, and by the administration of a grain of calomel in a teaspoonful of castor oil. In the fourth case the convulsions were caused by pneumonia, and were managed by treating the pneumonia, except that at the moment of the attack a warm bath and a stimulating enema were made use of. In a fifth the convulsion, which was a short one, occurred at the onset of an attack of bronchitis. No particular treatment beyond what was necessary for that disease was required. In a sixth, in a boy nine months old, the convulsion occurred suddenly, was violent, and lasted fifteen minutes. The cause could not be ascertained. The only treatment used for the convulsion was a warm bath. There was no return. In a seventh case, in a boy nine months old, a slight convulsion occurred during one of the paroxysms in the fifth week. No treatment was necessary, as the attack was very short, and there was no recurrence of the symptoms.

Hygienic Treatment.—This part of the management of the disease is of the highest importance, for it is by careful attention to its details that the complications which constitute the chief danger of the malady are to be prevented. In a considerable number of cases of pertussis, nothing more need be done than to insist upon strict attention to hygienic rules. The chief indications are, to preserve the child from taking cold, and to prevent indiscretions in diet. The clothing ought to be warm, and during the autumn, winter, and spring, flannel should always be placed next to the skin. The child ought to be kept in the house during damp weather at all seasons, and whenever, during the winter season, it is intensely cold. The diet should be nutritious, but of easy digestion. All heavy, rich food ought to be absolutely forbidden during the continuance of the malady.

Treatment of the Paroxysm.—It often happens that the paroxysms are so violent that the child seems to be in imminent danger of suffocation or of convulsions. This is especially true of infants. In six cases that we have seen, in infants under six months old, the kinks lasted so long, and the spasm of the larynx was so unyielding, that the children struggled as though laboring under tetanus; the countenance was disturbed and anxious; the face and hands, at first flushed, became purple from deep congestion; and on some occasions the breathing was suspended for several seconds, so that life *seemed* for the time in the greatest danger. The difficulty in these cases depends on the spasmodic closure of the glottis, which is sometimes, no doubt, completely shut. We have never known these alarming symptoms of asphyxia to occur when the hoop has been clear and distinct, for when that is present, the larynx cannot be very tightly closed.

When the symptoms above described occur in a child several years of age, the patient should be raised and supported in the sitting posture; when in an infant, the child ought to be held lightly in the arms, so that it may take any position which instinct prompts it to. At the same time,

cold water ought to be sprinkled from the fingers upon the face, the child should be gently fanned, or, if the weather be warm, taken to the open window; and if there be time, it is well to put the feet into mustard-water. It has been recommended on such occasions to apply compresses dipped into cold water to the sternum. We would propose the trial of a means which the late Dr. C. D. Meigs found very successful in arresting tonic spasm of the respiratory muscles, in a case of laryngismus stridulus. This is the sudden application of a piece of ice wrapped in linen to the epigastrium. When the laryngeal spasm is very intense and obstinate, a belladonna plaster, as before recommended, or a small blister to the front of the neck, may be useful in controlling it.

M. Bell speaks very highly of the results obtained by sprinkling a little ether on the clothes of the patient at the onset of the paroxysm; and Dr. Churchill (*Diseases of Childhood*, p. 223), who has tried ether in 12 or 14 cases, and chloroform in 6, regards it as a valuable addition to our remedies. He directs that about half a drachm of sulphuric ether should be spilled on the nurse's hand and held before the child's nose and mouth at the commencement of a fit of coughing. In only one or two cases no benefit accrued, while in others great mitigation of the spasm, and in three or four almost complete relief followed when the ether was thus applied. We should certainly recommend a trial of this procedure, making use, however, from preference, exclusively of the sulphuric ether.

CLASS II.

DISEASES OF THE CIRCULATORY ORGANS.

ARTICLE I.

CYANOSIS.

Synonyms; Definition.—This peculiar condition, known under the various names of Morbus Cœruleus, or the blue disease, and Cyanosis, may be defined as a permanent state of lividity or blueness of the skin, depending upon numerous malformations or derangements of the heart and great vessels.

In a comparatively slight degree, this condition attends many of the chronic organic diseases of the circulatory organs; and is also transiently present in the course of some acute diseases; but under neither of these circumstances does the lividity merit consideration as a separate affection, being merely due to the imperfect oxygenation of the blood.

There is, however, one form of cyanosis which we have occasionally met with that merits a special reference. In these cases, the blueness of surface has appeared from three or four days to as many weeks after birth, has been intense in its degree, and associated with marked disturbance of respiration, and yet, under proper treatment, the infants have usually recovered. We believe that the cause of such cyanosis is to be found in atelectasis of the lungs, which acts partly by causing general venous congestion, and partly perhaps by obstructing the flow of blood through the pulmonary artery, so that the right cavities of the heart become overdistended, and there results an admixture of venous and arterial blood through the still unclosed foramen ovale.

Before attempting to explain the peculiar blue color in cases of true cyanosis, it will be convenient to allude to the various lesions which have been found present in such cases.

Morbid Anatomy.—The blood in cyanosis is dark, and contains an excess of carbonic acid; it has also lost, to a great extent, its coagulability. The only organs beside those of circulation which present lesions, with any constancy, are the lungs.

Dr. J. Lewis Smith (*Dis. of Infancy and Childhood*, 1869, pp. 578–599), who has studied this disease with great care, and collected all the cases of it upon record, finds the condition of the lungs recorded with more or less minuteness in 110 out of 191 cases. In 26 cases there was tuberculosis, either confined to the lungs, or chiefly exhibited in these organs; in 35

cases the lungs were of small size, either from compression by effusion in the pleural sacs or pericardium, or sometimes, apparently, from the persistence of the fœtal state over a greater or less portion of the organ. In 35 cases the lungs presented a dark color, owing either to atelectasis or to engorgement and congestion. In 9 there was emphysema in a part of the lungs; in 2, pneumonia; in 2, the color was pale; in 1, a bright crimson; in 1, the lungs were larger than natural; in 1, the right lung was absent; and in 17, these organs were recorded as healthy.

There is also found, in a large proportion of cases, venous congestion of the brain, liver, or kidneys. By far the most marked and important lesions, however, are those of the heart and great vessels, which are, excepting in extremely rare instances, the essential seat of the disease. The number of these lesions already recorded is considerable, as will be seen from the subjoined table, borrowed from Smith, which shows their character and relative frequency.

1. Pulmonary artery absent, rudimentary, impervious, or partially obstructed,	97
2. Right auriculo-ventricular orifice impervious or contracted,	5
3. Orifice of the pulmonary artery and the right auriculo-ventricular aperture impervious or contracted,	6
4. Right ventricle divided into two cavities by a supernumerary septum,	11
5. One auricle and one ventricle,	12
6. Two auricles and one ventricle,	4
7. A single auriculo-ventricular opening; interauricular and interventricular septa incomplete,	1
8. Mitral orifice closed or contracted,	3
9. Aorta absent, rudimentary, impervious, or partially obstructed,	3
10. Aortic and the left auriculo-ventricular orifices impervious or contracted,	1
11. Aorta and pulmonary artery transposed,	14
12. The cavæ entering the left auricle,	1
13. Pulmonary veins opening into the right auricle, or into the cavæ or azygos veins,	2
14. Aorta impervious or contracted above its point of union with the ductus arteriosus; pulmonary artery wholly or in part supplying blood to the descending aorta through the ductus arteriosus,	2
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It is evident from a glance at this table, that the vast majority of the above lesions must occur before the full development of the heart is attained; and that consequently, in nearly every instance, cyanosis is a congenital affection. But further than this it will be observed, that in the first four groups in Smith's table, or in 119 out of 162 cases, the lesions affect the right side of the heart, and are precisely of the kind that we know are caused by inflammation of the endocardium. Bearing in mind then the well-ascertained law, that endocarditis occurring during fœtal life, almost exclusively attacks the right side of the heart, we can readily un-

derstand how such lesions could be produced by an attack of inflammation affecting either the valves of the pulmonary artery, or the tricuspid valves, or some part of the lining membrane of the right ventricle. Should such an attack of endocarditis occur after the development of the cavities and septa of the heart, and the closure of the foramen ovale and ductus arteriosus, and lead to occlusion of the orifice of the pulmonary artery, it would of course be impossible for life to be sustained. But where such a lesion is produced while the interauricular and interventricular septa are still imperfect, and the ductus arteriosus patulous, so much compensation may be effected that life can often be prolonged for many years. Thus, it is evident, that the first effect of the closure of the orifice of the pulmonary artery, at such an early period, will be to cause a large portion of the blood from the right ventricle to pass directly through the opening remaining in the interventricular septum into the left ventricle. Usually this opening is not free enough to relieve the right ventricle entirely, and there is consequently pressure exerted backwards on the blood entering from the right auricle, which forces part of it through the foramen ovale into the left auricle, and thus still further relieves the fulness of the right cavities. As there is no outward current through the pulmonary artery, owing to the occlusion of its orifice, blood flows back into this vessel from the aorta through the patulous ductus arteriosus, and thus supplies the lungs. At the same time the bronchial arteries become much enlarged, and, in some rare cases, blood has been able to reach the lungs through abnormal branches from the internal mammary or intercostal arteries. In cases of cyanosis which prove fatal very soon after birth, the most diverse and inexplicable lesions, as before enumerated, may be found; but in those instances where life is prolonged, the heart is usually found to present the associated lesions above described: contraction or occlusion of the orifice of the pulmonary artery, imperfect interventricular septum, and patulous foramen ovale and ductus arteriousus. In such cases, when the compensatory communications between the right and left side of the circulation are free, life may be prolonged for many years.

This was very nearly the condition found in the following case,[1] the opportunity of examining and describing which we owe to the courtesy of Dr. C. H. Thomas.

"The patient was a young man, æt. 22 years, who had been markedly cyanotic from infancy, and was poorly developed. He was unable to maintain a proper temperature. He suffered constantly from slight dyspnœa, with occasional exacerbations. At the autopsy there was marked congestion of the abdominal viscera, and the gall-bladder was packed with gallstones. Both lungs contained numerous yellow miliary tubercles.

"The heart was rounded. The cavities of the ventricles were not much enlarged, nor was there any hypertrophy of the walls of the left ventricle. The walls of the right ventricle were, however, decidedly thickened, though not equalling those of the left. The septum ventriculorum was disproportionately thick, and terminated about one-third of an inch below the level of the origin of the aorta

[1] See Descriptive Catalogue of Path. Museum of Penna. Hosp., No. 1501, p. 84, by William Pepper, M.D. 1869.

in a smooth, rounded edge, over which the endocardium was thickened. The septum also seemed inside of its normal position, so as almost to bisect the aortic orifice. The aorta, which was slightly dilated but quite healthy, thus communicated freely with both ventricles. The origin of the pulmonary artery was very much obstructed, owing to coalescence and contraction of its valves. The ductus arteriosus was, unfortunately, not preserved, but, owing to the large size of the pulmonary artery beyond the seat of obstruction, it had in all probability remained patulous. The foramen ovale was closed."

In this instance, the orifice of the pulmonary artery not being entirely closed, the opening in the interventricular septum had been large enough to allow the right ventricle to relieve itself in that way, and consequently the foramen ovale had closed.

When writing of atelectasis pulmonum (p. 137) we called attention to the fact that in some cases, where the state of imperfect expansion persisted, the continued obstruction to the pulmonary circulation was followed by the same train of lesions, viz., patulous ductus arteriosus and foramen ovale, and dilated hypertrophy of the right side of the heart, as are consequent upon obstruction of the orifice of the pulmonary artery, and which, as in the latter case, might be attended with cyanosis.

The mere persistence of the foramen ovale can scarcely be regarded as a cause of permanent cyanosis. It is quite possible that during the early days of extra-uterine life, a certain amount of cyanosis might exist owing to the admixture of venous and arterial blood allowed by this opening, but after the forces of the circulation become equalized, it is quite certain that the valve of the foramen may remain unattached, or may even be somewhat insufficient to close the opening, and yet no cyanosis be present.

As an illustrative case of one of the rarer forms of cyanosis, and one which bears in the most interesting manner upon the theory of its production, we abstract the following from a more full account published in the *Proceedings of the Pathological Society of Philadelphia.*[1]

The child was a well-developed male, born at full term. No discoloration was noticed at birth, but on the twelfth day, as the grandmother was preparing to wash it, it had a convulsion, and from that time presented coldness of the extremities, gradually increasing lividity, feeble and rapid pulse, and moaning and sighing respiration.

During inspiration, the sternum and upper parts of the chest were elevated, but the lateral regions remained unexpanded, and there was marked recession of the base of the thorax. The percussion-resonance was diminished on both sides, but especially on the right. The vesicular murmur was puerile, except over the right side, where it was feeble. The cardiac sounds were decidedly louder at the right scapula than over the left. The cardiac impulse at the left nipple was very indistinct, and the sounds there feeble but natural. On pressing two fingers lightly to the left of the ensiform cartilage, close to the costal cartilages, a very distinct and quite vigorous impulse could be felt, one much more distinct than at the nipple. At this point, a distinct blowing sound attended the systole of the heart. The diagnosis made at the time was: atelectasis of both lungs, of the right greater than of

[1] Transposition of the Arteries. Dr. J. F. Meigs. Proc. of Path. Soc., vol. ii, p. 37; and Am. Jour. of Med. Sciences, vol. xi, 1860, p. 415.

the left; dilatation with hypertrophy of the right ventricle; obstruction of the pulmonary artery, and open foramen ovale. Death occurred on the forty-fourth day after birth.

At the autopsy, the body was very small and thin. The thorax was flattened laterally, and contracted at the base. There was marked collapse of the lower lobes of both lungs, and especially of the right. The heart was one-half too large, and full, rounded, and distended with soft black clots. The walls of the right ventricle were very thick, and its cavity quite small; it presented the appearance we usually associate with the left ventricle. The walls of the left ventricle were thinner than those of the right; and its cavity was much more capacious than that of the right. The right auricle was dilated and considerably larger than the left. The foramen ovale presented an opening at its lower aspect of about 2 or 3 lines in diameter. The orifices of the venæ cavæ appeared smaller than usual.

The aorta and pulmonary artery were transposed. The aorta arose from the right ventricle in the usual position of the pulmonary artery; the pulmonary artery arose from the left ventricle, and passing under the arch of the aorta, gave to the latter, just beyond the left subclavian, the ductus arteriosus, which was quite pervious and of considerable size. The valves of the heart were healthy and not transposed. The pulmonary artery was of the natural size, and presented no obstruction at its point of origin. After giving off to the aorta the ductus arteriosus, it divided as usual into two pulmonary branches, which soon subdivided into others.

The aorta was of full size and presented nothing unusual. It gave off at its arch the innominate artery, and then the left primitive carotid and the left subclavian. Just beyond the latter it received, from the pulmonary artery, the ductus arteriosus.

The pericardium was normal in all respects.

Theories as to the Production of Cyanosis.—In the vast majority of cases the malformation which causes cyanosis is of such a character as to allow admixture of the venous and arterial blood, and, at the same time, to interfere more or less with the circulation of this mixed fluid. Ever since the time of Morgagni, authors upon this subject have been divided in opinion as to whether the coloration of the skin were due exclusively to one or the other of these causes: obstruction to the cardiac circulation and consequent venous congestion, or intermingling of the venous and arterial blood.

In regard to the first of these causes, although it has numbered among its advocates Morgagni, Louis, and Stillé, it cannot be considered competent to fully explain all the cases and peculiarities of cyanosis, although such central obstruction will unquestionably aid in its production.

Nor can the second theory be held exclusively sufficient, since not only are there cases met with where cyanosis is present and yet no admixture of venous and arterial blood is possible, but also, on the other hand, where a considerable degree of admixture exists without the production of cyanosis.

It seems necessary, therefore, as Smith has clearly pointed out, that any theory which pretends to embrace all the elements of this complex condition, should embody a reference to the fact that the essential defect in cyanosis is a want of arterialization of the blood.

Symptoms.—Even in cases where cyanosis is due to congenital organic

lesions, the peculiar symptoms are not always present until some time after birth.

Thus, in 138 of the cases of cyanosis collected by Smith, the time at which lividity was first noticed is stated as follows:

In 97 it was within the first week, and often within a few hours after birth.

In 3 at 2 weeks.	In 6 from 2 to 5 years.
" 1 " 3 "	" 1 " 5 " 10 "
" 2 " 1 month.	" 6 " 10 " 20 "
" 7 from 1 to 2 months.	" 1 " 20 " 40 "
" 5 " 2 " 6 "	" 1 over 40 years.
" 5 " 6 " 12 "	—
" 3 " 1 " 2 years.	41

Dr. Smith adds, "that in these 41 cases, in which blueness did not occur till after the age of one week, if the patient were less than two years old when it commenced, there was frequently no obvious exciting cause; but above this age, with three exceptions, such a cause is known to have been present. It is interesting to observe how trivial the exciting cause frequently is" (an acute attack of sickness, an attack of convulsions, difficult parturition, a fall, or even a severe blow), "and equally interesting to note how long patients have enjoyed good health, not having the least lividity, although the anatomical vice, to which the final development of cyanosis was due, had existed from birth."

The most characteristic symptom of cyanosis is the lividity of the surface, which varies in different cases from mere duskiness to a deep purplish tint. This color also varies in degree in different parts of the body, being most marked in the distant and especially the dependent portions, upon the mucous membranes, and wherever the capillary vessels are abundant, as on the face. Its degree varies, finally, in the same case with the condition of the circulation. In slight cases, when the patient is quiet and the circulation tranquil, the discoloration of the surface may be imperceptible, but upon any exertion, and especially in the more severe cases, the lividity becomes much intensified. In some instances, such as that narrated by us below, there may be actual ecchymoses of the surface, as in purpura.

The state of the general nutrition is much impaired, and the subjects of this disease are usually stunted and illy developed. In many instances the generative system appears even more imperfectly developed than the rest of the economy. The temperature of the body is always reduced, and exposure to cold is very poorly borne.

In a good many cases the thorax presents the deformity so often found in association with rickets, known as the "pigeon-breast." It usually happens, also, that the ends of the fingers and toes become bulbous. Disturbances of the circulation and respiration are of frequent occurrence. Thus there is often some abnormal bruit heard in the cardiac region, due to the abnormal condition of the heart. The pulse may be regular and of fair volume, but more frequently is small, irregular, or intermittent, and palpitation is very readily induced by exertion. The disturbance of respira-

tion usually corresponds in degree with the embarrassment of the circulation.

While the patient remains quiet his breathing may be easy and regular, but usually any sudden movement or exertion or emotion is sufficient to induce a paroxysm of dyspnœa, during which the lividity of surface becomes much deeper. In infants these paroxysms not rarely terminate in convulsions. Headache is frequently complained of, and is very apt to be caused by whatever disorders the circulation. During the paroxysms of palpitation, pain is often complained of in the region of the heart, but is rarely persistent.

Owing to the extreme venous stasis frequently present, there is a tendency to passive hæmorrhages in cyanosis, which expresses itself by bleeding from the nose, mouth, stomach, or rectum, or under the skin. Œdema of the lower extremities is often met with as a temporary condition after long standing on the feet; it is also apt to appear and to invade the rest of the body towards the close of the case, when the circulation becomes more enfeebled.

Modes of Death.—Many cyanotic patients die from the effect of some intercurrent acute disease, as hooping-cough or one of the exanthemata, all of which are very badly borne in this condition.

The theory that venous congestion is opposed to the development of tuberculosis, was applied by Rokitansky to this affection; but without any sufficient ground, since, as we have seen already, tuberculosis was found as the cause of death in no less than 26 of the cases collected by Dr. Smith.

In other cases death occurs suddenly, either during an attack of convulsions or a paroxysm of dyspnœa.

In severe cases of cyanosis life is rarely prolonged more than a few years; but in less marked cases the patients may even attain middle age. In 186 cases collected by Dr. Smith, the age at death was as follows:

In 17 under age of 1 week.	In 21 from 5 years to 10 years.
" 10 from 1 week to 1 month.	" 41 " 10 " " 20 "
" 12 " 1 month to 3 months.	" 20 " 20 " " 40 "
" 11 " 3 months to 6 "	" 4 over 40 years.
" 17 " 6 " " 12 "	—
" 12 " 1 year to 2 years.	186
" 21 " 2 years to 5 "	

So that in 67, or more than one-third, death occurred before the close of the first year; in 121, or more than three-fifths, before the age of 10 years; only 24 survived the age of 20 years, and 4 the age of 40 years.

We subjoin the history of a case of cyanosis which we had under observation for several years, in which the symptoms of this peculiar condition were extremely well marked.

J. W., æt. 16 years and 7 months, has been cyanotic since infancy, but for the past few years, at least, has enjoyed fair health. At present there is marked lividity of the lips and of the nose, especially at the extremity, which seems somewhat increased in size. His hands habitually appear as though stained with solution of carmine, the skin being uniformly livid over the whole hands, but becoming lighter colored on the forearms. Pressure partly removes the lividity, which returns

slowly after the withdrawal of the pressure. At times there have been little ecchymoses of the surface, followed by the effusion of serum under the epidermis, and the formation of superficial excoriations, which have left small cicatrices. Only a few of these have appeared on the hands.

These vascular disturbances are even more marked in the lower extremities. The feet are continually deeply livid; and over their surface and the ankles, very numerous ecchymotic spots have appeared, which underwent the same changes as those on the hands, and have left shining cicatricial spots, of a deep blackish-red color from the deposit of pigment, and surrounded by a dark brownish stain. There has also been a good deal of œdema of the feet lately. All of these conditions have been improved by the use of tight-laced stockings. The skin of both the hands and feet is rather soft and moist. The last phalanges, both of the fingers and toes, are markedly clavate and hypertrophied. Firm pressure upon them reduces their size; but, upon withdrawal of the pressure, the blood slowly returns, and they regain their former size. The temperature of the body is always low, and he suffers extremely from exposure to cold.

He suffers somewhat from dyspnœa, even upon slight exertion, but less so than formerly. He is also troubled with cough during the winter months. There is marked deformity of the thorax, the first and second pieces of the sternum uniting at an obtuse angle, and the cartilages of the third, fourth, fifth, and sixth ribs, forming a marked prominence on either side of the sternum; the ensiform cartilage is considerably depressed.

The apex-beat of the heart is in the fifth costal interspace, and just inside of the vertical line of the nipple. The heart's action is regular, and at present there is no abnormal cardiac murmur, though two years ago there was a distinct soft systolic bruit. The pulse in the standing posture is 114, in the sitting, 108. He has occasional attacks of epistaxis, and suffers quite frequently from attacks of gastric disturbance attended with severe headache.

The above note was taken in December, 1869. Since our last edition, this case has terminated fatally, and a post-mortem examination proved the existence of marked congenital malformation of the heart, of the character already fully described, originating evidently in obstruction of the pulmonary orifice.

TREATMENT.—In the form of cyanosis which we have described as depending on collapse of the lungs, the child should be placed in the position below recommended as rendering the heart's action most free; the temperature of the body should be carefully maintained, and a few doses of brandy in water or breast-milk should be given at intervals. There is evidently but little good that can be done by mere medication in cyanosis depending on malformations of the heart. When the heart's action is feeble and irregular, digitalis, iron, and quinia, may be administered. During the paroxysms of palpitation and dyspnœa, the best remedies are diffusible stimulants, such as Hoffman's anodyne, spirit of chloroform, ammonia, and brandy; and derivatives, such as sinapisms to the chest or hot mustard foot-baths. In cases where the digestion is markedly feeble, the use of vegetable tonics is indicated.

By far the most important part of the treatment, however, is a strict attention to the hygienic conditions of the patient. He should, so far as may be practicable, avoid all excitement and active exertion; his diet should be digestible and nutritious, his clothing should be warm, and, in addition, he should carefully avoid all exposure to severe cold.

In cases where the venous congestion of the legs is marked and attended with œdema or with enlargement of the veins, laced stockings should be worn.

It occasionally happens that cyanotic patients find that certain positions afford them peculiar ease and comfort. Believing that in cases where the lividity appeared soon after birth (cyanosis neonatorum), it was due to a patulous condition of the foramen ovale, the late Dr. Charles D. Meigs was led to recommend (*Diseases of Children*, 1850, p. 92), that such children should be placed upon a pillow, on the right side, the head and trunk being inclined upwards about 30° or 45°. The object of this position was "to bring the septum of the auricles into a horizontal position, so that the blood in the left auricle might press the valve of Botalli down upon the foramen ovale."

In a certain number of cases the adoption of this recommendation has undoubtedly seemed to relieve the lividity, so that it is perhaps desirable that all cyanotic infants should be placed in this position; though from a glance at the anomalies in the formation of the heart which frequently attend cyanosis, it is evident that in most cases it could furnish no material relief. We are ourselves inclined to attribute the relief afforded by this position, not to any influence upon the foramen ovale, but to the fact that the heart's action is far most free and unincumbered when the child is placed upon the right side, with the trunk somewhat elevated.

ARTICLE II.

DISEASES OF THE HEART.

As we are prevented, by the limits of this work, from giving any detailed account of many of the affections which merely occur in childhood in common with adult life, we propose in this article to offer only a few practical remarks upon the differences presented by diseases of the heart occurring at these two periods of life.

Apart from those congenital malformations of the heart, already discussed in the preceding article, the diseases of this organ most frequently met with in childhood, are pericarditis, and acute and chronic endocarditis, with valvular disease.

The most frequent causes of these affections are rheumatism, the peculiar alterations of the blood present in scarlatina, rubeola, and diphtheria, and extension of inflammation from the adjacent tissues, in cases of pleurisy or pneumonia. Of these well-recognized causes, rheumatism is by far the most frequent; for, although young children are comparatively rarely the subjects of this disease, it is followed by some cardiac complication in a larger proportion of cases in childhood than in after years. This fact will be more fully referred to in our remarks upon rheumatism, where we dwell

upon the importance of recognizing this marked tendency, and of watching most critically for the appearance of any symptom indicating that the heart has become involved. This extreme watchfulness is the more necessary, because it frequently happens in young children, that for several days before the development of any local articular trouble, there may exist marked rheumatic fever, with serious inflammation of the membranes of the heart.

In a few instances an acute cardiac affection cannot be traced to any of the causes above-mentioned, but appears to occur idiopathically, without exposure to any recognizable exciting cause.

So, too, in some cases of chronic valvular disease, and especially, it has seemed to us, of contraction and thickening of the mitral valve, the lesion cannot even be traced to any acute attack of endocarditis, but seems more akin to a fibroid degeneration, whose cause and early symptoms have been obscure and entirely overlooked.

Possibly, in some of these interesting cases, the real starting-point of the disease may have been an attack of endocarditis in fœtal life, which partially spoiled the valve, and set on foot degenerative changes, which slowly increased until they produced fatal symptoms.

Acute Pericarditis may occur at any period after birth. In very young infants it has been observed in conjunction with peritonitis, and was apparently due to erysipelas; while in other cases no cause could be assigned for its occurrence. The symptoms are, however, so vague and difficult to appreciate at this tender age, that the lesion is rarely recognized until after death. The infant is evidently in pain; the features are pinched and shrunken, the skin hot at first, and the pulse and respiration greatly accelerated. The physical signs can, however, rarely be satisfactorily determined, partly because death usually occurs before the lesions reach any considerable degree of development.

In older children the physical signs are often obscured by the coexistence of some inflammatory condition of the lungs or pleura, and the existence of pericarditis can only be surmised by the presence of a degree of disturbance of the circulation and respiration out of all proportion to the amount of lung trouble.

When, however, pericarditis occurs without any such complication, it may be often recognized by the seat of pain; the existence of great dyspnœa, amounting at times to orthopnœa; the great frequency of the pulse, which is often small, and even irregular; the disturbance of circulation, as shown by lividity of the lips and face; and, finally, by auscultation and percussion, which reveal at first merely a friction-sound, and later, when effusion has occurred, distant and feeble heart-sounds, with an increased area of cardiac dulness.

When severe, pericarditis in children usually proves fatal. After death the same anatomical lesions are found as after pericarditis in adult life. The membrane is, in the first stage, reddened, injected, dryish, and slightly roughened; while later it is still injected and even ecchymosed, thickened, softened, and covered with patches or uniform layers of whitish or yellowish-white lymph, the surfaces of which are usually flocculent or irregularly

roughened. The pericardial sac contains a variable quantity of turbid, or, at times, bloody serum; or, in secondary cases, a sero-purulent fluid.

In cases where recovery takes place, the results of the previous inflammation are found, after death has occurred from some other cause, in the form of more or less extensive adhesion of the two layers of the pericardium, or merely of thickening and opacity of that membrane.

Treatment.—In idiopathic cases, if the disease be recognized in the early stage, we should advise local depletion over the præcordia by three or four leeches or cut-cups in a child of five years of age, followed by the application of warm mush-poultices, the depletion being repeated if indicated; the internal use of large doses of acetate of potash and iodide of potassium, associated with doses of veratrum viride of appropriate strength, to quiet the excessive vascular excitement; and the careful administration of nutritious diet and small amounts of stimulus, if the powers of the circulation seem likely to yield to the influence of the disease.

In the very rare instances where the disease becomes chronic, and the effusion remains unabsorbed, the treatment should consist in the repeated application of small blisters over the præcordia, and the internal use of iodide of potassium, iodide of iron, with tonics and nutritious diet. In still more rare cases, the effect of chronic pericarditis is to induce extremely thick layers of lymph enveloping the heart. In one instance which we lately saw in consultation with Dr. C. H. Thomas[1] where pericarditis of several years' duration existed, the sac was obliterated by a layer of succulent almost gelatinous lymph fully one-half inch in thickness. In such a case, it is difficult to distinguish the lesion from hypertrophy of the heart. It might be done, however, by the absence of valvular murmur, and the feebleness of the apex-beat and of the heart-sounds. If, moreover, we have observed or can get an accurate account of the original attack, its character and the future course of the case would be of great value.

Endocarditis.—In many cases, acute endocarditis in children occurs in conjunction with pericarditis, although it also occurs frequently as an independent affection. It is due to the same series of causes, also, as have been already enumerated when speaking of this latter disease; of these undoubtedly rheumatism is far the most frequent. And as it is of far more frequent occurrence than pericarditis, and productive of even more serious results, it is necessary that we should, if possible, be more upon the alert to detect the very earliest symptoms of its presence. Since recent observation has established the occurrence of acute affections of the heart in the course of some other specific diseases, as stated in our remarks on pericarditis, it is an important rule to use the same care in repeatedly examining the heart in these cases also.

In severe cases, whether occurring idiopathically, or as a complication or sequel of some other disease, there is violent disturbance of the circulation, with great dyspnœa, and short, dry cough, without any of the physi-

[1] See report in Transactions of Philadelphia Pathological Society, vol. vi, 1876–77.

cal signs of pulmonary disease. The child is extremely restless, and, upon auscultation, an abnormal bruit is heard attending the heart's action. The valvular murmur, it must be remembered, is not harsh and strong as in some cases of chronic valvular disease, but may be so gentle and soft as to be heard with difficulty.

In most cases, the mitral valve is chiefly affected in acute endocarditis, and the murmur detected on auscultation is heard over the body of the heart and to the left of this organ, and often has its seat of greatest intensity near the apex. We have most frequently observed the murmur to be systolic in time, attending and more or less obscuring the first sound of the heart, in such acute cases. Of course, this indicates the existence of some imperfection in the closure of the mitral valves, allowing more or less regurgitation of blood into the auricle with each contraction of the ventricle. Occasionally a double murmur, attending both the systole and diastole, and indicating roughness as well as insufficiency of the mitral valve is heard. In more rare instances, we have found the aortic valves to be the seat of acute endocarditis, as shown by the presence of a single or double blowing murmur over the base of the heart, and transmitted most strongly upwards over the upper part of the sternum to the second right costal cartilage.

But more frequently the acute symptoms are not so marked or characteristic as this, and, when ensuing, for instance, in the course of acute rheumatism, may consist merely in a little increase of the heat of the skin, frequency of the pulse and restlessness, with or without vague complaints of pain about the præcordia.

Absolutely the only way of recognizing such cases is by auscultation, and consequently we would urge the immense importance of carefully auscultating the heart *daily*, not only in every case of acute rheumatism in a child, but also in every case where anomalous febrile symptoms, with acceleration of pulse, are present, and particularly if there be general soreness, or even resistance to motion.

In very severe attacks of acute endocarditis, death may occur early; but more commonly the disease is less severe, and the urgent symptoms subside, leaving, however, in but too many cases, organic valvular disease.

When death occurs during the acute stage, the endocardium is found injected, reddened, softened, and readily detached from the muscular wall. The lesions are most marked on the left side of the heart, and especially on the endocardium covering the mitral valve, where, in addition to the above-mentioned appearances, there are usually patches or rows of minute granular vegetations, which form a fine beaded line along the free border of the valves; or, in other cases, delicate fringe-like processes which hang from the leaflets. We have alluded at some length in our article on chorea, to the theory which has been framed to explain the frequent occurrence of this latter disease in connection with rheumatism, by the separation of minute fragments of such vegetations, and their impaction in some of the vessels of the brain.

The treatment of acute endocarditis should be the same as that recommended for acute pericarditis.

CHRONIC VALVULAR DISEASES.

There are certain general remarks which we desire to make in connection with these affections, which are applicable to them, without reference to the particular valve diseased: in addition to which, we will call attention to the diagnostic signs and special features of the diseases of each set of valves.

Causes; Frequency.—In very many cases, heart disease in young children is recognized for the first time when such marked lesions exist as to convince us that the disease has already been of some considerable duration. Undoubtedly this is partly because the acute symptoms of the early stage have been entirely overlooked. This is particularly the case when the disease is rheumatic in its origin. We are convinced that acute rheumatism is often overlooked in young children, and also that endocarditis occurring in the course of such attacks not rarely escapes detection. It is, therefore, very difficult to say in what proportion of cases in young children, valvular diseases have been of acute origin. In our own experience they have, with the exception of contraction of the mitral valve, almost universally followed an attack of endocarditis. In the case of mitral contraction, however, it is quite often impossible to trace the disease to any acute attack. It would appear, therefore, either that, contrary to the usual rule in early life, this lesion is often the result of a slow degenerative, fibroid change, or else that, in some cases, it may arise in fœtal life. This latter view does not seem at all impossible when we remember how slow is the development of this lesion, and for how long a time it may remain latent.

As to the relative frequency with which the different sets of valves are affected, lesions of the mitral valve undoubtedly preponderate largely. We have, it is true, met with extreme aortic disease in quite young children, marked by all the physical signs that are familiar as occurring in the adult; but such cases have been rare compared to those in which the mitral valve was the seat of the disease.

Anatomical Appearances.—The lesions which are found in chronic valvular diseases do not differ from those which are found in the adult, nor are they materially dependent upon the mode of their origin. It is, however, probably true that in those cases which have followed acute endocarditis, it is more usual to find numerous and large vegetations upon the valves, than where the lesion has been chronic and of gradual development from the start. The lesions which are found usually, are vegetations or calcareous incrustations on the valves, or there may be thickening, contraction, and coalescence of the valves and their chordæ tendineæ, either of which conditions may be attended with contraction of the orifices of the heart, and obstruction to the passage of blood. On the other hand, the contraction of the valves may be in such a direction as to render them insufficient to close the orifice, and thus allow regurgitation. The effect of these lesions upon the walls and cavities of the heart will vary with their degree and suddenness of development. Usually they are followed by dilatation of the cavities involved, and by thickening or hypertrophy of

their walls, which has usually seemed to us more constant and to bear a larger proportion to the dilatation than in adults.

Symptoms.—The general symptoms during the early stages of chronic valvular disease, are often extremely slight, consisting merely of some interference with the general development of the body; a little palpitation of the heart, and dyspnœa on exertion; occasional præcordial distress, and perhaps slight prominence of the cardiac region.

The vague character of these symptoms accounts for the fact that, after the subsidence of the acute symptoms of endocarditis, when the disease has begun in that way, such cases are very often neglected, and receive no proper care until the occurrence of dyspnœa, cough, and dropsy, gives warning only in time to recognize the approach of the fatal termination.

We make these remarks especially to call attention to the insidious mode of approach of many cases of chronic valvular disease of the heart in children; and to impress upon our readers the important practical rule that, whenever, in the investigation of a child suffering with obscure ill health, we learn of the previous occurrence of acute rheumatism, or find mentioned among the symptoms any irregularities of the circulation or action of the heart, careful physical exploration of the heart should immediately be practiced.

The special symptoms which attend the diseases of the different valves, may be briefly described as follows:

Diseases of the Aortic Valves.—These affections are, as already said, comparatively rare in children. The blowing murmur which attends them is usually strong and distinct. If the lesion causes obstruction of the aortic orifice, the murmur will attend the first sound; if there be regurgitation through the valve, it will attend or take the place of the second sound. In many cases the lesion causes both obstruction and insufficiency, and there is therefore a double murmur. In either case the murmur will be heard extending from the base of the heart upward and across the sternum to the second right costal cartilage, as well as downward along that bone to the xiphoid cartilage. It is also transmitted into the arteries. The murmur is often so loud that, especially in cases of regurgitation, it may be heard down over the body of the heart to the apex; and also to a varying distance on either side of the sternum over the upper part of the chest. Occasionally also a thrill may be felt over the upper piece of the sternum, in the second intercostal space at either the right or left edge of the sternum, or at the supra-sternal notch.

The action of the heart is regular, and may not be accelerated, though exertion readily excites palpitation. The apex-beat is quick and strong, and is found after a time below and to the left of its normal position. The area of cardiac percussion-dulness also becomes moderately increased, in consequence of gradual hypertrophy of the walls of the left ventricle.

The pulse is small, quick, and in cases of regurgitation, jerking and unsustained, or receding.

In severe cases, there are marked evidences of interference with the arterial circulation. The surface is pale, and shows the insufficient amount of blood which passes through the arterial capillaries.

The respiration is usually but little disturbed, excepting in consequence of unusual exertion, so long as the lesion is limited to the aortic valve, and the walls of the left ventricle undergo sufficient compensatory hypertrophy to overcome the obstruction to the circulation.

The *prognosis* in aortic disease of moderate severity has not seemed to us unfavorable so far as regards prolongation of life. Thus, for example, we treated a girl of 9½ years, who had a violent attack of acute articular rheumatism with endocarditis. This was followed by a double aortic murmur, which persists to the present time, although she has grown up, married, and has one child. Her health is delicate, and she has very moderate dyspnœa on exertion. We have frequently observed this same tolerance of serious aortic lesions for a number of years. We have never met with a case in which sudden death occurred in the course of aortic regurgitation, as so frequently happens in adults.

Mitral Obstruction.—This interesting form of cardiac lesion would merit a more full description here than any other valvular disease, because its symptoms are somewhat peculiar, and more especially because it is of such comparative frequency in childhood.

Its origin, as we have already remarked, is usually insidious, and it is frequently impossible to gain any history of acute disease in cases where marked mitral obstruction is detected.

The general symptoms which first attract attention to the heart are rarely noticed before the age of 7 or 10 years; and we may then learn that during previous years the child has seemed as active and playful as usual, or that he has always shown an indisposition to active play or exertion, and has become tired readily. Attention is attracted to the heart by the increased tendency to dyspnœa and palpitation on exertion, and by the readiness with which cough of a bronchial character is contracted on very slight exposure. Occasionally during these attacks of bronchitis with pulmonary congestion, hæmoptysis may have occurred. Examination may now show the existence of prominence of the præcordia; and the area of cardiac dulness is usually increased, though not to a marked extent. Frequently a thrill can be felt over the præcordia, and careful examination will show it to occur just before the apex-beat. We have known this thrill to begin distinctly about the base of the heart, and to extend quickly down towards the apex, terminating as the apex-beat was noticed. On auscultation, a murmur, usually of a low, hoarse, or churning character, is heard, which presents these additional peculiarities: it is generally distinctly *presystolic or auriculo-systolic* in time, occurring, that is, in the long period of silence preceding the first sound; its relation to the phenomena of the cardiac action can usually be determined without difficulty by observing that it follows the second sound, and that it stops just before, or else runs into, the time of the first sound and the pulse of the carotid artery. This murmur, also, although usually quite strong, is, as a rule, remarkably localized in comparison to other valvular murmurs: its seat of greatest intensity is at or near the apex, and it loses force rapidly on leaving this point in any direction. Attention to the peculiar

physical signs above given, as well as to the general symptoms, will generally render the diagnosis clear.

The prognosis, as regards prolongation of life and maintenance of comfort, is comparatively favorable; as regards improvement in the organic condition of the heart, it is of course entirely the reverse. We have under our care at present a lad of 16 years of age who presents the typical symptoms of mitral obstruction, but who, by care in his manner of living, enjoys entire comfort. Usually, however, the frequent recurrence of pulmonary congestion injures more and more seriously the equilibrium of the heart's circulation and the efficiency of the right ventricle, and eventually grave symptoms of failure of cardiac power, with general venous stasis, appear, and increase until a fatal result occurs.

Mitral Regurgitation.—This, which is the most frequent form of cardiac disease in young children, depends upon inflammatory alterations in the mitral valve, which render it insufficient to close that orifice during the systole of the left ventricle. In most cases it arises from an acute endocarditis, chiefly of rheumatic nature. In this condition, as in the last, the pulmonary circulation is apt to be disturbed from time to time, and therefore the early general symptoms which attract attention to the thoracic organs are usually shortness of breath on exertion, liability to cough, and palpitation of the heart. Of course, where we are in attendance upon the case of rheumatism when the acute cardiac inflammation occurs, the fact will be recognized by the symptoms detailed under the head of acute endocarditis. But unfortunately it often happens that this acute stage is quite overlooked, and we would therefore again urge the importance of a careful physical examination of the heart in every case where a child is brought to us complaining of vague symptoms of embarrassed breathing, though no suspicion has ever been raised of the existence of heart disease. Sometimes, indeed, much more marked general symptoms will have appeared, as, for example, severe dyspnœa on exertion, pulmonary congestion with cough and moist or dry râles over the posterior parts of the lungs, palpitation of the heart, lividity of the lips and fingers, and even œdema of the feet.

On physical exploration we often find prominence of the præcordia, with signs of more considerable hypertrophy and dilatation than in cases of mitral obstruction. The impulse is extended and too forcible, or may even be heaving; it is rarely attended with any thrill. On auscultation a blowing murmur, which varies very greatly in different cases in its force and character, will be heard accompanying or replacing the first sound of the heart. This murmur is heard at the base, and is transmitted most strongly towards the apex, where it often has its point of greatest intensity. It is also strongly transmitted to the left of the apex, being well heard in the infra-axillary space on the level of the apex-beat, and frequently, also, on the dorsum of the left chest, at the angle of the scapula. The only other form of valvular disease with which it is possible to confound this is mitral obstruction; but attention to the evident points of difference noted above will render the diagnosis easy in most cases.

The prognosis varies extremely in different cases, depending upon the

extent and rapidity of development of the lesion; the completeness with which the disturbance of the circulation is compensated by the hypertrophy and increased power of the walls of the left ventricle; and the vigor of the system and the preservation of the tone and nutrition of the muscular fibre of the heart. This form of heart disease illustrates more clearly than any other the more favorable prognosis which may be made in many cases of organic valvular disease in children, as compared with the same condition in adults. This depends partly upon the fact that when the lesion is not extensive, and when the patient is placed under favorable circumstances, the heart accommodates itself in its growth to the defective state of the valves, and overcomes the impendiment to the circulation by acquiring increased propulsive force.

Not only, however, are the valvular lesions in childhood thus partly compensated by hypertrophy of the walls of the heart, but there is also an undoubted tendency, in some favorable cases, for the valvular lesions, both mitral and aortic, themselves to diminish. Thus among the following cases, which we have selected from a large number of records collected in our practice, there will be found several where positive abnormal bruits, due to organic valvular disease, have gradually disappeared in the course of years.

Acute articular rheumatism; endocarditis; recovery; murmur persistent but diminishing.—H. S., a boy, æt. 12 years, had a severe attack of acute articular rheumatism in April, 1869, with swelling, redness, and pain of joints; a systolic murmur appeared at the apex without any pericarditis. He recovered, under the use of alkalies and opium. In November, 1869, seven months after the attack, he seemed perfectly well; had no dyspnœa except on violent exertion. The murmur at the apex is still audible, but less marked than three months ago, when he was last examined.

Acute endocarditis (rheumatic?); marked improvement in general symptoms, but persistent murmur.—B. H., a girl, at age of 4 years suffered from an ordinary catarrh, when we detected a loud, high-pitched murmur at the apex, and, on inquiry, learned that, when 2½ years old, she had a violent inflammation of the chest, supposed to be catarrhal fever. At present, at the age of 12 years, she is in excellent health, without any of the rational signs of cardiac trouble, but she still has a well-marked, rather prolonged, high-pitched, systolic murmur at the apex.

Repeated attacks of rheumatism with severe mitral disease; improvement in general symptoms and force of the murmur.—L. S., a girl, was subject to attacks of rheumatism from very early age, and has presented symptoms of cardiac disease from infancy. At age of 13, there was a strong systolic murmur heard over base and toward apex. She suffered much from violent palpitation, pain in præcordia, headache, and habitual dyspnœa, much increased on exertion. At age of 18, there is still a systolic mitral murmur, but of much less intensity than formerly. Her general health is excellent, and she has but little dyspnœa or palpitation at any time. The heart's action is still readily excited; the impulse strong, but without thrill; there is marked increase in the area of cardiac dulness, but no positive prominence of the præcordia.

Acute rheumatic endocarditis, chronic mitral disease; recovery in five years.—F. R., a girl, at the age of 6 years, was attacked with slight rheumatic fever, without any articular symptoms. In a few days, a distinct but not loud, rather low-pitched systolic murmur was heard at the apex. The treatment consisted of rest in bed, quinia, and Dover's powders. After ten days, all the acute symptoms disappeared, but the murmur continued. She regained her health, but for two years the mur-

mur could be detected, but then gradually diminished; and now, five years after first attack, no murmur can be detected, the first sound at the apex being merely a little prolonged. Her general health is excellent.

Acute rheumatic endocarditis; valvular disease, gradually recovering in course of two years.—M. B., a girl, at the age of 7 years had fever of a type that made us suspect pneumonia or pleurisy, but without cough, pain in the chest, or any of the physical signs of pulmonary disease. On the third day, there was complaint of pain in one groin, but with no other articular symptoms; rheumatism being suspected, a careful examination detected a roughish systolic murmur at the apex. She was leeched at the præcordia, confined strictly to bed, and had Dover's powders given her. The fever subsided, but the murmur continued for two years, gradually growing faint, and finally disappeared.

It is, however, only when the general nutrition of the patient is good, so that the tonicity of the heart's tissue is preserved; and when all exposure and exertion, which could overtax the energies of the crippled organ, are carefully avoided, that such compensation and gradual recovery are possible.

For in cases where the vigor of the heart's action fails, and degenerative changes occur in its muscular tissue, the tonicity of the walls soon diminishes, and allows the development of passive dilatation of the cavities. In this condition it is not long before the most grave symptoms of embarrassed circulation appear, and the case passes more or less rapidly through the stages common to fatal organic disease of the heart.

The following case may be quoted as a full illustration of the latter remarks, in regard to the effect of exposure and exertion in inducing a fatal result in cases which otherwise might have gradually improved.

Repeated attacks of acute rheumatism in early childhood; valvular disease and hypertrophy; gradual improvement; exposure to hardships of army life; rapid aggravation of symptoms and death.—W. D., male, as a young child suffered from repeated attacks of acute articular rheumatism with cardiac complication. At the age of 9, Dr. Gerhard pronounced him to be suffering from valvular disease and hypertrophy of the heart.

His condition was gradually improving, and he had so few symptoms of cardiac disease that, at the age of 18 years, he was able to enter the infantry service. At the end of one year, however, he was discharged for disability, and when seen by us in July, 1864, presented the following symptoms: bulging of præcordia; marked extension of the cardiac impulse, which was heaving and powerful; marked increase in the area of cardiac dulness from the presence of pericardial effusion; and strong systolic mitral murmur. He had lost flesh; the surface was sallow and lips livid; there was frequent cough with occasional hæmoptysis and epistaxis; the liver was enlarged, and there was frequently œdema of the feet.

Towards the close of the year, the heart's action grew more labored and feeble, the pulse thready and frequent, the entire body became anasarcous, and considerable ascites appeared. He suffered from constant orthopnœa and frequent cough, with bloody expectoration. The skin of the legs subsequently became gangrenous in parts, and he died December 28th.

At the autopsy, the heart was found enormously enlarged, extending over to the right of the sternum. The pericardium was firmly adherent throughout its extent, and in places was ¼ inch thick; there were several cartilaginoid plates in the substance of the investing pericardium.

The heart measured 9½ inches from apex to base, and 6 inches across at the base of the ventricles; the walls of the left ventricle were 1½ inches thick; the auricles were enormously dilated with very thin walls. The aortic and pulmonary valves were healthy and apparently sufficient; the tricuspid valves were also healthy, but probably insufficient. The mitral valves had entirely disappeared, from shrivelling and contraction, and there merely remained a very thick fibrous ring, studded with calcareous masses, bounding the auriculo-ventricular opening.

The muscular tissue of the heart presented an incipient state of fatty degeneration.

The liver was enormously enlarged, reaching nearly to the umbilicus, and presented intense nutmeg congestion.

The kidneys were large and congested; and the spleen was three times its normal size.

TREATMENT.—Having spoken somewhat in detail of the symptoms and prognosis of the different forms of valvular disease in children, it remains to make some general remarks upon their treatment. In the management of such cases, as in adult life, the most important point to be attended to is the careful regulation of the mode of life. The child should be warmly clothed, and carefully protected from any exposure which might induce an attack of rheumatism; all violent exertion of body or mind should also be avoided, and, so far as possible, all sudden emotions, as fright or anger. On the other hand, care should be taken that proper gymnastic and outdoor exercise should be regularly taken in such ways as to invigorate the frame and strengthen the muscular system, without producing too much exhaustion. The diet should be nutritious and digestible, and if the appetite should fail, and the child appear weakly and pale, vegetable tonics, with iron, should be administered.

The appearance of symptoms of pulmonary congestion, or of catarrh, should attract immediate attention, and lead us to employ counter-irritation and suitable expectorants to relieve the lungs.

In cases where the heart's action is excited, and too frequent and powerful, while evidences of excessive hypertrophy begin to show themselves, we should employ cautiously veratrum viride or aconite to control it. When, on the other hand, any of the cavities of the heart are subjected to overstrain from valvular obstruction or insufficiency, and the heart is acting irregularly and inefficiently, the greatest benefit will be obtained from the use of digitalis. Indeed, in many instances we have observed, under the prolonged use of this drug, very great permanent improvement, gradually showing itself both in the action of the heart and in the general symptoms.

Severe paroxysms of palpitation, should they occur, require the use of antispasmodics, diffusible stimuli, and revulsives, just as are indicated under the same circumstances in the adult. Should the attack not subside promptly, recourse should be had to digitalis, which may be freely administered, and will be found to afford marked relief.

In cases of rheumatic origin especially, we have thought that good results, in regard to the progress of the organic changes in the heart, have followed the prolonged use of iodide and bromide of potassium, given

with due regard to the danger of developing an anæmic state of the blood by the uninterrupted administration of these drugs for a long time.

On the whole, as we have already said, there is reason to be somewhat hopeful in the treatment of chronic valvular disease of moderate severity in young children, bearing in mind the wonderful power which the growing heart possesses of compensating such lesions, so long as by careful attention to hygiene and medical treatment we are able to preserve the tone and nutrition of its muscular tissue.

CLASS III.

DISEASES OF THE DIGESTIVE ORGANS.

CHAPTER I.

DISEASES OF THE MOUTH AND THROAT.

We have adhered to the arrangement of this subject adopted in our last edition, and shall consider the diseases of the mouth in the following order:

1. Simple or erythematous stomatitis.
2. Follicular stomatitis, or aphthæ.
3. Ulcerative, or ulcero-membranous stomatitis.
4. Gangrene of the mouth.
5. Thrush, or stomatitis with curd-like exudation.
6. Affections of the tonsils.
7. Simple, or erythematous pharyngitis.
8. Retropharyngeal abscess.

In the early editions of this work, we described pseudo-membranous pharyngitis in this place, but further observation and research have clearly established the fact that this is but the local manifestation of a constitutional affection, diphtheria; and we have accordingly given a full account of the whole subject, under this latter name, in the section on constitutional diseases.

ARTICLE I.

SIMPLE OR ERYTHEMATOUS STOMATITIS.

Definition; Frequency.—This form of stomatitis consists of simple diffuse inflammation of the mucous membrane of the mouth, unattended by vesicular or pustular productions, by ulcerations, or by membranous exudation. It is a disease of infrequent occurrence, except in the forming stage of other kinds of stomatitis, and of little importance, seldom requiring the attention of the physician.

The *causes* of the disease are the introduction of irritating substances,

such as hot drinks, and acrid or caustic preparations, into the mouth; difficult dentition; and probably sympathy with disordered states of the stomach. It occurs not unfrequently as a secondary affection, particularly in the course of measles, scarlet fever, and small-pox.

The *symptoms* of erythematous stomatitis are more or less vivid redness of the mucous membrane, sometimes diffused, and at others punctated or disposed in patches; slight swelling of the same tissue; heat; and tenderness to the touch, and also in the act of sucking or eating. The child is generally fretful and restless, and either loses its appetite, or refuses to nurse or take food freely, on account of the tenderness of the mouth. There are seldom any general symptoms except in secondary cases, in which they are those of the primary affection.

The *treatment* is very simple. It consists in the use of some demulcent wash, as gum water, sassafras-pith mucilage, a little honey put on the tongue occasionally, and if the inflammation be at all considerable, in the application of some astringent preparation. This may consist of honey and borax, two or three parts of the former to one of the latter, or of the following wash, recommended by M. Bouchut:

℞.—Mel. Rosæ, ... f℥j.
Aluminis, ... ℥ss.
Aquæ destillat., ... f℥ss.—M.

The application of any of the washes recommended is best made by means of a thick and soft camel's-hair pencil; or it may be done with a soft rag, which should be dipped in the wash, and then conveyed into the mouth on the point of the finger. The remedy ought to be used several times a day.

If signs of gastric or intestinal disorder are present, they should be attended to.

ARTICLE II.

APHTHÆ.

Definition; Synonyms; Frequency; Forms.—The term aphthæ ought to be restricted to the vesicular and ulcerous form of disease of the buccal mucous membrane, in which that tissue is covered with an eruption of vesicles which break, and are followed by small rounded ulcerations. Under this title writers formerly confounded the affection we are now considering with ulcerative stomatitis and thrush. It has been called by Billard follicular stomatitis, and by several other writers vesicular stomatitis.

The *frequency* of the disease is very considerable. We shall describe two *forms*, the *discrete* and *confluent*.

Causes.—The only causes which seem to have been ascertained with

any degree of certainty, are early age and the process of dentition: the contact of irritating substances, particularly stimulating and acrid articles of food, with the mucous membrane of the mouth; and the existence of some morbid irritation of the digestive tube, especially of the stomach. The confluent form is often connected with severe general disease of the constitution.

Symptoms; Duration.—Aphthæ begin in the form of small red elevations, having little white points upon their centres, which consist of the epithelium of the mucous membrane raised into vesicles. The vesicles are small in size, oval or roundish in shape, and of a white or pearl color. They soon break and allow the fluid which they contained to escape, after which there remains a little rounded ulcer, with excavated and more or less thickened edges, and surrounded almost always by a red circle of inflammation. The bottom of the ulcers is usually of a grayish color.[1] There is seldom any diffuse inflammation of the mucous membrane in this disease. The *number* of aphthæ varies in the two forms. In the discrete variety there are but few, whilst in the confluent form they are, of course, much more numerous. They generally appear first on the internal surfaces of the lips and gums, and then on the inside of the cheeks, edges of the tongue, and soft palate.

The discrete form is generally accompanied by symptoms of slight disorder of the digestive organs, consisting of thirst, acid eructations or vomiting, imperfect digestion, and a little constipation or diarrhœa. The confluent form, which is much more rare, especially in very young infants, usually coincides, as has already been stated, with severe general or local disease.

The *duration* of aphthæ is different in the two varieties of the affection. The discrete form generally pursues a rapid course, lasting from the beginning to the time of cicatrization, between four and seven days. Sometimes, however, when the vesicles are formed successively, one after the other, the disease lasts much longer. The confluent variety pursues a much slower course, and is much more difficult of cure.

Diagnosis and Prognosis.—The diagnosis of discrete aphthæ is not at all difficult, in consequence of their being isolated and succeeded by small and limited ulcerations. The confluent form, on the contrary, may be confounded with ulcerative or ulcero-membranous stomatitis, and with thrush. From the first-mentioned disease it may be distinguished, however, by attention to the circumstances that that affection begins by small white patches, and not by vesicles, as do aphthæ; that the ulcerations which follow the patches are covered with true pseudo-membrane; and that the white patches just spoken of appear first upon the gums, whilst aphthæ generally begin upon the posterior surface of the inferior lip, and upon the

[1] The grayish or yellowish-gray secretion, on the base of the aphthous ulcers, has lately been closely studied by Dr. J. Worms (Glasgow Med. Jour., July, 1864), who states that both microscopical examination and chemical tests invariably show its sebaceous nature. It is his opinion, therefore, that aphthæ are the acne of the mucous membranes; in support of which, it will be remembered, that they are found most frequently where the muciparous glands are most abundant.

tongue. From thrush it is to be distinguished by the facts that that disease commences by white points, which are not vesicular, and which, running together, form a creamy exudation; by the absence or very small number of ulcerations; and by the presence of the peculiar fungus of thrush.

Discrete aphthæ constitute a very mild disorder. They always recover without much difficulty. The confluent disease is more serious, because its progress is much slower, its cure more difficult, and because it is often connected, as has been stated, with some other severe disease.

TREATMENT.—Aphthæ, particularly the discrete variety, require in general, very simple treatment. The means to be employed are *general* and *topical*.

The *discrete variety* usually requires only topical remedies, regulation of the diet, and when there are marked symptoms of gastric derangement, the exhibition of some mild emetic, or of a laxative dose. The *local treatment* should consist of applications of demulcent preparations, as the mucilages of slippery elm, sassafras pith, flaxseed, marsh-mallow root, quince-seed, etc., which are to be used pure when there is no pain, or with the addition of a few drops of laudanum or wine of opium, when the mouth is sore and tender; the aphthæ ought to be touched occasionally with the mixture of borax and honey, or the aluminous preparation recommended for simple stomatitis. The applications must be made several times a day with a camel's-hair pencil, a pencil made of charpie or cotton, or with a soft rag covering the finger. When the ulcers which follow the vesicles fail to cicatrize rapidly under the above applications, or when they are numerous and painful, their cure may be very much hastened and the pain quickly relieved, by touching them very lightly with a stick of nitrate of silver, or a piece of alum, sharpened to a point; or we may employ a pencil dipped into a strong solution of nitrate of silver, or into a mixture of one part of muriatic acid to two of honey. Ether has been highly recommended as a local application, by Dr. J. Worms, who, as already stated, has observed the fatty nature of the deposit in aphthous ulcers.

The *general treatment* of discrete aphthæ need consist of nothing more than the prescription of a simple, unirritating diet in most of the cases. If, however, the digestive apparatus is deranged, the case must be treated according to the symptoms; by antacids or a gentle emetic, when the tongue is foul and the secretions acid; and by the use of a mild laxative, as castor oil, magnesia, or rhubarb, when there is constipation. When diarrhœa is present, we should resort first to a small dose of castor oil or syrup of rhubarb, with the addition of half a drop to two drops of laudanum, according to the age of the child, and afterwards to astringents and opiates, as will be recommended in the article on simple diarrhœa.

The treatment of *confluent aphthæ* must depend on their cause. The local treatment is the same as that for the discrete variety, except that mild cauterization should be resorted to at an earlier period. When they seem to depend upon a general morbid condition of the constitution, as congenital debility, a scorbutic diathesis, or upon chronic affections of the digestive organs, they must be treated in the first place by properly regu-

lated and nutritious diet, and by the exhibition of tonics and gentle stimulants, particularly iron, quinine, and small quantities of very fine old brandy; and in the second case, in the manner which will be recommended for chronic derangements of the stomach and bowels, when we come to treat of the diseases of those organs.

ARTICLE III.

ULCERATIVE OR ULCERO-MEMBRANOUS STOMATITIS.

Definition; Synonyms; Frequency.—This form of sore mouth is characterized by a secretion upon the mucous membrane of a plastic exudation in thick, yellowish, adherent patches, and by inflammation, erosion, or ulceration of the subjacent tissues. It is the same disease as the aphtha gangrenosa, and, we believe, the cancrum oris also of Underwood; the ulceration of the mouth of Dewees and Eberle; the stomatite couenneuse, and the ulcerative and pseudo-membranous forms of the stomatite gangreneuse of M. Valleix; the stomatite pseudo-membraneuse or diphtheritique of some writers; and the stomatite ulcero-membraneuse of MM. Rilliet and Barthez. It is the disease described under the title of gangrenous sore mouth by Dr. B. H. Coates (*North American Surgical and Medical Journal*, vol. ii, 1826), with the exception of a few cases which were what we shall treat of as gangrene of the mouth.

Of the different titles given above, we prefer that of ulcero-membranous stomatitis, as most expressive of the distinctive features of the disease. This form of stomatitis is not very frequent in private practice, but sometimes prevails extensively in hospitals, and other public institutions for children, where it often assumes an epidemic character.

Causes.—The *predisposing causes* are epidemic influence, of the existence of which we believe there is no doubt; according to some observers, contagion, which, however, has not as yet been positively shown; and bad hygienic conditions as to cleanliness, ventilation, food, clothing, and habitation. That it is epidemic, we have no doubt from our own experience, since we are rarely called to a case without soon meeting with others, while we sometimes pass several months without seeing a single example of the disease. We have also known it to be endemic in a household, having on one occasion met with seven cases in two families of children residing under one roof, on two other occasions with three cases, and on several others with two. It is most frequent between the ages of five and ten years, though it may attack all ages, and is more common in boys than girls. It occurs occasionally during the convalescence from severe diseases, as pneumonia, the eruptive fevers, typhoid fever, entero-colitis, and other affections of children.

The *exciting causes* of sporadic cases are unknown, with the exception,

perhaps, of the presence of a carious tooth in the mouth, and fracture or necrosis of the maxillary bones.

Symptoms; Course; Duration.—The disease begins with slight pain and uneasy sensations in the gums, which then become swelled, red, bleeding when touched, and are soon after covered with a grayish, pultaceous exudation of varying thickness. The exudation extends from the gums to the internal surface of the lips and cheeks, and sometimes, but more rarely, to the soft palate, and even to the pharynx and nasal passages. The plastic deposit occurs in the form of small, and slightly projecting, yellowish patches, which approach each other, unite, and form bands of pseudo-membrane, somewhat uneven upon the surface, and adhering with considerable force to the tissue beneath. When the exudation is detached, the mucous membrane is found to be of a red or purple color, bleeding, and excoriated or ulcerated. The ulcerations which exist under the false membrane are of various depths, of a grayish, livid, or blackish color, with swelled, softened, and livid red, or bleeding edges. Those which are formed upon the inside of the lips are rounded in shape, whilst those seated in the angle between the lips and gums, are usually elongated. In mild cases of this affection, the local symptoms, though perfectly characteristic, are less severe than those just now described. The ulcerations are often few in number, amounting to four, five, or six upon the tongue, to a few scattered over the inner surfaces of the lips, and to some upon the gums, and especially about the necks of the teeth. The other symptoms are the same as those above mentioned, with the exception that they are milder in degree.

When the disease is mild, and when it is properly treated, the false membranes become detached, leaving the mucous tissue merely excoriated, in which case it soon regains its natural condition; or else the ulcers which exist beneath rapidly become healthy and cicatrize. In violent cases and in those badly treated, the inflammation, on the contrary, persists; the pseudo-membranes increase in thickness, or if detached, are formed anew; the ulcerations become deeper; the disease extends; and the case lasts an indefinite period of time.

Other symptoms, besides those we have mentioned, characterize the disease.

The *breath* is always more or less fetid, and in bad cases, almost gangrenous. The *salivary* and *submaxillary* glands are generally more or less swelled, hard, and painful, and according to some authors, the surrounding cellular tissue is in the same condition, though this is denied by others. The *movements* of the lower jaw are stiff and painful in severe cases. *Deglutition* is not affected unless the disease extends to the pharynx. In violent cases there is usually a copious *discharge* of fetid, watery saliva, or of bloody serum, which flows from the mouth during sleep. When the ulcerations are deep and large, the tissues beneath are more or less swelled; the swelling, however, rarely assumes the hard, resisting, circumscribed characters, with the tense, smooth, hot, and shining appearance of the skin, which exists in true gangrene of the mouth. In most of the cases there is a moderate but decided *febrile reaction*, especially at the invasion. This

usually subsides or disappears after two or three days, though it sometimes increases if the disease becomes extensive.

The disease begins, as already stated, on the gums, and unless limited to these parts, as sometimes happens, extends to the lips and cheeks. In many of the cases it attacks only one side of the mouth, and this is more frequently the left than the right.

The *course* of the disease is usually rapid in epidemic cases, and in those which are properly treated. Where badly treated, on the contrary, it may last from one to several months, or terminate in gangrene of the mouth.

Diagnosis; Prognosis.—The *diagnosis* is, as a general rule, very easy, if proper attention be paid to the characteristic features of the disease. It has, as already stated, been very often confounded with gangrene of the mouth. The method of distinguishing between the two will be given in full in the article on that disease. From thrush it is to be distinguished in the manner which will be pointed out when that disease comes under consideration.

The *prognosis* is favorable in the great majority of the cases. Sporadic cases probably always terminate favorably. The epidemic disease, though rarely fatal, sometimes proves so from its extension to the pharynx and larynx, or from its termination in gangrene of the mouth. We have seen a large number of cases in private practice, and have never as yet known one to become gangrenous or to prove fatal. Of upwards of 120 cases of this kind, observed by Dr. Coates at the Philadelphia Children's Asylum, in a period of three months, all but one recovered (*loc. cit.*, p. 21). The cases which occur in the course of other diseases are not dangerous in themselves, but are so as being the sign of a great severity of the primary affection.

Treatment.—The treatment may be divided into *general*, and *local* or *topical*. The *general treatment* should consist in most of the cases in attention to the diet, which ought, in healthy and vigorous children, to be simple and unirritating, and in those who are weak and debilitated, nutritious and digestible. If the bowels are costive, or the child feverish and uncomfortable, a laxative dose may be given with advantage; or some simple diaphoretic, as nitre and water, or the neutral mixture, may be used through the day, and a warm foot-bath or an immersion-bath given in the evening. When the constitution is feeble, and the child weak or anæmic, tonic remedies are indicated. The best is probably quinine, or one of the ferruginous preparations; or the compound infusion of gentian, with addition of Huxham's tincture of bark, may be resorted to. The best internal remedy, however, and indeed the only one of any kind that is necessary in most cases, is the chlorate of potash, which possesses a stimulant and alterative action upon the mucous membranes. This is spoken of in the highest terms by Dr. West, of London, who regards it almost as a specific. We have used it now for many years past in a very large number of cases, and have seldom found it necessary to employ any other means, excepting some mild cathartic dose where the bowels have been constipated, and a wash of borax or alum in honey of roses, or borax

in simple honey. The symptoms have begun to amend in every case in from three to four or five days, and recovery has taken place in about a week or a little more. The dose is from two to three grains every four hours for a child three years of age, and four and five grains for one of nine or ten years. Mr. Hutchinson (*Med. Times and Gaz.*, 1856), who believes also that this salt is almost a specific in this affection, recommends it in larger doses than the above, giving as much as five grains, thrice daily, to an infant of one year old. We have usually prescribed it in the dose of two grains four times a day, in a mixture of syrup of ginger and water, for children three or four years old.

Prior to the discovery of the efficacy of the chlorate of potash in the affection, the *local treatment* constituted the only effectual and reliable means of removing it, and the most violent and painful applications were thought necessary and were made use of. Strong solutions of nitrate of silver, and pure or diluted muriatic acid, were frequently employed in severe cases. Now, however, these caustic substances may probably be entirely dispensed with, except in cases that show a tendency to assume the form of gangrene of the mouth. In ordinary cases the only local applications that need be used, and these are not essential when the child resists very much, are demulcent washes to keep the mouth clean, to be employed in the manner recommended in the article on aphthæ, and some mild astringent wash. This may consist of borax and honey, or borax and sugar, in the proportion of two or three parts of the former to one of the latter, or, what is in our opinion preferable to either of these, of a drachm of borax rubbed up with an ounce of honey of roses.

Should the disease resist the treatment by the chlorate of potash and the simple washes just now recommended, we may employ the following combination, proposed by Dr. Dewees, and of which he says that it "has so far never failed us."

℞.—Sulph. Cupri, ... gr. x.
Pulv. Cinch. Opt., ... ʒij.
Pulv. G. Arab., ... ʒj.
Mel. Commun., ... fʒij.
Aquæ Font., ... fʒiij.—M. et ft. sol.

The ulcerations to be touched with the mixture twice a day, with the point of a camel's-hair pencil. Or, we may resort to the following one recommended by Dr. Coates (*loc. cit.*), and of which he says, that he "settled down, after various trials, in the employment of the following:

℞.—Sulph. Cupri, ... ʒij.
Pulv. Cinchonæ, ... ℥ss.
Aquæ, ... fʒiv.—M.

To be applied twice a day, very carefully, to the full extent of the ulcerations and excoriations."

MM. Rilliet and Barthez recommended very highly the plan pursued by M. Boneau at the Children's Hospital. This is to cleanse the mouth first,

and then to apply dry chloride of lime (calx chlorinata of the Pharmacopœia) to the diseased surfaces. The application is made by means of a piece of rolled paper, or a stiff pencil, which is to be moistened and then dipped into the powder so that some may adhere, or with the finger. The surfaces are to be gently rubbed with the powder, and after a few moments' contact, washed clean with pure water. This is to be done twice a day, until the ulcerations assume a clean, healthy appearance, after which the following mouth-wash is to be employed:

℞.—Mucil. G. Acac., ... ℥j.
Syrup. Cort. Aurant., ... ℥ss.
Calc. Chlorinat., ... ʒj.—M.

The chief danger from the disease depends on the circumstance that it sometimes terminates in gangrene of the mouth, to be presently described. Any disposition to such a termination should be carefully watched, and the proper preventive means, consisting of local stimulating or caustic applications, with the internal use of stimulants and tonics, be at once resorted to.

ARTICLE IV.

GANGRENE OF THE MOUTH.

Definition; Synonyms; Frequency.—Gangrene of the mouth is an affection which occurs chiefly in children of debilitated constitution, and especially as a sequel of some of the eruptive fevers. It begins generally by ulceration of the mucous membrane of the cheek, which after a longer or shorter time, runs into gangrene, and extends rapidly to the gums; after a few days, if the disease be not arrested, the central tissues of the cheek become thickened and indurated, an eschar forms upon the integument, and spreads in depth and width, until at last the cheek may be perforated, the whole side of the face and jaws destroyed, the teeth loosened, and the maxillary bones exposed and necrosed. It is known by a great variety of names: gangrænopsis, cancrum oris, gangræna oris, canker of the mouth, gangrenous erosion of the cheeks of Underwood; necrosis infantilis, gangrenous stomatitis, etc. It is a *frequent* disease in the hospitals for children in Europe, and a not uncommon one in institutions of the same kind in this country. It sometimes prevails endemically in hospitals. It is a rare disease in private practice, and we have as yet met with but few cases, excepting in public institutions.

Predisposing Causes.—The disease is nearly, but not exclusively confined to the period of childhood. It is most common between the ages of three and six years; is very rare, but does sometimes occur in infants; and is of nearly equal frequency, probably, in the two sexes. Unfavorable *hygienic conditions* constitute a strong predisposing cause. Children living

in hospitals or any crowded institution; those whose parents are poor or in want, and whose constitutions have been greatly deteriorated by long illness, by the tubercular diathesis, or by acute diseases, are particularly apt to be attacked. It almost always follows upon some previous acute or chronic disease, particularly measles, or some other acute exanthem; pneumonia; entero-colitis; hooping-cough; long-continued malarious fevers, etc. MM. Guersant and Blache say (*Dict. de Med.*, t. 28, p. 601), "The existence of some anterior disease is a necessary condition of gangrene of the mouth; we have never known it, nor has M. Baron, to occur as an idiopathic affection." It has been affirmed by some persons to be *contagious*, but this is exceedingly doubtful. The fact of its occurring sometimes in an endemic form has already been referred to. It has been known also to prevail as an epidemic.

The *exciting causes* can rarely be ascertained with any certainty. The only one which seems to have been proved to exist in some instances is the exhibition of large doses of the mercurial preparations, and even this is questioned by some very good authorities.

Anatomical Lesions.—Upon examination after death, it is found that the *integument* surrounding the mortified spot soon runs into putrefaction. The lip or cheek in which the disease is seated is swelled, hardened, tense, and shining, of a purple or greenish color, and presents a deep, circumscribed engorgement. On the most prominent part of the swelling there often exists a rounded or oval, and distinctly limited eschar, of variable size, from a third of an inch to an inch, or even more, in diameter. In some instances the cutaneous slough is much larger, and extends irregularly to different parts of the face, to the chin, neck, eyelids, and even to the neighborhood of the ear, so as to occupy the whole of one side. Under these circumstances the tumefaction is neither so considerable, nor so regular, as when the slough is smaller. The eschar is always black, and generally dry and parchment-like, and extends a third or two-thirds of a line in depth, or quite through the integument. The tissues beneath the skin are not generally implicated, though in some cases the eschar is detached and there is a perforation of the cheek through which may be seen the alveolar processes.

The *mucous membrane* of the mouth is always affected with mortification. The disease may be limited, so as to exist in the form of an elongated ulceration, of a dark grayish color, situated in the fold where the mucous membrane is reflected from the cheek to the lower jaw; or, in a larger proportion of cases, it is seated on the internal surface of the cheek, opposite the interval between the alveolar processes. Sometimes the disease is much more extensive, and occupies all or a part of the internal surface of the cheek. In such instances the whole thickness of the mucous tissue is destroyed, and it presents upon its surface a blackish or brownish pultaceous slough, almost liquid in consistence, which may be scraped off with a scalpel, leaving beneath loose shreds of mucous membrane, without any trace of organization. The gums frequently participate in the disease, and are converted into shreds, or completely destroyed.

The *maxillary bones* are sometimes, in severe cases, when the disease has

extended to the gums, exposed, blackened, and even necrosed. The *teeth* are very often uncovered and loosened, and not unfrequently some are lost. The *tissues* between the skin and mucous membrane are found either hardened and infiltrated, or sphacelated to a greater or less extent. In the least severe cases, the fatty cellular tissue, and the muscular structure of the cheek are infiltrated with serum, but preserve their organization. When the disease is more aggravated, the gangrene extends to these tissues also, and always to those adjoining the mucous membrane first; so that the cellular structure beneath that membrane, and then the muscles, are infiltrated with a sanious fluid, and either in a state of sphacelus or tending thereto, whilst some of the adipose tissue beneath the skin is still merely infiltrated. In yet worse cases, the sloughs formed on the two surfaces of the cheek come into contact, and if their separation from the sound parts has taken place, a perforation is the consequence.

The condition of the *bloodvessels* in the midst of the diseased parts has been carefully examined by MM. Rilliet and Barthez. These authors state that when the tissues of the cheek are merely infiltrated, the vessels remain healthy, permeable, and their parietes are scarcely or very slightly thickened. When the vessels run along the edge of the slough, they are still permeable, but their walls are thickened, and begin to assume the appearances of the mortified tissues. Lastly, when they traverse the centre of the eschar, they can still be traced out, but their canals are found obliterated by coagula, in the whole extent of the mortified parts; or else the coagula occupy the vessels at their points of entrance into and exit from the slough, while between these points their walls are thickened, tend to assume the color and softness of the putrefied tissues, and their canals are filled with pultaceous gangrenous matter. The writers quoted do not suppose that the obliteration of the vessels is the cause of the sphacelus, since that change occurs only after the death of the surrounding tissues has already taken place.

The disease very rarely occurs on both sides of the mouth at once, though this does occasionally happen.

The *submaxillary glands* are nearly always in their natural condition, but in rare instances are softened and engorged.

Gangrene of the mouth never, or very rarely, indeed, exists without lesions of other organs. Of these the most frequent are acute pulmonary affections, and after them, acute or chronic diseases of the gastro-intestinal tube, and then malarious fevers, pleurisy, pneumothorax, peritonitis, and nephritis.

Symptoms; Course; Duration.—The following account of the symptoms of the disease is taken chiefly from the work of MM. Rilliet and Barthez. Gangrene of the mouth generally begins during the course or convalescence of some acute or chronic disease, by ulceration, aphthæ, or phlyctenæ of the mucous membrane, and, in rare instances, by œdema of the substance of the cheek. At the same time the face is pale, and usually continues so throughout the disease; the nostrils and eyelids are often incrusted, and the latter infiltrated or sunken, and surrounded by bluish circles; the lips are swelled and covered with scabs, or dry. The breath

of the child is fetid from the beginning, and, as the disease progresses, becomes gangrenous. There is but little fever at first, unless the case be accompanied by some acute disease; the pulse is commonly frequent and small in the beginning, rising gradually from 80 or 90 to 100 or 120, and becoming insensible towards the end. In cases occurring in the course of other diseases, the pulse rises sometimes to 120 or 140, and is larger and fuller. The child is generally languid and quiet at first, or more rarely cross and peevish. The strength may be either lost entirely, merely diminished, or the patient may retain a sufficient amount of force to sit up and observe what is going on around, and even to leave the bed the day before death. Half the children observed by MM. Rilliet and Barthez, in whom this symptom was noted, sat up in bed until within a few days of the fatal termination. In most cases but little complaint is made of pain in the mouth, though in some it is said to be severe.

The ulceration already spoken of as forming the first symptom of the disease is generally of a grayish color, and resembles very closely that which exists in the ulcero-membranous form of stomatitis. It may be seated either on the gums, in the fold formed by the junction of the cheek or lip with the gum, or on the inside of the cheek, opposite the space between the alveolar processes. It may present a gangrenous appearance from the first day, or not until after two or three days; or lastly, it may pass through the stages characteristic of ulcerative stomatitis, and terminate in the affection under consideration. Dr. B. H. Coates (*loc. cit.*) describes, under the title of gangrenous sore mouth of children, the ulcero-membranous form of stomatitis, and a few cases of gangrene, and states that three or four children out of 120 affected with ulcerated gums "suffered small spots of mortification, and one by the delay arising from the tardy report of a nurse, suffered necrosis in a portion of an alveolus."

The ulcerations just described assume the following appearances as the gangrenous nature of the malady develops itself. They become grayish, and then dark in color, bleed easily when touched, and are covered with pultaceous sloughs, exhaling a characteristic fetid odor. The gangrene extends to the neighboring parts, from the gum to the cheek, or from the cheek to the gum, and implicates at last the whole side of the mouth, or of the lower lip. At the same time the affected cheek or lip undergoes a circumscribed infiltration, which is at first rather soft, but becomes afterwards firmer, and forms at last a hard and rounded knot or tumor in the centre of the cheek, which is now tense, shining as though smeared with oil, and pale, or marbled with purple spots, while the slough on the inside is of a brownish color, more extended in size, and sometimes surrounded by a dark ring. The hard tumor of the cheek just described usually appears between the first and third days after the sphacelation of the mucous membrane, though in some instances not until a later period. It is formed, as stated in the account of the anatomical lesions, by engorgement of the cellular and adipose tissues. The child, at this stage, is still able to sit up in bed and take notice, or shows evident signs of weakness and depression; the face is swelled and destitute of expression on the affected side; a bloody or dark-colored saliva runs from the mouth, which is partially

open; the appetite is not entirely lost in all cases, the patient still demanding and taking food; vomiting is rare, but diarrhœa is almost always present; the thirst is generally intense; the skin is warm and feverish, natural, or too cool, and almost always dry, the differences depending probably more upon the concomitant disease than upon the mouth affection. The respiration is natural or altered according to the nature of the primary disease, which is, as already stated, in a large proportion of the cases, a pulmonary affection. The intelligence is generally undisturbed, though in some rare cases there is insomnia, delirium, or piercing cries.

If the disease continues to progress, as it almost always does when it has reached the stage we are describing, there appears in many, but not all the cases (8 of the 21 observed by MM. Rilliet and Barthez), a slough or eschar upon the most prominent and discolored part of the swelling of the integument of the cheek or lower lip. This generally makes its appearance between the third and sixth days of the disease, but in other cases, as early as the second, or not before the twelfth, or even later. The skin, at the point where the eschar is about to form, becomes purple, and then black; sometimes a phlyctena makes its appearance, which is very soon converted into a small, dry, black slough. This, if not limited by a process of separation from the living tissues, becomes larger and larger by the extension of the sphacelation, until it may, as already stated, embrace the whole side of the face. In grave and fatal cases, the gangrene sometimes extends to all the tissues of the cheek, and meeting at last, the disease which had commenced on the inside of the mouth, occasions a perforation, through which may be seen the teeth, alveolar processes, and the whole interior of the buccal cavity. In such instances as these, several of which we have seen in the Pennsylvania and Philadelphia Hospitals, the appearance presented by the child is, as may well be imagined, of the most pitiable kind. Even under these circumstances, however, with the cheek perforated, the edges of the opening irregular and covered with shreds of dead tissue, the gums destroyed, the teeth loosened, and the maxillary bones exposed, blackened, and perhaps necrosed, with a dark and fetid sanies flowing from the mouth or perforation, and a putrefactive smell infecting the air around, the child may retain, in some instances, its strength, so as to sit up in bed, ask for food, and drink with avidity. In other cases, on the contrary, the patient, at this stage, is exhausted to the last degree, and refuses both food and drink. During the closing stage of the disease there is generally profuse diarrhœa, rapid emaciation, dry skin, small, rapid pulse, and at last death in a state of utter prostration.

In favorable cases the recovery may take place in the early stage, before the integument becomes involved, and while the gangrene is limited to the mucous membrane, or at a later period, after the slough has separated. In the first instance the child generally recovers without deformity, though we saw one case in which necrosis of about an inch of the front of the inferior maxilla took place, without any loss of the soft parts. When the child recovers after the formation of the cutaneous slough, a very rare event, the gangrene ceases to extend, the eschar separates and is cast off, the edges of the opening assume the appearances of a healthy ulcer, and

after a length of time approach each other and cicatrize, leaving generally a large, uneven, discolored scar, like that of a burn, which remains through life a horrid deformity.

The *duration* of the disease varies according to its termination. When this is unfavorable, which happens in much the larger proportion of cases, death usually occurs about the end of the first, or in the course of the second week, though it has been known to occur at a later period. In favorable cases the duration is commonly longer, particularly if a cutaneous eschar has been produced, as the separation of the slough and cicatrization of the ulcer which remains require a tedious and slow process on the part of nature.

Complications are very apt to arise in the course of the disease. The most frequent is pneumonia. MM. Guersant and Blache state that it exists in nine-tenths of the cases; MM. Rilliet and Barthez found it in 19 out of 21; of the 19, it began in 8 during the progress of the gangrene, and apparently under the influence of the latter, whilst in the remaining cases it existed before, and acted perhaps as a predisposing cause to the affection of the mouth. Another and more dangerous complication is the occurrence of gangrene in other parts of the body, particularly the soft palate, pharynx, œsophagus, anus, and more frequently the vulva and lungs.

Diagnosis.—Some authors have described as identical affections, under the title of gangrenous stomatitis, the disease under consideration and the one already treated of as ulcero-membranous stomatitis. This has been done particularly by M. Taupin, who is followed in his description by M. Valleix (*Guide du Méd. Prat.*, t. iv). It seems clear to us, moreover, that Dr. B. H. Coates, in his very valuable paper on the "gangrenous sore mouth of children" (*loc. cit.*), mingles in his description the two diseases referred to. It seems clear, however, that the differences between them as to frequency, symptoms, course, amenability to treatment, and termination, which are fully pointed out in the diagnostic table below, fully warrant us in regarding them as different and distinct diseases.

The diagnosis of gangrene of the mouth is, in most cases, very easy. The ulceration of the mucous membrane, followed by gangrene; the deep-seated induration of the cheek, at first pale on the outside, then dark-colored, and terminating after a time in a characteristic slough; the course of the malady, and the nature of the general symptoms, will generally prevent any difficulty in the recognition of the disease.

From stomatitis it may be distinguished by attention to the points laid down in the following table taken from MM. Rilliet and Barthez:

STOMATITIS.	GANGRENE.
Begins by ulceration or by pseudo-membranous plastic deposit.	Begins by ulceration, which is sometimes grangrenous from the first, or by œdema of the cheek.
Odor very fetid and sometimes gangrenous.	Odor always gangrenous.
But little extension of the local lesion, which always retains the same appearances.	Considerable and rapid extension; the tissues assume a peculiar dark grayish tint.

STOMATITIS.	GANGRENE.
But little swelling of the cheek or lips, or simply œdema of those parts, without deepseated induration, tension, or unctuous appearance.	Extensive swelling and œdema of the cheek, with deepseated induration, tension, unctuous appearance, purple spots.
Salivation rarely so considerable as to flow from the mouth; when present sometimes sanguinolent; never mixed with shreds of gangrenous tissue.	Salivation abundant; constant escape of fluid, at first sanguinolent, afterwards putrefactive.
Never an eschar on the exterior.	Often an eschar upon the cheek or lips.
Never complete perforation of the soft parts; denudation of the bones never occurs; loss of the teeth very rare.	Perforation of the soft parts frequent; denudation of the bones constant; loosening of the teeth constant, and their loss frequent.
Course of the disease slow when left to itself; recovery rapid under the influence of treatment.	Course rapid, and termination fatal, as a rule, when the disease is left to itself, and in spite of all treatment.

Gangrene of the mouth may be confounded with malignant pustule. The method of diagnosis has been drawn by M. Baron in the following words: "Malignant pustule always begins on the exterior; affects the epidermis first, and extends successively to the corpus mucosum, chorion, and subjacent parts; whilst on the contrary, the gangrene under consideration attacks the mucous membrane first, then the muscles, and lastly the skin."

Prognosis.—The prognosis of true gangrene of the mouth is exceedingly unfavorable. The great majority of the subjects die in spite of all that can be done. Dr. Coates (*loc. cit.*, p. 14) says that a black spot on the outer surface of the swelling "has always been in my own experience the immediate harbinger of death. It is proper to state, however, that I have heard it said that cases had recovered in this city, in which the gangrene had produced a hole through the cheek." MM. Rilliet and Barthez state that "death is the ordinary termination of gangrene of the mouth; though there are instances of recovery on record." Of 29 cases analyzed by them, only 3 recovered. MM. Guersant and Blache (*loc. cit.*, p. 596) state that unless arrested in the formative stage, it ends fatally almost constantly in from five to ten days, and frequently before perforation has taken place. Of 36 cases observed by M. Taupin in the Children's Hospital at Paris, not one escaped (Guersant and Blache, *loc. cit.*, p. 597). The authors of the *Compendium de Médecine Pratique* say of this disease (t. i, p. 632), "Death is the almost inevitable termination." Dr. Marshall Hall (*Edin. Med. and Surg. Journ.*, xiv, p. 547) reports six cases of the disease, two of which followed measles, one repeated attacks of pneumonia, one fever (type not mentioned), one worm fever, and one typhus fever. All but one, the case occurring in the course of typhus fever, in a girl, twelve years old, died. This girl recovered, with, however, falling in of the right cheek, "a frightful chasm" on the left side of the mouth, and caries of a portion of the alveolar process, palate bone, and second molar tooth. Recoveries sometimes occur, however, as in the case mentioned by Dr. Hall, after perforation, but nearly always with terrible deformities, with adhesions of the walls of the mouth to the jaws, with incurable fistulæ, etc.

The prognosis is more favorable in private practice than in hospitals. The favorable circumstances in any case are: good hygienic conditions; vigorous constitution of the child; the absence of dangerous concomitant disease; the continuance of appetite and strength; and a disposition to limitation and separation of the slough. Unfavorable symptoms are weak and debilitated constitution of the patient; severe coexistent disease; prostration of the strength; and extension of the sloughing process. Death may also occur from hæmorrhage in consequence of the separation of the slough, as in a case quoted from Hueter by Bouchut.

TREATMENT.—The reader need but refer to the remarks on prognosis to be assured that no treatment as yet discovered promises much success. We would call attention also to the following statement,—that the remarks about to be made apply only to true gangrene of the mouth, and not to all the cases described by some writers under the title of gangrenous sore mouth or even that of gangrene of the mouth, since, as already stated, they confound together true gangrene and ulcero-membranous stomatitis.

The treatment is divided into *local* and *general*. The *local treatment* recommended by the French writers, consists in cauterization of the sloughing parts with one of the mineral acids, with nitrate of silver, or with the actual cautery. This is the plan proposed by MM. Billard, Baron, Guersant and Blache, Barrier, Rilliet and Barthez, Bouchut, and Valleix. The authors of the *Bibliothèque de Médecin Praticien* remark, however, that nearly all the patients subjected to cauterization die, and that of the small number saved, there are as many who had not been subjected to that treatment, as there are of those to whom it had been fully applied. They wonder, therefore, that recent authors continue to repose the same confidence in it, as did their predecessors. "For us," they say, "we are of opinion that cauterization exerts but slight influence, if it have any at all, and it is greatly to be desired that the zeal of practitioners might discover some more efficacious remedy" (*loc. cit.*, t. v, p. 551).

It is very important to make use of the caustic application as early after the beginning of the sphacelus as possible, for if it be allowed to spread to any considerable depth or extent, there is scarcely a hope of arresting it by any means. MM. Guersant and Blache recommend pure nitric, sulphuric, or muriatic acid; MM. Rilliet and Barthez propose the acid nitrate of mercury, or muriatic, sulphuric, or acetic acid; M. Valleix proposes the treatment employed by M. Taupin, which is to remove the pseudo-membrane and a part or the whole of the gangrenous eschar with scissors, to make some scarifications upon the healthy parts, to apply pure muriatic acid, and after the fall of the slough, to make use of dry chloride of lime (calx chlorinata). The acid most generally employed is the muriatic. The local treatment proposed by MM. Rilliet and Barthez is the following: As soon as the ulcerations assume a gangrenous appearance, to touch them with a brush or sponge dipped into acid nitrate of mercury, or pure muriatic acid, the brush to remain in contact with the sloughs for a few instants, and then to be applied rapidly around and on the parts beyond them. After this cauterization, an application is to be made of dry chloride of lime (in the manner recommended in the article on ulcero-

membranous stomatitis), which is to be left in contact with the sloughs for a few minutes, when the mouth must be thoroughly washed with a strong jet of water from a syringe. The cauterization and use of the chloride of lime are to be resorted to twice a day, and the mouth washed three or four times in the interval with large injections of simple water, barley-water mixed with honey of roses, or better still, with a strong decoction of cinchona. If the case goes on favorably, and the sloughs separate, the cauterizations are to be suspended, and the chloride of lime alone employed. If, on the contrary, a slough forms on the outside of the cheek, a crucial incision must be made into it, and a brush charged with the same caustics introduced between the cuts; powdered cinchona is then placed in the openings, and retained there by a piece of diachylon plaster or by pledgets of charpie, dipped in a solution of soda. This treatment is to be continued until the slough separates, when the edges of the wound, and all the diseased parts that can be reached, are to be cauterized.

In applying escharotics to the mouth, certain general precautions are required, of which it is necessary to give some account. When they are used upon the inside of the cheek, a spoon must be introduced into the mouth, with the concavity directed towards the alveolar processes, in order to preserve the teeth and tongue from being touched. When the application is made upon the gums, the cheek should be drawn to one side by an assistant, and the tongue pushed out of the way with the finger, or a spoon. If the acid happen to touch the teeth or tongue, it must be instantly washed off. The mouth ought always to be thoroughly cleansed with water immediately after the cauterization, to remove any superabundance of acid.

The kind of brush most suitable for the application of the mineral acids is one made of charpie, strongly tied to a solid handle. The sponge-mop, which is sometimes used, is made by fastening a small piece of fine sponge to the end of a stick.

MM. Guersant and Blache recommend that the acid be applied to the slough every hour, until the sphacelus ceases to extend. They state that this plan is sometimes advantageous when the gangrene is confined to the gums only, but that it is generally powerless when the disease has extended to the cheek, or has implicated the deepseated tissues. Under the latter circumstances, and when the inefficacy of caustics has been shown by trial, they propose the use of the actual cautery, as recommended by M. Baron, and other distinguished practitioners, and which, they add, has afforded them some brilliant results in very bad cases.

M. Barrier advises that we should accurately expose the diseased parts by crucial incisions, and apply the escharotic to all the parts forming the limits of the gangrene, in such a way that the tissues already disposed to slough shall be thoroughly cauterized, while those a little beyond are so in a less degree.

In applying these powerful caustics, several authorities recommend the administration of an anæsthetic.

The English writers, and those of our own country, seem rather less disposed than the French to make use of powerful escharotics, and lay more

stress upon the general treatment. Underwood, following Dease, of Dublin, advises that "the parts should be washed and likewise injected with muriatic acid, in chamomile or sage tea, and afterwards dressed with the acid, mixed with the honey of roses, and over all a carrot poultice." Dr. Symonds (*Lib. of Pract. Med.*, vol. iii, p. 23) directs the cheek to be frequently rubbed with a stimulating embrocation of camphorated oil and ammonia, on the first appearance of the swelling, and in the intervals to be kept moist with a tepid lotion containing muriate of ammonia and alcohol. On the slightest appearance of an eschar upon the interior of the mouth, it is to be touched with solid nitrate of silver, or strong muriatic acid. If sloughing have already commenced, the nitrate of silver lotion is said to be the best application. The mouth is to be frequently washed or syringed with a solution of chloride of soda, and when mortification has taken place, we are to endeavor to prevent it from spreading, by carrot or fermenting poultices. Maunsel and Evanson say that the early application of muriatic acid, undiluted, or mixed with one or two parts of honey, is the only efficient application in these forms of gangrene. Dr. Fleming (*Dublin Hosp. Gaz.*, May 1st, 1865) recommends the application of a concentrated solution of nitrate of copper, to the sloughing surfaces, and also paints the circumference of the disease and the surrounding cheek with collodion, which, he believes, acts favorably upon the capillary circulation of the part. Dr. Gerhard (*Lib. of Pract. Med.*, vol. iii, Am. ed., p. 24) says, "The best local applications are the nitrate of silver, if the slough be small in extent; if much larger, the best escharotic is the muriated tincture of iron, applied in the undiluted state: after the progress of the disease is arrested, the ulcer will improve rapidly under an astringent stimulant, such as the tincture of myrrh, or the aromatic wine of the French Pharmacopœia." Dr. Dunglison (*Prac. of Med.*, vol. i, p. 36) recommends the application with a brush, of a mixture of equal parts of creasote and alcohol, after incisions have been made through the gangrenous parts. Dr. Condie (*op. cit.*, 6th ed., p. 174) states that he has found a strong solution of sulphate of copper (thirty grains to the ounce of water), applied very carefully twice a day, to the full extent of the gangrenous ulceration, by far the most successful lotion.

We have, ourselves, lately employed carbolic acid in two severe cases. The pure acid was carefully applied to the sloughing ulcer on the inside of the cheek, and subsequently a solution of one part of the acid in fifty of water, was frequently employed to wash out the mouth. The application of the undiluted acid seemed to have a beneficial effect, by checking the progress of the sloughing, and completely destroying the putridity of the dead tissue which had not as yet separated. One of the cases recovered quickly, without perforation of the cheek; but in the other death occurred, with symptoms of profound adynamia, though there was little, if any, extension of the gangrene.

It seems to us very clear, after the study of the treatment recommended by the different writers quoted above, that the most important part of the local management of the disease is the early application of some escharotic substance to the ulcerations, or to the mortifying parts; the best is probably

pure muriatic acid. This should be made use of twice or three times a day, observing the precaution to wash the mouth with water, immediately afterwards, by means of a syringe. Later in the disease, when it has extended to the skin, the use of escharotics, or of the actual cautery, is still recommended by many writers, but opposed by others. We confess we should be inclined to prefer, at this stage, the use of muriated tincture of iron, as recommended by Dr. Gerhard, of carbolic acid as used by ourselves, of strong lotions of sulphate of copper, of solutions of nitrate of silver of moderate strength, or of the dressings of muriatic acid and honey of roses, as proposed by Underwood, in connection with carrot and fermenting poultices, as recommended by Underwood and Symonds. Throughout the course of the disease the mouth ought to be frequently cleansed by washing or injecting with solution of chlorinated soda, mixed with eight parts of water, or with a dilute solution of carbolic acid, which corrects at the same time the terrible fetor of the disease.

The importance of these measures can scarcely be overestimated, since the presence of gangrenous tissue about the oral cavity must lead to the introduction of the poisonous results of putrefaction into the system, both by the fetid discharges which partly flow down the œsophagus, and still more by the contamination of the inspired air. Indeed, it seems quite possible, as urged by Dr. Keiller (*Edin. Med. Jour.*, April, 1862), that in cases of unchecked gangrene of the mouth, death occurs in a great measure, from secondary blood-poisoning, resulting from the continued and unavoidable inhalation of air poisoned by emanations from the gangrenous sloughs. It is evident, therefore, that local applications, both of caustics and antiseptic lotions, must be of great service, by arresting the sloughing and correcting or checking the foul discharges.

General Treatment.—All writers recommend the use of tonics, stimulants, and nutritious diet, unless the presence of high fever, or the state of the digestive organs, seems to contraindicate their employment. From our own personal experience in the treatment of this affection; from a consideration of what we have seen most successful in other forms of gangrene, as that following accidents and surgical operations in deteriorated constitutions; from what proved effectual in a case of idiopathic gangrene of the vulva, in a child ten years of age, which came under our charge; and from what is necessary in that analogous condition of the constitution which accompanies typhoid and cachectic diseases, we are induced to believe that the general treatment must be of at least as great importance as the local, and that the steady and persevering use of tonics, stimulants, and of the most strengthening diet, should always be insisted on from the earliest period, whether fever be present or not. The quantity of stimulants, and the amount of food, ought, it seems to us, to be measured only by the capacity of the digestive organs to receive and assimilate them. Of the tonics, the best are quinine and muriated tincture of iron, which may be given in syrup, in doses of a grain of the former with from three to five drops of the latter, four or five times a day, to a child three or four years old. The most suitable stimulants are very fine old brandy, Madeira wine given in considerable quantities, and, if the stomach is sure

to receive it well, carbonate of ammonia, or better still, the aromatic spirit of hartshorn. The diet must consist of milk made into punch with brandy, wine-whey, the yelk of eggs beaten up with wine, strong soups and beef tea, animal jellies, and, if the child wish it, tender meat finely minced.

The room in which the child is placed ought to be large, if possible, and at all events thoroughly ventilated.

ARTICLE V.

THRUSH.

Definition; Synonyms; Frequency; Forms.—Thrush is associated with the growth of a peculiar fungus, the *oidium albicans* (Robin), and appears as a deposit upon the mucous membrane of the mouth, of a whitish or grayish-yellow exudation, of a soft cheesy consistence, at first adherent, and afterwards spontaneously detached, and generally unaccompanied by ulceration of the tissue beneath. This constitutes the whole disease in some cases, no other lesion being discoverable; whilst in other instances, and probably in a large majority, it is connected with some more or less serious general or local disorder. It is the disease described under the title of aphthæ or thrush, by Underwood and Eberle; of aphthæ, by Dewees; of erythematic stomatitis, with curdlike exudation, by Dr. Condie; and of aphtha lactantium, aphtha lactamen, and aphtha infantilis, by the older writers. It is the muguet of the French.

The *frequency* of the disease is very great in hospitals for children. It is common also amongst the children of the poor, and comparatively rare in the middle and upper classes of society. It occurs under two forms, the *idiopathic* or *primary*, and *symptomatic* or *secondary*. By the first is meant the form in which the affection of the mouth is the only perceptible lesion; by the second, that in which disease of other organs or of the constitution generally, precedes the buccal exudation.

Causes.—Predisposing Causes.—The disease occurs at all *ages*, but is by far most common during the first two months of life. *Altered health* from any cause, *deficient ventilation*, and *want of cleanliness*, strongly predispose to the production of thrush. Much difference of opinion exists as to the nature of the connection between *enteritis* and thrush, especially since the publication of the researches of M. Valleix, who thinks that the latter disease is almost always the consequence of the former, and who doubts the existence of purely local cases of thrush. MM. Trousseau and Delpech, on the contrary (*Journ. de Méd. de MM. Beau et Trousseau*, January, February, April, May, 1845), report 14 cases out of 58, in which there was neither gastric nor intestinal complication, and others in which enteritis did not occur except as a consequence of thrush. They state, however, that though enteritis does not exist in all cases, and is a simple

complication in others, it is sometimes the true cause, the sole origin of the disease. Again Dr. Berg, in a very accurate and careful history of the disease (*Brit. and For. Med. Rev.*, October, 1847, p. 429) in which he demonstrates its *cryptogamic nature*, states "that both the local and general symptoms which accompany thrush in the child are, in most cases, immediate or secondary consequences of the presence of the parasite, and not to be regarded as the causes of that fungoid vegetation." It is believed by many observers to be *contagious*. This opinion is rendered doubtful, however, by the assertion of MM. Baron, Billard, Guersant, and Valleix (*loc. cit.*, t. iv, p. 63), that they have known children in health to be fed with the same spoon which has been used for others affected with the disease, without their contracting it. M. Bouchut on the contrary, and Dr. Berg (*loc. cit.*), both of whom believe in the cryptogamic nature of thrush, assert it to be contagious. Dr. Berg is of opinion that it is "conveyed from one patient to another by sporules or fragments of sporules, in the dried state, floating in the atmosphere, but that still more frequently it is propagated by the bottles from which children with thrush have been fed, or by the nipple, especially where, as in many hospitals, two children are suckled by one nurse." This gentleman made many experiments in order to decide this question, all of which proved favorable to the idea of contagion.

Of various predisposing causes which have been cited as productive of the disease, the ones most generally admitted are the use of *artificial diet*, particularly one consisting of farinaceous substances, and, in children who are suckled, an *unhealthy state* of the nurse's milk. To show the truth of these assertions, we make the following quotations. Underwood says: "A principal remote cause of this disease seems to be indigestion, whether produced by bad milk, or other unwholesome food, or by the weakness of the stomach." Dewees remarks that "children fed much upon farinaceous substances are especially exposed to the attacks of this disease, particularly when their food is sweetened with brown sugar or molasses." Dr. Eberle says: "Unwholesome and indigestible nourishment, and overdistension of the stomach, during the early stages of infancy, almost inevitably lead to the occurrence of aphthæ (thrush). Bad and old milk, and thick farinaceous preparations sweetened with brown sugar or molasses, are especially apt to give rise to the disease." Much influence is ascribed by Dr. Berg to the operation of artificial food in favoring the growth of thrush. M. Valleix (*loc. cit.*, p. 60), who has studied the subject with the greatest care and attention, says that amongst the hygienic conditions which may act as predisposing causes "one alone has seemed to me to exert a positive influence, and this is *improper alimentation*." He adds, that since the publication of his *Clinique*, he has several times met with cases of thrush, "and I have always found that the children had been put upon feculent diet. On the other hand, I have never known a child to have the disease, who had been suckled exclusively during the early months of life." MM. Trousseau and Delpech, in the very valuable paper on muguet (thrush), already quoted, say: "We would be justified, therefore, in asserting, that we have never known an infant to die of thrush, who had been suckled at

a healthy breast, or whose health had not been dangerously compromised by other causes." To show in another mode the influence of this cause, we will state that of 29 cases of the disease observed by these gentlemen in children who were suckled, only 7, or one-fourth, died; whilst of 22 in those who were not suckled, 17, or more than three-fourths, died. Our own experience is precisely that of MM. Valleix, Trousseau, and Delpech.

Season exerts a considerable influence upon the production of thrush, as M. Valleix found that more than half the cases occurred during the three warmest months of the year.

Exciting Causes.—The deprivation of the breast, and a consequent resort to artificial diet, particularly one consisting of farinaceous substances, is probably much the most frequent exciting cause of thrush. An unhealthy state of the milk of the nurse will also act as an exciting cause. We have met with two cases of the disease, one of them fatal, which appeared to depend upon the latter circumstance. Dr. Berg believes that prolonged sleep from any cause disposes to the disease, by favoring the growth of the parasite, or by so changing the secretions of the mucous membrane of the mouth, as to render them important agents in augmenting the disorder. An acid state of the buccal secretion is cited as a cause by many authors, and is clearly proved to exist in a great many instances.

Anatomical Lesions.—The characteristic deposit is found upon the mucous membrane of the mouth, pharynx, œsophagus, and in rare cases, of the stomach and intestines. The question of the possibility of the extension of thrush to the gastric mucous membrane has been much discussed, and the highest authorities have been almost equally divided upon it. This disagreement has arisen solely from the want of microscopical examination, which enables the observer to distinguish readily between true thrush and other appearances of the gastric mucous membrane which closely resemble it. The most conclusive demonstration of its occurrence upon the mucous membrane of the stomach has been recently furnished in a valuable article on this subject, by M. J. Parrot (*Arch. de Physiologie Norm. et Path.*, Nos. 4 and 5, 1869); and in a still more recent article (*id. op.*, vol. iii, 1870, p. 621), he has also determined the possibility of its development in the large intestine. It is a curious fact, and a very important one, insisted upon by MM. Trousseau and Delpech, and other observers, that the false membrane never extends to the nasal or air-passages; and they call attention to the singular difference in this respect between the affection under consideration and diphtheritic inflammation, which attacks almost exclusively the nostrils, pharynx, larynx, and bronchia. It appears, however, from recent observation, that the peculiar growth of thrush has been found upon both the epiglottis and the inferior vocal cords; and Parrot (*loc. cit.*) gives the details of a case in which the fungus was found in the air-vesicles of one lung.

Lesions of the digestive mucous membrane are met with in nearly all the cases. M. Valleix states that softening of the gastric mucous membrane is almost constant, and that it is often accompanied by redness and thickening. The authors cited above are of opinion that the gastric

lesions have been greatly exaggerated, and assert them to be much the same as exist in other diseases foreign to the digestive apparatus. Various morbid alterations of the mucous membrane of the intestines exists in nearly all fatal cases. This fact is acknowledged as well by MM. Trousseau and Delpech, who deny the invariable connection of these alterations with thrush, as by M. Valleix, who asserts the connection almost without reserve. In nearly all cases the mucous membrane of the large intestine presents some of the following lesions, which are mentioned in the order of their frequency: thickening, injection, softening, or ulceration. In the ileum are found, in a great many cases, injection, softening, or thickening of the mucous membrane, unusual development of the mucous follicles, and tumefaction and ulceration of the glands of Peyer.

In severe symptomatic cases a certain amount of erythematous inflammation is commonly found upon the skin of the buttocks and thighs, and ulcerations sometimes exist upon the inner ankles. Traces of inflammation sometimes, but very rarely, exist in the membranes of the brain, and the lungs not unfrequently present the lesions of secondary pneumonia. Before leaving this part of the subject, we may remark that in the few cases we have met with in private practice, no ulcerations occurred upon the malleoli, and the erythema was observed only in the neighborhood of the anus.

Dr. Dewees describes the autopsy of a child who died about the end of the first month of life, of what he designates as aphthæ. The lesions coincide so closely with those which are characteristic of thrush, that we will quote the description, in order that the two may be compared together by the reader. "We found the whole tract of the œsophagus literally blocked up with an aphthous incrustation, to the cardia, and there it suddenly stopped. The inner coat of the stomach bore some marks of inflammation, as did several portions of the intestines; but not a trace of aphthæ could be discovered below the place just mentioned." In the previous description of the case, he says that coat after coat of aphthæ were thrown off, and each new crop appeared to be more abundant, and less amenable to remedies. (*Dewees on Children*, pp. 304–305.)

Dr. Eberle says: "I have myself had an opportunity of examining the body of an infant, that had died of this disease (aphthæ or thrush). In this case the aphthæ were very distinct, throughout the whole course of the œsophagus. The stomach and bowels presented nothing that bore any resemblance to this eruption; but there were decided marks of inflammation in the mucous membrane of the small intestines, with a vast number of minute superficial ulcerations, and larger patches of softening of this tissue, throughout the colon and lower part of the rectum." (*Diseases of Children*, pp. 172–173.)

Symptoms.—We shall first describe the characters of the exudation, and then proceed to the consideration of certain general and local phenomena which exist to a greater or less extent in both forms of the disease.

The mucous membrane of the mouth is often somewhat red, dry, and tender for a longer or a shorter time (generally from one to three days), before the appearance of the exudation, and at the same time the papillæ

of the tongue swell and become protuberant. Next the exudation shows itself in the form of small, whitish points, sometimes on the tongue first, and in other cases on the inside of the lips, whence it extends to the cheeks in idiopathic mild cases, and to the roof of the mouth, soft palate, pharynx, and œsophagus, in the grave symptomatic form. The points of false membrane first deposited rapidly increase in size and thickness, so that in from one to three or four days, they assume the form of large patches, or a continuous membrane, which covers the whole or a considerable portion of the cavity of the mouth. When the exudation is recent, it is thin, and its surface smooth; when, on the contrary, it has been longer deposited, it becomes thicker, and its surface is rough. It is at first of a milk-white or pearly hue, but when undisturbed assumes a grayish or yellowish color. It is soft in consistence, breaking down under the finger like cheese, and presenting no traces of organization to the naked eye. It adheres to the mucous membrane with considerable tenacity at first, but becomes looser after awhile, and is detached spontaneously at last without any lesion of the tissue beneath.

The foregoing description applies to the exudation as it appears to the unassisted eye. We pass next to give an account of the characters it presents, when subjected to microscopical examination, and in so doing shall quote the language of Berg, who first discovered that thrush essentially depended upon the presence of a peculiar parasitic fungus, to which Robin has given the name of oidium albicans. Dr. Berg (*loc. cit.*) states, that the white coating of the exudation consists of epithelium, thickened by the swelling of its constituent cells; from the epithelium there springs a parasitic fungus in greater or less quantity, so that the chief portion of a patch of aphthæ (thrush) is composed either of epithelium or else of the parasitic growth. Under a magnifying power of from 200 to 300 diameters, an aphthous crust is seen to consist of epithelial cells, with a more or less interwoven coat of fibres, and a variable number of spherical or oval cells, without any sign of exudation-corpuscles, but only a small quantity of molecular albuminous deposit. "We can often trace the successive development of these cells from a spherical one of the smallest size, to an oval cell, and thence to a filament; and we have no doubt ourselves that the smaller cells are sporules, out of whose development the larger oval cells are formed, and finally, the filaments in the same manner as has been observed in other fungoid growths of this nature." Numerous projecting fibrils are observed in the circumference of an aphthous crust when submitted to the microscope; but these are rendered infinitely more clear by a weak solution of potash, which dissolves the albumen, and renders the cells of the epithelium transparent, while, at the same time, it diminishes their intimate cohesion, and the network of vegetable fibres is more plainly seen. "These fibres are cylindrical, with sharply defined dark edges, and their centres are transparent in transmitted light; they are generally equal in thickness, but at times they are, as it were, knotted together, and divided by distinct walls of separation. . . . . In their interior, these fibrils often exhibit nucleated cells; occasionally these are very numerous, and of small size, but at times they are larger. In

their course the fibrils divide into numerous branches, whose diameter is not less than that of the original stem, and I have occasionally observed these ramifications to increase in thickness, at their free extremity, and to terminate in a club-shaped end with a species of cell. From the sides of the fibrils spring numerous sporules, forming a point of departure for new ramifications. . . . . Careful investigation has shown us that these cells are placed upon the sides of the fibrils, and in particular that they are congregated around the terminations of the latter. It must, therefore, be admitted that the cells and the fibrils are both constituent parts of one and the same organization. When this growth vegetates undisturbed, its fibrils penetrate between the layers of the epithelial cells, but do not extend deeper than the inferior layer, though they spread laterally in every direction. On the free surface of the epithelium, the ramifications rise above the surface, exhibiting at the same time an abundant fructification, which gives a yellowish hue to the exterior."

M. Parrot, in describing the appearances of thrush upon the gastric mucous membrane, states that the disease presented itself in the form of small prominent rounded masses, of yellowish color, and either isolated or in groups. These were adherent to the mucous membrane, nearly all umbilicated, and upon pressure the central depression became filled with a cheesy-looking material. On microscopic examinations of sections, the spores and filaments of the muguet were found infiltrating the tissue, and as it were planted there, at times scattered in small numbers, at others accumulated in large masses, and holding between them many oil-drops and some débris of the mucous membrane. The muscular coat of the stomach was not involved, but in some instances the spores and filaments penetrated the mucous membrane, and extended to the submucous space. In other cases the mucous membrane was only superficially involved.

The reader is referred for a more full account of the cryptogamic theory of thrush to the interesting review of Berg's work above quoted, and to Bouchut's work on the diseases of new-born children; and for a complete description of the oidium albicans to the work of Robin, *Histoire Naturelle des Végétaux Parasites*, Paris, 1853; the articles of Parrot above quoted; and the article on thrush in Vogel's work on the *Diseases of Children* (Amer. ed., 1870, p. 99).

Symptoms of the Mild Form of Thrush.—This form is the one most frequently met with in private practice. It is mild in all its characters, and often presents no other symptoms than those connected with the mouth. These are *heat* and *dryness*, with *tenderness* of that part. The tenderness is shown by the child's crying and jerking the head backwards when the finger is introduced into the mouth, whereas, in health, the infant will almost always seize the finger and suck it with considerable force. It is shown, also, by the refusal to take the breast, or by the difficulty with which this is done, the child occasionally letting the nipple drop with a cry of pain, then seizing it again, and again dropping it with fretting or screaming. In some of the cases there are various signs of disorder of the digestive tube, which are, however, seldom severe. They consist of slight diarrhœa, the stools being at first yellow, and afterwards green and

acid; of occasional vomiting, of attacks of colicky pain, and sometimes of feverishness. To show how frequent is the occurrence of diarrhœa in thrush, and to prove also that it is not a necessary accompaniment of the disease, as has been supposed by some persons, we will quote the fact mentioned by Dr. Berg, that of 115 cases, in only 29 did the stools retain the normal yellow color throughout the whole course of the disease; while in the remaining 86, green evacuations appeared simultaneously with the invasion, or supervened at a later period. We may cite also the cases reported by MM. Trousseau and Delpech, of which only 14 out of 58 presented neither gastric nor intestinal complications.

The amount of exudation is generally small in this form, and it rarely extends behind the soft palate. The *duration* is usually between four and nineteen days, the average being about eight or twelve. The termination is almost always favorable.

Grave Form.—It is under this form that the disease is most apt to occur in public institutions for children, and particularly in foundling hospitals. That it sometimes occurs, also, in private practice, will not be doubted, we think, by any who will read with care the descriptions of the disease given by Underwood, Dewees, and Eberle. We have ourselves met with two fatal cases in private practice, which presented all the symptoms described by M. Valleix as characterizing those observed by him in the Foundling's Hospital at Paris, with the single exception of the ulcerations upon the internal malleoli. They were both children of parents who had every comfort at their command. One died at the age of four weeks, in consequence of the attempt to rear it on artificial diet. The other perished when six weeks old, apparently from some unhealthy condition of the mother's milk, which seems the more probable from the fact that the same mother had previously lost two children under precisely similar circumstances; all the children of this person were born vigorous and hearty, and did well for a short time, but soon after the birth, the nipples of the mother became dreadfully excoriated, the digestive organs of the infant began to give way, and death finally occurred with all the symptoms of fully developed thrush. We can surmise now, though no examination was made at the time, that the cause of the disease was a continuance of colostrum-corpuscles in the mother's milk.

The most important *symptoms* of the grave form are the buccal *exudation*, various *abdominal* symptoms, particularly diarrhœa, vomiting, and colic, and more or less marked *fever*. The order of succession of the symptoms in severe thrush is not always the same. In most of the cases the first symptom observed is, probably, diarrhœa, which is soon followed by fever, and in a few days by the appearance of the false membrane in the mouth. In a smaller number of instances the buccal exudation is the first symptom observed. The characters of the exudation are much the same as those observed in the mild form of the disease, except that the membrane is thicker, covers a larger portion of the mouth, and generally extends to the pharynx and œsophagus. In addition to the plastic deposit, there sometimes exist, especially in very bad cases, ulcerations upon the roof of the mouth, frænum linguæ, and gums. These are generally few

in number, and either confined to the mucous tissue, or they may extend to the fibrous texture beneath; the surface upon which they rest is generally softened in consistence; their edges are irregular, soft, and of a whitish or reddish color. The heat of the mouth is not generally increased, except in very severe cases; the mouth is moist at first, but afterwards becomes very dry, and, from the refusal to suck the finger when it is introduced between the lips, and the difficulty with which the acts of suckling or feeding are performed, is evidently tender and painful.

The symptoms depending on the enteritic affection, are *tenderness* of the abdomen, *diarrhœa*, *vomiting*, and *fever*. The abdomen is usually distended by flatulent collections in the bowels, and is more or less painful to the touch, particularly in the right iliac fossa and epigastrium, and in severe cases over its whole extent. At the same time the child evidently suffers from colicky pains, as shown by restlessness, by uneasy, twisting movements of the trunk, by kicking of the limbs, and by crying, particularly just before or at the moment of the evacuations. The appetite is usually diminished or entirely lost. The diarrhœa comes on gradually, the stools retaining their natural color at first, and being merely thinner and more frequent than natural. As the case progresses, they become more and more liquid and numerous, and almost invariably of a bright green color, and very acid. The green color of the discharges, and their highly acid condition, is noticed by all observers. *Vomiting* occurs in many of the cases, but is less frequent than diarrhœa. In some instances it is very obstinate and distressing, causing the rejection of whatever alimentary substances the child may take. Under these circumstances it has often been observed to coincide with the presence of a great deal of exudation upon the base of the tongue and soft palate, which has been supposed to act as its exciting cause. In other instances it is not so frequent, and as the matters ejected consist of greenish or yellowish bile, while, at the same time, the epigastrium is very sensible to pressure, this form of vomiting has been thought to depend upon gastritis.

Fever exists in most cases, from the time that diarrhœa makes its appearance, and sometimes at an earlier period. It is at first moderate, but as the case goes on, often becomes intense, the pulse rising gradually from 80 to 90, or 120, 140, and even 160. The *heat* of the surface, especially of the abdomen, is much increased, and accompanied by dryness. The feverish condition of the system is shown also by the restlessness and fretting of the child, and often by loud, frequent crying. When the exudation extends into the pharynx, the cry usually becomes hoarse and indistinct.

There are two other symptoms which occur in the course of thrush, about which some discussion has arisen. These are, the appearance of an *erythematous redness* about the anus, and upon the buttocks, genitals, and upper parts of the thighs, and *ulcerations* upon the internal malleoli. The erythema is stated by M. Valleix to precede the other symptoms in the greater number of instances, whilst MM. Trousseau and Delpech deny the correctness of the assertion, and observed it to follow the diarrhœa in the majority of their cases. It seems to us that the latter authors are correct

in ascribing the erythema to the irritation produced by the contact of the urine with the skin, which is predisposed, by the cachectic state of the constitution, to take on inflammation from causes which would not affect it in a healthy subject. The erythema is sometimes followed by papules, vesicles, blebs, and ulcerations, all of which probably depend upon the cause just referred to. The malleolar ulcerations are ascribed to the friction of the ankles against each other, a cause sufficient to produce such an effect in a broken-down, diseased constitution, though insufficient in a healthy one. We may mention that we have seen the erythema frequently in private practice, but never the malleolar ulcerations.

During the acute period of the disease, the *strength* of the child is not much diminished, but as the case approaches its termination, if no favorable change takes place, the patient becomes weak and exhausted; the face assumes a pale and sallow look; the features are sharp and defined, and the eyes dull and surrounded by bluish circles. At the same time the whole body becomes emaciated, the skin loses its elasticity, and hangs in folds or wrinkles upon the limbs, and the surface assumes a dark and dingy hue. As the fatal termination approaches, all restlessness ceases, and the child lies profoundly still, or only moves the mouth from time to time, or utters a faint cry; the diarrhœa diminishes, and the vomiting generally ceases; the pulse becomes very rapid and weak, the extremities cold, and death occurs in the midst of profound quiet, or after a few slight convulsive movements. The *duration* of this form of the disease is very uncertain. It is often less than that of the mild form, since many children die in the first five days after the appearance of the exudation. In other cases it is much longer, from a few weeks to two months. Relapses are not uncommon.

Before closing our remarks upon the symptoms, it is proper to state that the disease sometimes occurs at the termination of acute local affections, as pneumonia, bronchitis, or pleurisy, under which circumstances there will be, in addition to the symptoms peculiar to thrush, those of the malady which preceded it.

Nature of the Disease.—Repeated microscopic examinations have so uniformly confirmed the statements of Gruby and Berg, that it is no longer doubtful that a peculiar parasite, oidium albicans, is a constant element in the exudation of thrush. It is, however, far from being so well determined what relation this growth bears to the disease; since, while one class of authorities consider it the essential and sole cause of the other local and general symptoms, another regard it merely as an epiphenomenon, the spores of the parasite finding a suitable nidus for development on the already diseased mucous membrane. Fortunately, the solution of this question is of no very great practical importance, as the causes of the disease are well ascertained, and its prophylactic and curative treatment will not be affected by the view entertained.

Diagnosis.—The diagnosis of thrush is rarely difficult. Aphthæ differ from it in their vesicular nature during the formative stage, in the ulcerations which follow the vesicles, and in the absence of false membranes. From ulcero-membranous stomatitis it may be distinguished,

by the formation in that disease of false membrane in layers from the beginning; by the presence of ulcerations; by the spongy, bleeding state of the gums; by the fetid breath; by the absence of the abdominal symptoms which exist in thrush; and by the microscopic appearances of the deposit.

Prognosis.—The prognosis must depend, in great measure, upon the circumstances under which the disease occurs. In private practice, and whenever the patients are suckled by their own mothers, or by healthy nurses, it is a mild affection. But in foundling hospitals, on the contrary, where the children are mostly brought up by hand, it is one of the most fatal maladies to which children are subject. The prognosis varies according to the form of the disease. The mild form is rarely fatal, while the grave form is fatal in the great majority of the cases.

To show the frightful severity of the disease under certain circumstances, we may mention that of 140 cases which occurred in the wards of M. Baron, at the Foundling's Hospital of Paris, only 29 recovered; while of 22 cases observed by M. Valleix, in the same hospital, but 2 recovered (Valleix, *loc. cit.*, p. 74). Again, M. Bouchut states that of 42 cases observed by himself, at the Necker Hospital, 14 were of the idiopathic (mild) form, all of which terminated favorably; and 28 of the grave or symptomatic form, of which 20 died, and 8 left the hospital still laboring under the disease. Of the 20 fatal cases, 12 presented the lesions of chronic entero-colitis, 4 of acute entero-colitis, 8 of pneumonia, and 1 of hydrocephalus. It may be stated, in conclusion, that the danger is greatest, in private practice, when the attack occurs in a child fed on artificial diet; when there is reason to suspect an unhealthy state of the nurse's milk; and in proportion to the extent and quantity of the exudation, its resistance to treatment, and the severity and obstinacy of the abdominal symptoms.

Treatment.—*Prophylactic Treatment.*—The most certain means of preventing thrush are evidently to procure for the child a full, healthy breast of milk, to give it a good habitation, to secure for it perfect cleanliness, and to attend properly to its clothing. When it is impossible, from any cause, to obtain a nurse for the child, the diet ought to be most carefully regulated as to quality, quantity, and times of administration. Careful attention to these points will, and, we doubt not, have, greatly diminished the frequency and lessened the severity of the disease in private practice.

General Treatment.—It is clear that the successful management of thrush must depend much more upon judicious regulation of the hygiene of the child than upon any therapeutical system that can be devised. The most frequent cause of the disease is, as we have seen, artificial diet, especially one in which milk is sparingly used or excluded, or an unhealthy state of the nurse's milk. It is reasonable to conclude, therefore, that attention to the removal or mitigation of these and other unfavorable hygienic conditions, constitutes the most important indication of treatment.

If a child who has been attacked with thrush is suckled exclusively, the milk of the nurse ought to be subjected to chemical and microscopic ex-

amination; and should it be found to present unhealthy characters, another nurse ought to be procured as soon as possible. In all such cases the nurse must pay strict attention to her diet, avoiding all articles which she knows or suspects to disagree with her, and all very rich dishes. Dewees recommends that she should abstain from most common vegetables, except rice, and from all kinds of liquors, especially the fermented.

When the disease occurs in a child who is nursed and fed alternately, and the remark about to be made applies still more appropriately to one fed entirely upon artificial diet, the most important remedy in the case is to procure a good wet-nurse. This is far better than any medical treatment that can be instituted. Often, however, this is impossible, and, under such circumstances, the regulation of the diet ought to be attended to with the utmost care by the physician himself, who should specify its material, quantity, and mode of preparation.

As we shall be obliged constantly to refer to the proper diet for young children in our future articles on diseases of the digestive organs, and indeed all through this work, we think it will be best to make some general and extended remarks on the subject here, where we first meet with a disease the cause of which is almost always improper food, and the cure of which is the abandonment of a faulty, and the substitution of a proper aliment.

In the first place, we wish to repeat the statement already made, that the breast gives the only food for infants which can be relied on as the correct one. This may seem very much like saying that white is white, and red is red, or that two and two do indubitably make four; indeed, to ourselves it seems utterly superfluous, but we have known so many medical men, men in authority in the nursery, and such hosts of fathers and mothers, who cannot be made to believe this, that we feel compelled to reiterate our own individual opinions as strongly as possible. But cases do constantly occur in which a young infant must be wholly or in part fed artificially, and here we have to recommend some substitute for breast-milk. In this city, ass's milk, which is conceded to be more like human milk than that of any other animal, cannot be had, and we are forced to take cow's or goat's milk. The latter is not so common as to be readily obtained, and practically we are driven to the use of the former.

In choosing cow's milk, the first thing to be thought of is the purity of the milk. In small towns and in the country it is very easy to obtain fresh pure milk, but in large cities it is often very difficult. Still, with due care and diligence, and money, it can generally be done. Our own practice has always been to choose a milkman who himself brings milk from a farm, or who, at least, employs himself the man who delivers it. We never have, and never shall, so long as we can help ourselves, take milk from those middlemen who buy it of anybody that may have it to sell. Moreover, the person who has charge of the child should always, if possible, know the milkman personally, and know exactly where he comes from, and what manner of man he may be. An *honest* farmer or dairyman who pastures and feeds his own cows on a healthy farm is the man to be employed to furnish milk to the poor little baby who has to seek another

dairy than his own mother's. If the character of the milkman is not a sufficient guarantee, or if, from any accident, the milk has to be changed, or if any doubt arises as to its quality, there are some simple methods of judging which can be made use of by any person of ordinary intelligence, and which will reveal any gross deception on the part of the milk vender.

A good specimen of cow's milk ought to be slightly acid or neutral; it should contain a certain average proportion of cream, and it should have a certain average density.

These points may be ascertained with sufficient accuracy to guide us in our choice or refusal of any sample of milk, in the following mode: Litmus-paper turns red when touched by any acid; a very weak acid will do this. If a good specimen of litmus-paper (which can be procured of the apothecary) turns faintly red when dipped into milk, the milk is properly acid; if turned bright red, the milk is too acid. When no change is produced on the litmus-paper, the milk is either neutral (which is sometimes the case with healthy milk), or it is alkaline. To determine whether it be neutral, turmeric-paper, which is turned brown by alkaline solutions, must be used. If the specimen is found to be alkaline in a marked degree, either the cow is diseased in all probability, or some alkali has been added to the milk.

It is a curious fact that Dr. Parkes (*Manual of Practical Hygiene*, 2d ed., London, 1866) is almost alone in asserting that healthy cow's milk is either faintly acid or neutral. Most authorities assert that it is alkaline. In order to determine this matter for ourselves, we tested the milk of thirty-one fine cows, fed on the finest pasturage in the neighborhood of this city. This was done by taking the milk, just as it was drawn from each animal, separately in the milking-house, and testing at once with the best litmus-paper. In all the paper was turned red more or less distinctly. Dr. John Ashhurst, of this city, tested for us, with both litmus- and turmeric-paper, the milk of nine fine Durham and of four Alderney cows, belonging to his father, all on the finest pasturage. He says that in one Durham and in one Alderney the milk appears to have been almost neutral, and in all the rest more or less acid. In testing the milk of another Durham, litmus-paper was reddened, whilst the turmeric was also slightly changed, but he supposed the latter change to be due to a greasy condition of the milk, owing to the fact that the cow was in the latter period of a long lactation.

To determine the proportion of cream, we may make use of a glass vessel, made of a section of a cylinder, tall, and not too wide, and graduated to inches, with the upper inch divided into hundredths, or a French glass divided into centimetres, such as may be found in the shops for the sale of chemical apparatus. This is to be filled to the upper mark with milk, and put aside for twenty-four hours; at the end of that time the cream will have separated and risen to the top, and its proportion can be read off on the graduated scale. According to Dr. Parkes, the cream should be from 4 to 6 per cent. In the milk of Alderney cows, it will reach 30 to 40 per cent. This seems to us too large a proportion for the use of children.

We think, however, that the average of cream given by Dr. Parkes is probably rather too low. The *Maison Rustique*, a French work of very high authority on agriculture, states (tome iii, p. 61) that the milk of cows, of good race, well kept, furnishes 15 per cent. of cream. The milk supplied by the milkman employed by one of us gave 14 per cent. of cream on one occasion, and 10 at another. The specific gravity of the former specimen was found to be 1029. Of three other specimens bought at hazard, of different dealers, the proportion of cream was 7 per cent., 6 per cent., and 14 per cent., respectively. We are disposed to think, therefore, that families ought to endeavor to procure milk containing at least 10 per cent. of cream.

We next have to ascertain the density, in order to determine the proportion of water. The most common adulteration of milk is, of course, with water, to increase its quantity, and so augment the profits of the salesman. The density or specific gravity, let it be remembered, is no safe guide as to the proportion of cream. That must be settled in the mode just described. But the density gives the proportion of water. The specific gravity of good, pure milk is given by Dr. Parkes at 1030.5, or 1026, at a temperature of 60° Fahr. We found it in an excellent specimen to be 1029. Dr. Parkes found that when, in milk of the specific gravity above mentioned, one part of water was added to nine of milk, the specific gravity fell to 1027 or 1023; when three parts of water were added to seven of milk, it fell to 1021 or 1017.5; and when five parts of water to five of milk, it fell to 1015. These were the proportions obtained by several experiments.

We found that the specific gravity of a specimen of excellent milk, as ascertained by a hydrometer, was 1028. When to this milk was added one-fourth part of water, the specific gravity fell to 1024, and when a half had been added it fell to 1020. In another specimen, the specific gravity, obtained in the same way, was 1030 at a temperature of 64° Fahr. When to this specimen one-half water was added, the specific gravity fell to 1020.

By these three simple methods of examination, the acidity or alkalinity of the milk, the proportion of cream, and the proportion of water, can be determined. If the milk is either strongly acid or alkaline, it is not to be trusted. If it be strongly acid, it has undergone the acid fermentation, and is not fit for use. If it be strongly alkaline, it has either been adulterated by the addition of an alkali, probably, according to Dr. Parkes, carbonate of soda, to prevent or arrest the lactic acid fermentation, or it may have been taken from a diseased cow. Dr. Parkes suggests the latter probability in a doubtful way. Dr. J. F. Simon, of Berlin (*Animal Chemistry with Reference to the Physiology and Pathology of Man*, vol. ii, p. 67), states, that he analyzed milk drawn from the teat of a cow having vaccinia, and found it strongly alkaline, and showing with the microscope mucus- and pus-corpuscles, while that drawn from a healthy teat had a mild acid reaction, and contained no pus- or mucus-corpuscles. He also states (page 68), that Herberger has analyzed the milk of cows suffering from the grease, and found it to contain an increased quantity of the alkaline salts,

in the first stage; in the second stage it was thick and viscid, and had, besides, an unpleasant and putrid taste and smell. In both stages, the presence of carbonate of ammonia (an ingredient never before observed in the milk) was detected.

The most common adulteration of milk is with water. The mode of detecting this, by ascertaining the specific gravity, has already been given. Starch is sometimes used to thicken a thin milk. The microscope will detect this by showing the presence of the starch-granules.

The mother will often wish to preserve milk, especially in our hot summer weather, or for a few days, when on a journey. The best preservative in hot weather, for the day, is of course a good ice-chest. Dr. Parkes says that when boiled, "the bottle quite filled, and at once corked up and well sealed, the milk lessens in bulk, and a vacuum is formed above. It will keep thus for some time. A little sugar aids the preservation. If the heat is carried in a close vessel to 250° Fahr., the milk is preserved for a very long time, even for years; the butter may separate, but this is of no consequence;" or, if a little carbonate of soda and sugar is added, without boiling, he says it will keep for ten days or a fortnight. Cooley, in his *Cyclopædia of Practical Receipts*, states, that the addition of ten to twelve grains of carbonate, or bicarbonate of soda, to each pint of milk, will preserve it for eight or ten days in temperate weather, and adds that this addition is harmless, and, indeed, is advantageous to dyspeptic patients. The method of boiling, proposed by Dr. Parkes, is the one now so much used for preserving fruits fresh.

Having determined upon the use of cow's milk, we have next to consider its mode of preparation.

It should never be given pure to young infants, at least such is our clear conviction. We still believe that the old rule, of two parts of water to one of milk, is the proper one during the first month. We know that some of the more recent writers, and not a few of the physicians of this city, now order half water and half milk, and some children do well on that proportion; but we still believe that when the milk is of full average richness (containing ten or fifteen per cent. of cream, and having a specific gravity of 1028 to 1030), the old rule of two-thirds water is safest. And this is certainly true of all sickly children within the month. It is easy to increase the proportion afterwards, if the child does not develop as it ought; but the stomach once seriously deranged and overloaded by too rich a food, a severe and even a lingering illness may be the penalty the child will have to suffer.

When the child comes to be one or two months of age, the proportion may be increased to one-half, with care; always, however, returning to the first rule, should the child exhibit signs of gastric disturbance, or should the stools contain many whitish lumps, consisting of undigested casein. At the age of five or six months the proportion may be made two-thirds milk, and thus, gradually, the milk may be given pure, though we have seen many children who, even at a year of age, did better with a moderate dilution than with the pure fluid.

The *quantity* of food to be given each day is a very important consideration, and one about which less is usually said than the matter deserves. In the first edition of this work, published in 1848, it was stated that, from various inquiries and observations, we were led to believe that a healthy infant of two or three weeks old, would receive, from a good nurse, and digest well, about a pint of food in twenty-four hours, and that by the end of the first, and in the second month, the quantity taken by the child increased to a pint and a half or a quart. Some of the data upon which these assertions were based were the following: A woman, attended in her confinement by one of us, had a pint of milk drawn, by the nurse, daily from the breasts, in addition to what the child took. On asking the nurse how much she supposed the child—a vigorous, hearty boy—took at the same time, her reply was that, judging from the frequency and vigor with which he nursed, she supposed he took as much as was drawn from the breasts. Another patient lost her child at birth, and desiring to go out as a wet-nurse, kept up the flow of her milk by using a puppy. Six weeks after her confinement, a good breast-pump was given her, and she was desired to keep all the mllk she could obtain in twenty-four hours. The quantity measured exactly a quart.

It was also stated, in that edition, that careful inquiries were made, in regard to this matter, of one of the most experienced and intelligent monthly nurses we ever knew. She was desired to answer accurately the two following questions:

1. How much milk do you think a healthy mother gives to her child daily, after the flow is fairly established?

2. What quantity of nourishment do you give in twenty-four hours, to infants you are compelled to feed exclusively?

The reply to the first question was that she had often drawn more than a pint from the breasts in the twenty-four hours, in addition to what a healthy child took, and that she had frequently taken as much as three pints from women who had lost their children. She supposed, therefore, that a hearty child would take, during the first two weeks, at least a pint, and much more afterwards.

To the second question she replied, that she usually gave to hearty children of one, two, and three weeks old, a pint of food in twenty-four hours.

It was stated in the first edition of this work, that, judging from the above data, a young infant ought to take at least a pint of nourishment in the twenty-four hours. Our experience, since that time, has convinced us that, if anything, this estimate is rather too low than too high. Now we should say that, in the first ten days after birth, a pint or a little over is about the right quantity. After that period a pint and a half to a quart is probably the proper amount up to the second month. In the second and third months many children require a full quart, and some three pints; though, after all, we must be ruled very much by the instinctive wants of the individual child. When fed at regular intervals, upon food of the proper strength, we do not think children often take more than they need.

In the first month the child ought to be fed every two hours, if it takes

the food well. After the first month, once in three hours, is usually the best rule. Feeding the child once in three hours, between six in the morning and six in the evening, and twice in the night, would give six meals in the twenty-four hours. If six ounces (a gill and a half) be given each time, the child would get thirty-six ounces, which is a little over a quart. As the age increases, eight ounces may be given every four hours, which would make a quart and a half; and we have met with very few children who exceed this, particularly as by this time the food consists of two-thirds or three-fourths milk, or even pure milk. It may seem needless to add that, unless the child is taking decidedly less than the average stated above, it ought not to be in any degree forced or enticed to swallow more than it takes willingly. The moment it has had enough, the nurse ought to cease to offer any more.

As this matter of the quantity of artificial food necessary for the development of the child is a very important one, and as it is a point which has not been very clearly defined by most writers, we have thought it well to lay before our readers the following calculation of what infants may need, from the estimate made by Dr. Parkes as to the amount of food necessary for adults.

According to that author, an adult of average size and activity will, under conditions of moderate exertion, take in twenty-four hours from $\frac{1}{26}$th to $\frac{1}{20}$th of his own weight in solid and liquid food. The relative proportion of the so-called solid and liquid food varies greatly, but is usually about 40 oz. avoirdupois of the former, and 60 oz. of water. As, however, all the so-called solid food—bread, meat, etc.—contains a certain amount of water, the actual average amount of water-free food taken by an adult, weighing 150 lbs., is 23 oz., or $\frac{1}{105}$th of the weight of the body; and the amount of water about 75 oz. Or, in other words, every pound weight of the body receives about 0.15 oz. of water-free food and 0.5 oz. of water in twenty-four hours. This water-free food is composed as follows, according to Moleschott:

	oz. avoirdupois = 437.5 gr.
Albuminous substances, . . .	4.587
Fatty "	2 964
Carbohydrates, ...	14.257
Salts (of all kinds), ...	1 058
	22.866

On the basis of these calculations, an infant at birth, the average weight being 7 lbs., would require 1.05 oz. of water-free food; and a child weighing 20 lbs., which is probably the average weight of healthy children of five to six months old, would require 3 oz.

Assuming the total solid of cow's milk to be 10 per cent., which is rather less than the average as given by Becquerel and Rodier (see composition of healthy milk), it would require to yield an ounce of water-free food rather more than 10 ounces of milk.

Thus on this supposition (*i. e.*, that the total solids of cow's milk of sp.

gr. 1026, equal 10 per cent.) one pint imperial (20 oz.) will contain in round numbers,

Casein,	262	grains.
Fats,	217	"
Lactin,	341	"
Salts,	43	"
Total,	863	" = very nearly 2 oz. avoirdupois of water-free food.

According to this, therefore, the infant at birth requires little more than ½ pint imperial of unskimmed cow's milk; the child at five or six months about 1½ pints imperial.

It is evident that the proportion of fat and water is in great excess in this exclusively milk diet; but these two principles are required in early infancy in much larger relative amount than at a later period of life. It will also be seen that by diluting the above amounts of cow's milk with one to two parts of water, we obtain, as the proper amount of food for newborn infants, from a pint to a pint and a half; and for children about five or six months old, from 3 to 4 pints, amounts which correspond closely with the results obtained from examination of the quantity of milk secreted by nursing women.

Some authorities recommend the regular use of lime-water, instead of simple water, for the purposes of dilution. We ourselves have not been in the habit of using it, except when the rejection of the milk in hard and large curds, or the frequent appearance in the stools of small whitish lumps of undigested casein, showed a too early and too great coagulation of the milk in the stomach. In such cases we always direct lime-water to be added to each meal. As to the quantity of this alkali, we will state that Dr. Eustace Smith (*Wasting Diseases of Children*, London, 1868, p. 33), directs, during the first six weeks of life, that half lime-water and half milk be used. Dr. Routh (*Infant Feeding*, 2d ed., London, p. 397) advises that from an ounce to an ounce and a half of lime-water be added to each pint of food. The latter is about the proportion we use. In many cases, however, our patients do perfectly well without any.

Besides the dilution with water, sugar must always be added. Formerly, the best lump white sugar was always used. Brown sugar has been found not to answer well. Of late, experience has shown that sugar of milk, which is the natural sugar found in this fluid, is preferable to cane sugar. The amount of sugar of milk to be added should always be specified by the physician, and not left to the haphazard judgment of the nurse or mother, as most persons use too much. A drachm and a half, or about a heaped teaspoonful, is the proper proportion for each eight ounces of food.

Many different and more or less complicated preparations of food have been recommended by different authorities. We do not think that any of the various feculent substances, so much vaunted and advertised for the use of the public, are of any value in the early months, as compared with milk. Milk must be the basis. It is the really important part of the

nutriment. It matters not greatly what be the feculent substance used, we think, if only the milk be good and in sufficient quantity, and the feculent material be in small proportion. To depend on amylaceous food is usually to sicken, and finally to starve the child. And yet we have found by experience that a small quantity of amylaceous material combined with the milk does render the food more digestible. We think that the opinion held by several physicians, that the particles of starch lessen the tendency of cow's milk to coagulate into hard large masses, by being interposed between the elements of the casein, may be the correct one. At all events, experience, as stated above, has led us into the habit of using a small quantity. The following preparation was published in our first edition, and we have employed it in a great many instances, and have found it the best substitute, as a rule, for the natural aliment, that we are acquainted with.

It is made by dissolving a small quantity of prepared gelatin or Russian isinglass in water, to which is added milk, cream, and a little arrowroot, or any other farinaceous substance that may be preferred. The mode of preparation and the proportions are as follows: A scruple of gelatin (or a piece two inches square of the flat cake in which it is sold) is soaked for a short time in cold water, and then boiled in half a pint of water until it dissolves,—about ten or fifteen minutes. To this is added, with constant stirring, and just at the termination of the boiling, the milk and arrowroot, the latter being previously mixed into a paste with a little cold water. After the addition of the milk and arrowroot, and just before the removal from the fire, the cream is poured in, and a moderate quantity of loaf sugar added. The proportions of milk, cream, and arrowroot must depend on the age and digestive power of the child. For a healthy infant within the month, we usually direct from three to four ounces of milk, half an ounce to an ounce of cream, and a teaspoonful of arrowroot to a half pint of water. For older children, the quantity of milk and cream should be gradually increased to a half or two-thirds milk, and from one to two ounces of cream. We seldom increase the quantity of gelatin or arrowroot.

We have given this food to a great many children during the last twenty-five years, as well to those brought up entirely by hand, as those partly suckled, or weaned, and can truly state that they have thriven better upon it than upon anything else we have employed. In several cases it has agreed perfectly well with infants who could not, without vomiting, diarrhœa, and colic, take plain milk and water, cream and water, any kind of farinaceous food prepared with water, chicken water, or in fact any other food that had been tried. In the cases of sick children, it ought sometimes to be made even weaker for awhile than in the proportions first mentioned above.

We have been pleased to find that Dr. Routh (*loc. cit.*, p. 315) quotes, with great approval, a food recommended by Dr. Merei for feeble children, with bowels previously deranged, which is almost exactly the same as the above. Dr. Merei is one of the physicians of the Clinical Hospital for the Diseases of Children, in Manchester, and one who must therefore, have

had a large experience. He first makes a decoction of arrowroot with a teaspoonful of arrowroot to three-quarters of a pint of water, this quantity to serve for a whole day's supply. It is stated by Dr. Routh, that the arrowroot is not given as an aliment, but as a softish substance, to soothe mechanically the irritation of the intestinal mucous membrane. "Langenbeck, indeed," he says, "believes that in such cases the granules of starch intersperse themselves between the particles of casein, and thus in great measure prevent the formation of hard, indigestible curds." The mixture Dr. Merei gives, is stated to consist of three or four parts of this thin decoction of arrowroot, to one part of new milk, slightly boiled; and to the twenty-four hours' amount of food thus prepared, he adds about one or two tablespoonfuls of *cream*. Children, it is further stated, will digest well from a pint to a pint and a half of this mixture in twenty-four hours, according to their age. As they grow older, he increases the proportion of milk, but not of cream.

This is so much like our own preparation, recommended twenty-five years ago, that we feel strengthened in our own conviction as to its utility, particularly as the two experiences have occurred so far apart as England and America, and to persons who have reached the result by experience as well as theory.

There are other preparations, such as those of Dr. Frankland and Mr. Lobb, which may do well in some cases, but they are so complex, and require so much time, as to render them almost useless in the nursery. The one recommended by Baron Liebig, called Liebig's food, we have used occasionally, but have been disappointed in its action; and it, likewise, is so difficult of preparation, that we doubt its coming into general use in the nursery, where a food, to be well and properly prepared, must be simple.

Condensed Milk is now a good deal used as a diet for children. It is made by evaporating the water from milk placed in open pans or vats, at a temperature of from 150° to 175° Fahr. Generally, seventy-five per cent. of the original bulk of water is driven off. There are two varieties of the preparation, one in which the milk is simply evaporated, so that four pints become one pint, without the addition of any preserving substance; and another, in which, after evaporation to the same degree, cane-sugar is added. The former will keep from one to four weeks, the latter for months or years. The latter is the preparation almost universally used for children. It is of a thick, semifluid consistence, is preserved in tin cans carefully soldered, and may thus be readily transported. It keeps closed, it is said, for years, and, even when a can is opened and kept open, it becomes drier or more solid, but does not spoil for some weeks.

It contains about one-third of its weight of sugar. Dr. Pavy (*Treatise on Food and Dietetics*, Phila. ed., 1874, p. 187) gives the proportion of lactin or sugar of milk in cow's milk as 5.2 per cent. It appears from three analyses of condensed milk (see Pavy, *loc. cit.*, p. 194), that the quantity of sugar of milk was 16.50, 12.00, and 17.54 per cent. respectively. In the same specimens the amount of cane-sugar was 27.11, 29.59, and 27.06, in the different examples. This would give the whole amount of sugar of the two kinds in the different specimens 43.61, 41.59, and 44.64. If con-

densed milk be reduced to its original fluidity, by the addition of the seventy-five per cent. of water, which had been driven off by evaporation, we should have a milk containing considerably less than the five per cent. of lactin or sugar of milk, said to exist in ordinary cow's milk, and from six to seven per cent. of cane-sugar, of which there is none in the natural product.

This preparation is now used to a considerable extent in this country on journeys and voyages, at some of the seaside watering-places in the summer, and in some of our cities, where good fresh milk cannot be obtained. It is used of very different strengths by different persons. A physician who has a large practice in this city, and who uses it constantly in his practice, preferring it in many cases to fresh milk, adds six tablespoonfuls of boiling water to one heaped teaspoonful of the condensed milk, and gives the child as much as it wishes to take. Of course, no sugar is added, as the milk is already far sweeter than the natural fluid. This proportion makes a milk of a very weak character. Condensed milk, as stated above, is reduced in the manufacture in the proportion of four to one. If we add six tablespoonfuls of water to one tablespoonful of condensed milk, we get a fluid only one-sixth as strong as fresh milk; or allowing for the larger quantity of condensed milk, when the teaspoonful is heaped up, it would make a fluid certainly not more than one-fourth the strength of fresh milk. This is a singular commentary on the modern practice of giving young infants pure cow's milk—a practice insisted upon by some recent writers. In one case in our practice, the mother gave her child, thirteen months of age, twelve small cans of milk, holding, perhaps, each four ounces, in thirteen days. Her practice was to dissolve two heaped teaspoonfuls of condensed milk in twelve tablespoonfuls of water, which filled an eight-ounce feeding-bottle. This amount of the food was given three times between midnight and noon, and five times in the afternoon and evening. The child took also half a pound of beef made into half a pint of beef tea. It grew well, but was fretful, irritable, and had large, copious, pasty, and white stools. The food was reduced by us at once to one teaspoonful of condensed milk in six tablespoonfuls of water at each feeding. On this diet, the stools improved and the child was much happier. The food was then gradually changed to fresh milk, and the child is now healthy-looking and cheerful. Another very feeble infant of six months old, who, when we first saw it, had had frequent indigestions and convulsions on fresh milk, did very well on one heaped teaspoonful of condensed milk mixed with four tablespoonfuls of fresh water and two tablespoonfuls of lime-water, with ten drops of wine of pepsin after each feeding, and a mixture of soda, two and a half grains, sweet tincture of rhubarb five drops, and paregoric, two drops three times a day. We tried several times fresh milk, but it did not answer. When the child had reached the age of fourteen months, it had become reasonably healthy, and we ordered some weak beef tea twice a day, and the substitution of one tablespoonful of fresh cream in place of one of the tablespoonfuls of lime-water. It is now doing well. In another case, one of a pair of twins was brought to us at the age of four and a half months—a miserable,

little, pale, feeble, and undergrown infant. Fresh milk had been tried, but had caused indigestion and diarrhœa time and again. We ordered one teaspoonful of condensed milk to five tablespoonfuls of water and two tablespoonfuls of lime-water. On this food the child was much more comfortable, and grew slowly. The food was now increased in strength. Two heaped teaspoonfuls of the milk were added to ten tablespoonfuls of plain water and two tablespoonfuls of lime-water, and this amount given every two or three hours. At the age of eight months the child had grown somewhat, was in more comfortable health, but was still very small, white, and puny. We now ordered one tablespoonful of cream to be substituted for one tablespoonful of the plain water, in the above preparation; and also two tablespoonfuls, twice a day, of a beef tea made by pouring four tablespoonfuls of hot, not boiling, water on one teaspoonful of Valentine's meat extract. The child is, at the present time, doing well on this food, which is to be changed by slow degrees, if possible, to fresh milk. The other one of these twins looks well, is well grown, and cheerful, on condensed milk, made by adding three teaspoonfuls of the milk to ten of simple water, and three of lime-water.

Another patient informed us that condensed milk was ordered for her child, in New York, in the proportion of one tablespoonful to twelve tablespoonfuls of water, which proportion would represent new milk a third, to water, a little more than two-thirds. The child was so starved at the end of six weeks, that the physician gave the food up in despair, and returned to fresh milk.

Our own conclusion is that condensed milk is not, by any means, so good a diet for young children as fresh milk. It certainly is unlike the fluid created for the young. It contains a large amount of cane-sugar, which does not exist either in woman's or cow's milk, and apparently, from the analyses referred to above, it has less sugar of milk than it ought to have. But, while this is our opinion in general, we think there are some cases in which for a time it is digested better than fresh milk. These cases are usually those of delicate infants, who have never been nursed at all, or very imperfectly nursed, or who have been made sick by being fed upon too strong a diet of fresh milk, or, lastly, who have an idiosyncrasy which renders them incapable of digesting the casein of fresh milk, when the food is made in any of the usual proportions of water,—a third, half, or even two-thirds. We believe that the reason why some children take and digest a food made of condensed milk, whilst they reject, or fail to digest properly, a diet made of fresh milk, is the result of the very small amount of casein they get in the former. Few medical men in this city think of diluting fresh cow's milk more than one-half for infants of two and three months old and upwards, and not a few insist upon giving it pure or with only a third of water. Yet, when we use one teaspoonful of condensed milk in six teaspoonfuls of water, we make a very thin diet, for, to reduce the ordinary preparation to the strength of fresh milk, we must mix one teaspoonful with only three of water. Then, to reduce this representative of fresh milk to an ordinary half water and half milk diet, we must add four more teaspoonfuls of water, when we should have one teaspoonful of

condensed milk to seven of water. But it is quite the custom here, as stated above, to mix a heaped teaspoonful of condensed milk with six tablespoonfuls of water. So that, even assuming that the heaped teaspoonful represents in fact two ordinary teaspoonfuls of condensed milk, which is not quite the fact, we should have a preparation equal to one part of new milk to a little more than two parts of water, or about a third milk. In view of this fact we may properly ask, on what does the child live? It must be that it lives in some measure upon the cane-sugar which has been added to the milk to preserve it, and that it digests the thin diet better than ordinary fresh milk diet, simply because it is so deficient in casein.

The question as to whether condensed milk can safely be relied upon as a permanent food for infants and young children, is one that cannot yet be authoritatively answered. We do not believe in it, except as a measure of necessity, where good, pure, and fresh milk cannot be obtained, or where a fair and careful trial demonstrates that the condensed milk diet suits best. But, even in these latter cases, we always get back at as early a period as possible to the fresh milk.

Dr. Edward Smith (*Foods*, New York, 1873, p. 323) says: "This preparation has been recommended as a food for infants, and it is much liked by them; but it is an error to assume that a given quantity when dissolved in water will yield new milk or be as useful as new milk in feeding infants and young children, and it should never be used as a substitute in such cases whenever new milk can be obtained."

At page 325 he says again: "Without explaining the medical aspect of the question (which would be out of place here), I remark that as a food the addition of nearly two ounces of sugar to the pint of cow's milk greatly lessens its nutritive value, and induces a tendency to starvation of the muscle-forming element. Thus, whilst in natural cow's milk the proportion of nitrogen (flesh-forming) to carbon (fat-forming) is 1 to 12, in the preserved milk it is not much more than one-half, or about 1 to 20. If the object were to feed an animal for the market it would be obtained by this method, but if to make infants into strong muscular men and women, the proportion which nature has provided must be supplied."

Dr. Smith gives also the views of Dr. Daly (*Lond. Lancet*, Nov. 2, 1872), who, while noting the fact that condensed milk is much liked by children, and that those who are fed upon it grow fat and look very well, yet gives it as the result of his experience that they have not the same degree of resistance and vital power as those who are fed on cow's milk, but sink much more quickly and dangerously under an attack of diarrhœa or any other acute disease.

Dr. Arthur V. Meigs, one of the assistant physicians to the Children's Hospital of this city, informs us that he has been obliged, in most of the cases of cholera infantum, brought to the dispensary during the hot summer months, to change the diet of those fed on condensed milk to fresh milk, as he has found that they rarely do well on the condensed milk diet. His friend and colleague, Dr. Louis Starr, has arrived at the same opinion as to the comparative value in this disease of the two kinds of diet.

There is still another objection to condensed milk which we must refer

to. It is more difficult to detect adulterations in it than in fresh milk. We have already given a simple method by which any intelligent mother or housekeeper, can detect a material adulteration of fresh milk. That condensed milk is not what it ought to be, at least in some instances, is proved by the report of the New York Board of Health for 1870 (see *Two Lectures on the Morals of Trade*, by R. Heber Newton, New York, 1876, Appendix A), where it is stated that "the condensed milk is found, with few exceptions, to be made of skimmed milk entirely or in part. It is thus robbed of its cream, and is therefore deficient in fat (butter). This really renders it unfit for the nourishment of children and the fraud is more objectionable than that of diluting the whole with water." The report adds: "It is a notorious fact that most of the condensed milk companies regularly send cream to the New York market." We have already said that Dr. Edward Smith asserts that "whilst in natural cow's milk the proportion of nitrogen (flesh-forming) to carbon (fat-forming) is 1 to 12, in the preserved milk it is not much more than one half or about 1 in 20." We suppose that Dr. Smith here refers to the condensed milk of the English factories.

Dr. Thomas King Chambers (*Diet in Health and Disease*, Philadelphia, 1875, p. 65), says of condensed or Swiss milk that "it certainly is digestible, as is shown by the fact of infants brought up by hand upon it growing fat and apparently strong, a fact of which most of us have ocular proof. Great care should be taken that only the softest water is used for its solution, and precautions taken against its adulteration. As it is a recent invention it is pure enough at present, but extensive use will probably teach ingenious methods of sophistication." Dr. F. W. Pavy (*Treatise on Food and Dietetics*, Philadelphia, 1874, p. 194), gives no personal opinion as to its value, but cites, in a foot-note, Dr. Daly's opinion (already quoted) of it.

The causes which compel us to resort to artificial food for young children, are, of course, very numerous. Thus, it may be impossible, after the death of the mother, to secure a reliable wet-nurse; or the mother's supply of milk may be manifestly insufficient; or again, although the quantity is abundant, the milk either disagrees with the child, and causes vomiting and diarrhœa, or does not nourish it properly. In every case, therefore, where we have reason to suspect that the mother's milk is of improper quality, we should subject it to a careful examination; and, it is needless to add, that whenever a wet-nurse is chosen, a similar examination of her milk should invariably be made.

According to Vernois and Becquerel, who examined the milk of eighty-one nursing women, the composition of a healthy woman's milk is as follows:

1000 parts of milk contain—

Water,	889 08
Sugar,	43 64
Casein,	39.24
Butter,	26.66
Salts,	1.38

For practical purposes, however, it is quite sufficient for the physician

to determine the specific gravity, the reaction, the amount of cream, and the microscopic appearances of the milk. The first three of these points are to be ascertained in the way already directed in the examination of cow's milk. The density of the milk should be about 1030 to 1032. The amount of cream, as tested by the graduated galactometer, should be at least three per cent. In regard to the reaction, our own observations are not in accordance with the statements of the majority of authors. Thus, according to Vogel (*op. cit.*, p. 32), "fresh woman's milk is bluish-white or pure white, has a feebly sweetish taste, and *alkaline reaction*." In order to determine this point, the following observations were made on forty-three women in the Philadelphia Hospital:

The subjects chosen were all in good health, and varied in age from nineteen to forty-one years. They were all suckling their own children, who were from nine weeks to eighteen months old, and, in three-fourths of the instances, in good health and well grown. In a good many cases the children had suffered more or less severely from diarrhœa during their teething.

The mode of testing was as follows: A few drachms of milk were first expressed from the nipple and rejected; a couple of drachms more were then expressed into a spoon, and tested with litmus- and turmeric-papers. In no instance was there the slightest alkaline reaction with the turmeric. In one instance only was there an acid reaction, and that a very faint one; while in forty-two of the forty-three cases, in nineteen of which the milk was tested twice, on successive days, the reaction was neutral.

It is necessary, in thus testing the milk, to express it into a spoon, since litmus-paper is reddened when applied to the moist nipple.

It would appear, then, from these observations, that woman's milk can, at least, not be regarded as unhealthy on account of having a neutral reaction.

The microscopic examination should determine the quantity and size of the fat-globules, and the presence or absence of colostrum-corpuscles.

The fat-globules, also called *milk-globules*, which are observed in healthy woman's milk, should not be very numerous, and should not vary in size more than from the 0.0012 to 0.0020 of an inch in diameter. The fat-globules, as present in milk, are invested with a delicate albuminous envelope. If the milk be allowed to stand, and the upper stratum of cream which forms be examined, along with the ordinary fat-globules, there will be numerous others of much larger size.

In addition to these fat-globules, there are also found in the milk during the first two or three weeks after confinement, a number of granule-cells, the so-called "*colostrum*-corpuscles." These bodies, which present the ordinary appearances of granule-cells wherever found, consist of an aggregation of minute oil-globules in an albuminous basis; they vary from 0.003 to 0.006 of an inch in diameter; and when examined by transmitted light, appear opaque and dark-colored. After the period above mentioned (end of the second week), they should diminish rapidly in number, and only reappear in case the nursing woman is attacked with any acute febrile affection. If, therefore, they are found to persist long after the time men-

tioned, or if, having almost disappeared, they return in numbers, the milk must be regarded as unhealthy.

After these general remarks on the diet for hand-fed children, which we hope will not be thought too tedious, having regard to the great importance of this subject, not only in thrush, but in all the diseases of childhood, we return to the treatment of the special disease under consideration, thrush.

Few children, with thrush, unless the case be a very mild one, will take the full allowance of milk and water we have assumed to be necessary in the first weeks after birth. It is clear, however, that if the patient be taking only half a pint or a gill a day, it cannot live long on so much less than the natural quantity. It ought to take, under these circumstances, about two or three tablespoonfuls of food every two or three hours, between morning and evening, and once or twice in the night, which would amount to from eight to ten ounces in the day; and this quantity ought to be given if the child can be induced, without forcing, to take so much. If the usual proportion of two parts water to one of milk, or if the arrow-root and gelatin preparation above recommended, should be rejected in hard curds, or if masses of undigested curd be found in the stools, it is best, for a few days, to dilute with three or even four parts of the arrow-root solution, or to try for a short time, merely cream and water, one part of the former to three, four, or five, of the latter, returning to the mixture of cream, milk, and water, as soon as possible.

In mild cases of the disease, which have been caused by some temporarily unhealthy state of the nurse's milk, or, as we have seen it, from the occasional use of artificial food to eke out a diminished supply on the part of the nurse, after regulating the diet as directed, the use of the following mixture, which we have employed for many years past, will often prove very successful and tranquillizing:

℞.—Sodæ Bicarb., ...	ʒss.
Tr. Opii Camph., ...	gtt. xl.
Tr. Rhei, ...	gtt. lxxx.
Syrup. Simp., ...	fʒij.
Aq. Menth., ...	fʒxiv.—M.

A teaspoonful three times a day.

This dose, continued for several days, or even weeks, will, unless the cause continue in force, relieve the pain and wakefulness, lessen the diarrhœa, and greatly promote the comfort of the child. In connection with this, the mouth should be touched, once or twice a day, with a solution of nitrate of silver, of one grain to the ounce.

In the *grave form* of the disease it is necessary, after regulating the diet, to employ remedies for the disordered condition of the alimentary canal. These should consist principally of alkalies, astringents, opiates, occasionally a dose of some laxative substance, nitrate of silver, and the external employment of baths, warm cataplasms to the abdomen, and sometimes of revulsives.

The *alkalies* usually employed are soda, lime-water, magnesia, chalk, and prepared crab's-eyes. Of these we prefer, in most cases, the soda, lime-

water, chalk, or crab's-eyes, to be given in the manner which will be recommended in the article on entero-colitis. Dewees recommends very highly the following formula:

R.—Magnes. Alb. Ust., ... gr. xij.
Tinct. Thebaic., ... gtt. iij.
Sacch. Alb., ... q. s.
Aquæ Font., ... f℥j.—M.
A teaspoonful to be given every two hours until the bowels are tranquil.

He says of it that he has "long adopted it with entire success." In conjunction with the internal use of alkalies and astringents, we would recommend the practice pursued by M. Valleix of employing *opiate enemata* and warm *poultices* containing laudanum, applied upon the abdomen. The enemata should consist of one drop of laudanum in a tablespoonful of starch-water for young infants, to be used morning and evening. The poultices may be made of Indian or flaxseed meal, placed between two pieces of soft gauze flannel, to be secured around the body by a band, and renewed from time to time.

Purgative remedies are much used in this country in all cases of intestinal disorder. We believe them to be unnecessary, and generally injurious, in thrush, except at the onset, and occasionally through the course of the disease, when we may suppose the bowels to contain accumulations of partially digested aliment, or highly irritating secretions. Under these circumstances, and only then, from half a teaspoonful to a teaspoonful of castor oil, or a teaspoonful of spiced syrup of rhubarb containing half a drop of laudanum, may be prescribed, and repeated in case the same condition of things should recur. When once the diarrhœa with green watery stools is established, we believe all cathartics to be, as a rule, injurious.

Opiates, in moderate quantities, given in combination with alkalies or astringents, or used by injection or externally, are of the greatest service at all stages of the grave form of the disease. When the diarrhœa is severe and obstinate, and particularly when the stools contain mucus or blood, or are attended with tenesmic straining, nitrate of silver given internally, or used by injection, may be resorted to with very probable benefit. The doses and modes of administration will be described under the heads of entero-colitis and dysentery.

Some authors recommend the application of one or two leeches to the margin of the anus, or over the left iliac fossa. We think they can rarely be proper, and if so, only in vigorous, hearty children, and in cases presenting strongly marked inflammatory symptoms. When the symptoms indicate great exhaustion, or tend towards a state of collapse, resort must be had to stimulants, of which the best are weak brandy and water, or a mixture of equal parts of wine-whey and arrowroot water.

Local Treatment.—The local treatment is important in all cases, but is of much less consequence than the general treatment, and particularly attention to the diet and other hygienic conditions of the patient. Topical remedies undoubtedly have the effect, however, in some instances, of

arresting the progress of the exudation, and hastening the resolution of the disease of the mouth; but we have uniformly found, in grave cases, that no remedies applied to the mouth had any decided influence upon the abdominal disease, which is, after all, the cause of the fatal termination in the vast majority of cases. The local treatment ought, therefore, to be regarded as adjuvant only to the general management of the disorder.

In mild cases the most suitable local treatment, the one recommended by Underwood, Dewees, Eberle, and MM. Trousseau and Delpech, and that which we have generally employed, is the occasional application to the mouth of borax. It may be used mixed with an equal quantity of honey, and applied by means of a rag or pencil; or with an equal quantity or two parts of finely powdered white sugar, of which a pinch is to be put upon the tongue every two or three hours; or in solution, in the proportion of a drachm to two ounces of water. The best mode probably is to mix it with honey. If this application fail to arrest the deposit of the exudation, we may resort to alum in powder or solution, or, better still, to solutions of nitrate of silver, or to careful cauterization with the solid nitrate. The alum may be used in the same manner as borax, or according to the followed formula, recommended by M. Valleix:

℞.—Aluminis, ... gr. xv.
Mel. Rosæ, ... ʒijss.
Decoct. Hordei, ... fʒiijss.—M.

In the use of the nitrate of silver, we should resort to a solution of five grains to the ounce of water. MM. Trousseau and Delpech, however, recommend one of thirty grains to the half ounce, or more frequently cauterize lightly the whole mucous surface with the solid caustic.

Solutions of salicylic acid, 10 or 15 grains to the ounce, effected by means of glycerin, or solutions of carbolic acid, have also been used by us with good results.

Between the applications of any of the above-mentioned remedies, the mouth of the infant ought to be occasionally moistened and cleansed with some of the mucilaginous solutions, as gum-water, flaxseed tea, or that made from sassafras pith, slippery elm bark, or marsh-mallow root.

Strict and careful attention must be constantly paid to the state of the skin around the anus, and upon the thighs and buttocks. These parts ought to be well cleansed, after each evacuation of urine or stool, by gentle pressure, and not by rubbing, with a fine sponge dipped into tepid milk and water, then dried with a soft napkin in the same manner, and well anointed with simple cerate, or, what we find better than anything else, Goulard's cerate. These precautions ought to be still more carefully observed if erythema has already made its appearance.

ARTICLE VI.

AFFECTIONS OF THE TONSILS.

1. Acute Inflammation of the Tonsils.—Tonsillitis.—This painful affection (known also as angina or cynanche tonsillaris), occurs in childhood less frequently, but with the same symptoms as after the age of puberty. We have occasionally met with severe cases of it in children under the age of 5 years.

Symptoms.—When the attack is sudden, there are marked fever, restlessness or heaviness, and complaints of severe pain on deglutition. If the child be old enough to answer questions, the pain will be found to radiate from the fauces towards the ear, and to be increased by opening the mouth. Painful enlargement of one or both tonsil glands will be found by pressing the finger below the angle of the lower jaw. On examining the fauces, there is marked redness of the half arches and posterior border of the soft palate: the affected tonsil projects from its bed as a rounded, deep-red body, which may extend even beyond the median line; and if, as less frequently happens, both tonsils are severely inflamed at the same time, they may even meet and entirely occlude the isthmus of the fauces. The surface of the gland often presents small yellowish points which closely resemble patches of false membrane, although careful inspection will show that they are beneath the mucous membrane, and are really only the distended follicles of the gland. Deglutition is so painful, especially for liquids such as milk or water, that the little patients will at times utterly refuse to swallow.

Course and Duration.—The disease lasts from 3 to 7 days, and terminates in different ways. It very rarely proves fatal, and only does so by obstructing breathing, and at the same time so seriously interfering with nutrition that the child's strength fails. In most cases the result is favorable, and the termination is either by suppuration or gradual resolution of the enlarged gland. When suppuration occurs, the symptoms have gone on becoming more and more aggravated until they reach their height, and the case seems attended with great danger, when suddenly, after an effort at vomiting, or spontaneously, the tonsillar abscess bursts, a gush of pus occurs from the mouth, and prompt relief is afforded. Occasionally the occurrence of suppuration is marked by a chill, or some decided change in the febrile movement.

More frequently in children, however, the tonsil does not suppurate but gradually becomes smaller; the redness subsides, and the distended follicles disappear. There is a strong tendency, especially after this latter mode of termination, for the tonsil to pass into a state of moderate chronic enlargement.

Diagnosis.—The conditions with which acute tonsillitis in children is most apt to be confounded, are diphtheria and scarlatinous angina.

From diphtheria it may be told by the more acute and sthenic character of the symptoms; by the absence of enlargement of any but the tonsil

glands, and by the local appearances, particularly the absence of pseudo-membranous exudation.

From the angina of scarlatina it may be distinguished by the less frequent pulse and lower temperature, but chiefly by the absence of eruption, so that in some cases the diagnosis cannot be positively determined until the time at which the eruption of scarlatina makes its appearance has passed.

Treatment.—So long as the child is able to swallow, quinia may be given in full doses, to diminish the fever, and perhaps diminish the liability to suppuration. It may be given combined as follows:

℞.—Quiniæ Sulph., ... gr. xviij.
Tr. Ferri Chloridi, ... gtt. xlviij.
Potassæ Chloratis, ... gr. xxx.
Syr. Zingiberis, ... f℥j.
Aquæ, ... f℥ij.

Dose: Ft. sol. 2 teaspoonfuls 4 times a day, for a child 5 to 7 years old.

If, however, the inflammation be very acute, suppuration will occur in all probability, despite our efforts.

It is almost impossible to make any applications to the throat. That which is most readily effected, and affords as much relief as any other, is the inhalation of steam or vaporized warm lime-water. Warm, slightly sedative embrocations may also be applied to the neck. It is doubtful whether poultices, or any such applications, hasten suppuration sufficiently to make up for the annoyance they cause the child. Even if the occurrence of suppuration be suspected, it is usually impossible to obtain so full a view of the parts as to enable an incision to be made to evacuate the pus. As, however, the abscess will discharge spontaneously in nearly all cases, it is only when the symptoms of obstruction of the throat are very urgent, that it is desirable to insist upon such an examination.

The treatment for the chronic enlargement which sometimes remains after an acute tonsillitis, will be considered in the next section.

2. Chronic Enlargement (Hypertrophy) of the Tonsils—Causes.—The tonsils are in young children much more subject to this affection than to acute inflammation. The enlargement may begin during the first year of life, but usually does not become sufficient to attract attention until the second or third year. Most frequently it has no connection whatever with previous acute inflammation of the part, but is chronic and indolent from the beginning. It is often observed that several children of the same family will suffer from this condition, and it is in fact associated in many cases with rickets or with scrofula. We have, however, observed marked and enduring enlargement in children of apparently sound constitution. According to West, the irritation of the latter period of first dentition may be the exciting cause in some of these cases.

We have already alluded to the fact that occasionally, especially in somewhat older children, it has been an acute attack of tonsillitis—either simple or diphtheritic—which has induced the state of chronic enlargement.

Anatomical Appearances.—Both tonsils usually share in the enlargement, though not always to an equal degree. They project into the fauces

from either side, forming pale red tumors of rounded form, with a surface that may either be smooth and glistening, or rough and irregular from the rupture of numerous distended follicles. They impart a sense of elastic firmness to the finger when pressed. The exact anatomical condition is in part an enlargement of the follicles of the gland, associated with thickening of the fibro-cellular stroma. The term hypertrophy, commonly applied to this condition, must therefore be regarded as indicating merely the increase in size of the gland.

Symptoms.—There can be no doubt but that many symptoms have been attributed to the influence of enlarged tonsils which are in reality dependent upon entirely different causes.

The results which are constantly observed are loud snoring during sleep, and snuffling, thick voice. There is also often a tendency to acute catarrhal attacks, during which the enlargement of the tonsils increases, and the interference with the breathing and voice is much increased. Indeed, in some unusually severe cases the respiration is constantly labored, and the child is annoyed by a frequent dry hacking cough. The pressure of the enlarged glands upon the mouths of the Eustachian tubes may produce tinnitus and hardness of hearing. The most serious results which are, by many authors, attributed to enlargement of the tonsils are alterations in the nose and upper jaw, and the production of the chicken-breast deformity of the thorax. In consequence of the obstruction of the nasal passages caused by the upward pressure of the soft palate, the form of the anterior nares may be somewhat altered and contracted, but we are rather inclined to refer the small size of the features and the ill-developed upper jaw to the rickety cachexia which is so frequent a cause of enlargement of the tonsils. So, too, the narrowing of the isthmus of the fauces must tend to make inspiration difficult, and thus to prevent full expansion of the chest, but we can hardly imagine that such obstruction could produce marked chicken-breasted deformity of the thorax, if it were not for the fact that in such patients there is usually a high degree of rickets coexisting. It must be borne in mind that precisely this deformity of the thorax is frequently met with in cases of rickets where there is no enlargement of the tonsils. The condition of these glands and the changes in the jaws and chest-walls must then, we think, be regarded as results of a common cause. So, too, it is probable that the sudden suffocative attacks which have been described as occasionally attending chronic enlargement of the tonsils have been spells of laryngismus stridulus, dependent upon rachitic disease of the bones of the skull.

Prognosis.—It will be readily seen, therefore, that although this condition of the tonsils is obstinate, and yields slowly, if at all, to treatment, it is rarely of itself followed by any serious consequences. In very many cases it gradually subsides after the patient reaches puberty, while in others treatment is successful in reducing the enlargement. We have, however, known it to persist most obstinately for many years, even after partial ablation and prolonged treatment.

Treatment.—The frequent association of enlargement of the tonsils with a rachitic or strumous diathesis must be borne in mind, and if there

is any evidence of the existence of such a constitutional taint, the appropriate treatment must be adopted. Even where no decided evidence can be found, it seems desirable to administer such alterative tonics as the iodide of iron, or the compound syrup of the phosphates of iron and alkalies. The prolonged use of cod-liver oil, with iron and arsenic, has also proved of service.

Counter-irritation by the daily application of dilute tincture of iodine, or compound iodine ointment, behind and below the angle of the jaw, may be used, and sometimes appears to favor the reduction of the swelling.

Local applications to the enlarged glands are of much service in some cases, but to do good must be steadily persisted in, in conjunction with proper internal remedies. Those which have on the whole appeared most useful to us have been Lugol's solution of iodine diluted with two to four parts of water, and nitrate of silver in the form of rather strong solution, as gr. x to the fluidounce.

We have also found it of material service in hastening the reduction of the enlargement to whiten the surface of the tonsils once in three or four days by a light application of solid lunar caustic.

Recently, the use of injections of ergot and iodine as a means of causing the resolution of enlarged glands has been frequently recommended. We had found positive benefit from their employment in cases where the children were old enough to permit this little operation to be performed without too much alarm. The injections should be made into the substance of the hypertrophied tonsil, by means of an ordinary hypodermic syringe; and may be repeated about once a week, or according to the effect produced. The amount injected should not exceed a few drops, 3 to 5, and should be introduced very gently, so as to avoid pain as far as possible. The fluid used may be either single solution of iodine diluted with water, or a dilute solution of ergotin, 48 to 96 grains to the ounce.

Careful attention to diet, and particularly to the proper and sufficient clothing of the child must be insisted on, so as to avoid, as far as possible, the repeated acute attacks of slight tonsillitis which are apt to occur. Under the persistent employment of the general and local means above recommended, we have usually found that the hypertrophy of the tonsils has diminished towards the age of puberty. In some instances, however, we must confess that all forms of treatment, general as well as local, have proved unavailing. We must then resort to excision of the enlarged glands, if the symptoms caused by their presence are sufficiently urgent to render it advisable.

The excision of the tonsil (or rather of the prominent portion of it, for the entire gland rarely needs removal) is an operation attended, in skilful hands, with little difficulty and no danger. It may be readily performed with a Fahnestock's or Physick's tonsillotome, or, as many operators prefer, by raising the gland from its bed with a special kind of forceps, and then slicing it off with a bistoury.

The symptoms which would lead us to advise the early removal of the tonsils are frequent irritative cough, much interference with hearing or with the tones of the voice, or coexisting rachitic deformity of the chest.

ARTICLE VII.

SIMPLE OR ERYTHEMATOUS PHARYNGITIS.

Definition; Frequency.—Simple pharyngitis consists of an erythematous inflammation of the pharynx, tonsils, and soft palate, unaccompanied by ulceration, deposit of false membrane, or gangrene. It is very frequent both as an idiopathic and secondary disease. We constantly meet with it in children of all ages during the cool months of the year.

Causes.—It may occur at all ages, and is equally common in the two sexes. It is more frequently a secondary than an idiopathic affection. The diseases in the course of which it is most apt to occur are scarlet fever and measles, and next, pneumonia and bronchitis. It is often an accompaniment of simple laryngitis. The idiopathic form is most common in this city in the late winter and early spring months. It is said to prevail sometimes in an epidemic form.

The *exciting causes* of the disease are not always easily detected. In most instances, however, we believe that exposure to cold is the cause of the attack.

Anatomical Lesions.—In mild cases the alterations of texture observed during life, and in a few instances after death, the patient having died of some other disease, consist of greater or less redness, swelling, softening, and a rough or granular and sometimes œdematous condition of the mucous membrane covering the soft palate, tonsils, and pharynx. The uvula and tonsils are generally tumefied, and the crypts of the latter filled with mucous or purulent fluid of a yellowish color. In one very severe case which proved fatal, MM. Rilliet and Barthez found the tonsils very red, soft, only slightly swelled, and infiltrated with pus; the pharynx was covered with a thick layer of bloody mucus; the mucous membrane of the throat was of a dark red color, thickened, and granular, but not softened. The submaxillary glands were of a grayish color, enlarged and soft.

Symptoms.—Simple pharyngitis of moderate severity begins with restlessness, irritability, fever, slight cough, and in some instances, pain in the throat, which is complained of by older children, and betrayed in those who are very young by the refusal to nurse or take food, because of the difficulty of swallowing. The *face* is generally flushed, sometimes very deeply so. Young children are often drowsy, but from irritability and fever refuse to sleep except on the lap. The *fever* is marked by acceleration of the pulse, which rises to 100, 110, or more in children over five years of age, and to 120, 130, or 140 in those under that age, and by unusual warmth or even heat of the skin. At the same time the *respiration* is generally more frequent than natural, but almost always regular; in cases attended with high fever, we have counted the breathing at 42 and 50. *Auscultation* reveals pure vesicular murmur or slight sibilant rhonchus. The *voice* is clear, or, in rather severer cases, obscured and nasal, and in some instances, speaking is painful and difficult. *Cough* is a fre-

quent symptom. It has been present in a great majority of the cases observed by ourselves. In some of these it was harsh and croupal, so that the children seemed threatened with croup. The croupal sound seldom lasted over one night, after which the cough was merely hoarse, and gradually became loose towards the termination of the attack. In the remaining cases it was rare and dry in the beginning, and more frequent and looser as the disease progressed. *Pain* is a frequent, but far from constant symptom at the outset of the disease. It generally exists during deglutition. When present it is shown in infants, as stated, by their refusing the breast, or nursing only at long intervals, and with difficulty; while in older children it is complained of. It is not, however, a constant symptom, as we have often seen children of one, two, and three years old, with severe angina productive of violent fever, who swallowed fluids and soft solids without a sign of pain. Throughout the acute period of the disease there is generally considerable *thirst;* the *appetite* is diminished or entirely suppressed; the *stools* are usually natural, or there is slight constipation.

The throat should always be examined when there is the least reason to suspect that an attack of sickness depends upon inflammation of that part, and whenever a child has been seized suddenly with fever, particularly in cold weather, and there is nothing more evident by which to explain the illness. To examine this part well, the tongue must be strongly depressed with the handle of a spoon, which should be carried back to the base of the tongue. This may be done in the youngest infant.

The *appearances* presented by the throat are as follows: The soft palate, uvula, tonsils, and generally the pharynx also, are more or less reddened and swelled, and the mucous membrane commonly looks rough and granular. The fauces are often filled with frothy mucus, and in severe cases coated all over with mucous or purulent secretions, which sometimes line the inflamed surfaces in such a way as to resemble false membranes. They are to be distinguished only by careful examination, and by removing a small portion on a pencil or sponge-mop, in order to ascertain their real nature. We have seen the mild form of inflammation in a child ten days old, in one eight weeks, another three months, and a fourth nine months old.

Dr. Wertheimer (*Jour. für Kinderkrankheiten*, Band xxxii) calls attention to a variety of angina, which he calls œdematous, and which is specially characterized by serous infiltration of the submucous tissue of the pharynx, the mucous membrane itself being pale and smooth, and soft and sticky to the touch.

The *submaxillary glands* and neighboring cellular tissue are sometimes swollen, in consequence of the extension of the inflammation to them. This is often evident to the eye, but it is more correctly judged of by the touch. At the same time the glands are usually somewhat painful to the touch. The amount of swelling is slight in very mild cases, or there may be none at all. In severer cases it is much more considerable.

The *breath* is said to be often fetid. We have not met with this character in the simple disease. *Expectoration* is rarely present. We have

never noticed it under six years of age. Slight *nervous symptoms* occur in nearly all the cases, consisting, as already stated, of restlessness and irritability in mild attacks, and of insomnia or drowsiness, with starting and twitching, in those which are more severe.

The fever generally occurs at first only in the after-part of the day and during the night, often becoming intense at that time, with restlessness and starting, and subsiding or disappearing entirely towards morning, to recur again the next afternoon or evening. Children not unfrequently play about all the early part of the day, and are attacked with the symptoms just mentioned as night comes on. The disease generally pursues this course for three or four days, and then passes away entirely or, if it lasts beyond that time, the fever becomes continued, and the attack runs on for seven, eight, or ten days.

In *grave* cases of simple angina, the disease begins with *vomiting*, *fever*, and severe *nervous symptoms*, in the shape of excessive restlessness, or somnolence, and occasionally convulsions. The fever is violent, the pulse being very frequent and full, and the skin hot and flushed. The intense heat and flushing of the skin, which in sanguine children sometimes affects the greater part of the surface of the body, together with the activity of the circulation, not unfrequently make the onset of the disease resemble very closely that of scarlet fever. Four cases of this kind that have come under our notice presented severe nervous symptoms at the invasion. In a girl between two and three years old, they consisted of wildness and ecstatic expression of the face, and trembling uncertain movements of the limbs, which would probably have terminated in convulsions, but for the timely interposition of a warm bath. In the three others, general convulsions occurred. Two of the subjects in which convulsions took place were between five and six years old, and one between three and four. In two the convulsions occurred at the onset, and in a third on the second day. The convulsive movements lasted from ten to twenty minutes, and were followed by somnolence for a few hours in two, and by stupor for a day in the third. It should be stated, however, that two of these subjects were predisposed by constitution and temperament to spasmodic attacks, as one had had a fit previously from a similar cause, and the other two from difficult dentition. The third had never suffered from any symptoms of the kind, and did not appear predisposed to them.

The *tongue* is generally dry and coated with a thick whitish fur in grave cases; the *respiration* is quick, loud, and nasal; and the *voice* guttural or nasal, and difficult. There is usually extreme *thirst*, and not unfrequently delirium. The throat is commonly violently inflamed, of a deep-red color, and coated over with mucous or purulent secretions. The submaxillary regions are often swelled, and the deglutition sometimes, though not always, difficult. When the disease proves fatal, the different symptoms soon reach their height, and death may occur in two or three days. We have never, however, known simple pharyngitis to terminate fatally. The *duration* of the grave cases is variable. In the four that we have noted, it was between three and eight days.

Secondary pharyngitis, which, as has been stated, is a very frequent

disease, will be treated of in the articles on the various diseases in the course of which it occurs.

Diagnosis.—The diagnosis of simple pharyngitis is not always without difficulty, as there are no local symptoms in two-thirds of the cases at the invasion, nor in some instances at any period of the attack. The physician and attendants, therefore, are often deceived as to the real cause of the violent fever which has so suddenly made its appearance, and are disposed to refer it to any but the true one.

It has happened to us several times in cases of children attacked with simple angina, to suspect pneumonia from the sudden occurrence of fever, rapid respiration, slight, dry cough, and the absence of pain in the throat, difficulty of deglutition, or other symptoms, to call our attention to the real seat of disease. The diagnosis is to be corrected only by the absence of the physical signs of pneumonia, and the consequent necessity of finding some other cause of the sickness. Angina may be mistaken also for indigestion, which is one of the most frequent causes of sudden fever in childhood, and is accompanied, like severe angina, by vomiting. The distinction between the two is to be made by careful inquiry as to the history of the attack, by examination of the matters ejected from the stomach, and by inspection of the throat. Severe cases, particularly when ushered in by convulsions, may be mistaken for disorder of the nervous system dependent upon dentition. The only method of ascertaining the truth is again the inspection of the throat. Cases of this kind might also be mistaken for the beginning of scarlet fever. Time only, and the development or absence of the symptoms peculiar to the latter disease, could enable us to determine the diagnosis.

The diagnosis between simple and pseudo-membranous pharyngitis will be given under the head of diphtheria.

Prognosis.—Simple pharyngitis of moderate severity is very rarely, if ever, a fatal disease. Severe or grave erythematous pharyngitis, on the contrary, is often a dangerous malady. The four cases that have come under our care, however, all recovered. The unfavorable symptoms in such cases are: very violent fever, greatly altered physiognomy, difficult respiration, choked and guttural voice, excessive jactitation, delirium, convulsions, and coma.

Treatment.—Mild cases of simple angina need but little treatment. The child ought to be confined to a warm room in all cases, and kept in bed, or on the lap, if it have fever. The diet must be restricted to milk preparations and bread, so long as the fever continues. The therapeutical part of the treatment may consist in the use of some mild evacuant, as one or two teaspoonfuls of castor oil, half a teaspoonful or a teaspoonful of magnesia, a small quantity of syrup of rhubarb, or what is all-sufficient in many cases, a simple enema. At the same time we may give, if the frequency of pulse, heat of skin, and restlessness be considerable, a few doses of spirit of nitrous ether, or spiritus Mindereri, alone, or combined with from one to four drops of antimonial wine, according to the age. A warm bath, if the child is not afraid of it, is an admirable remedy when there is much excitement of the circulation; or a foot-bath, containing

salt or mustard, may be used. Frictions over the throat and neck are often very advantageous; they may be made with hartshorn and sweet oil, with or without the addition of laudanum, or a small quantity of spirit of turpentine may be applied upon the skin, so as to produce slight counter-irritation. When there is much pain and difficulty of deglutition, the case is best treated by the use of nitrate of silver in solution (5 or 10 grains to the ounce), or of powdered alum, applied by means of a large throat-brush.

In the *severe form* of the disease the treatment must be much more active than in mild cases. When the fever is very high, and threatening nervous symptoms are present, the most speedy means of controlling them is a warm bath, continued for fifteen or twenty minutes. If the effects of this should be slight or transitory, one or two leeches may be applied behind the angles of the jaw, unless the fright and consequent resistance on the part of the child are so great as to render their application objectionable. Some evacuant dose should be given early in the attack; it may consist of castor oil, magnesia, epsom salts dissolved in lemonade, fluid extract of senna, or infusion of senna and manna. The quantity must be sufficient to produce several copious stools, and should it fail to operate in three or four hours, and the fever continue, it is always well to assist it by means of a purgative enema. Two hours after the exhibition of the cathartic, it will be proper to resort to small doses of sulphuret of antimony with Dover's powder, repeated every hour and a half or two hours, in the manner recommended in the article on pneumonia. If the secretions into the fauces be very abundant and tenacious, so as to impede respiration, the best means of getting rid of them is by an emetic of ipecacuanha or alum. If they collect again, the throat ought to be cleansed from time to time with a small sponge-mop. The inflamed surfaces should be touched two or three times a day with a solution of nitrate of silver (from five to ten grains to the ounce). The late Dr. C. D. Meigs was in the habit of employing with much benefit, in the severe angina of children, whether idiopathic or secondary, a wash made according to the following formula:

℞.—Cupri Sulphat.,
Quiniæ Sulphat., āā, ... gr. vj.
Aquæ Destillatæ, ... f℥j.—M.

This is applied in the same way as the lunar caustic solution, and we have frequently seen it produce most excellent effects.

The four grave cases observed by ourselves recovered under very simple treatment. This consisted in the use of the warm bath, of doses of castor oil to move the bowels freely on the first day, and of syrup of rhubarb or enemata afterwards to keep them soluble; of doses of antimonial wine and nitre every two hours in such quantity as to avoid sickness; of mustard foot-baths; stimulating frictions to the outside of the throat; applications of lunar caustic solution to the throat internally, three or four times a day; and of rigid diet. In one case the warm bath was used three times in a single day, because of the extreme restlessness and heat of the skin, and was productive each time of much benefit.

ARTICLE VIII.

RETROPHARYNGEAL ABSCESS.

This name is applied to collections of pus formed in the cellular tissue between the posterior wall of the pharynx and the vertebral column. More frequently the abscess is seated quite high up on the level of the glottis, though cases are recorded where it occupied a lower position behind the œsophagus.

Causes.—Retropharyngeal abscess occurs idiopathically, or as a sequel to some of the specific fevers, or, more frequently, in connection with caries of the cervical vertebræ. In one of our own cases, it followed directly upon a long sleigh-ride, and was due evidently to the severe chilling of the body. Although it cannot be regarded as a disease peculiar to childhood, it is far more frequent in the first ten years of life than during any subsequent decade.

Symptoms.—The early symptoms are irregular and not characteristic. In cases where the abscess is connected with caries of the cervical vertebræ, the symptoms of this latter condition have preceded. In all cases, however, the first indications which lead to a suspicion of the existence of a post-pharyngeal abscess are gradually increasing difficulty of swallowing and of respiration, which is attended with a loud, stertorous sound, unlike the stridulous breathing of croup. There is also marked stiffness of the neck, and the head is rigidly retracted. Any effort to bend the head forward is followed by urgent increase of the dyspnœa, and the same result has been noticed to follow when the recumbent position was assumed. There is an appearance of fulness on one or both sides of the neck behind the angle of the lower jaw. Of course the child presents a high degree of restlessness and distress, which increases until the interference with breathing and swallowing may prove fatal from combined exhaustion and asphyxia. In the presence of such symptoms as the above, a careful examination of the pharynx, both by direct inspection, if possible, and by the finger, should immediately be made. The mouth is usually filled with mucus, but the swelling of the posterior wall of the pharynx may frequently be seen projecting forward so as to constrict the pharyngeal space, and obstruct more or less the opening of the glottis. The finger, if carried back over the root of the tongue, comes in contact with a rounded swelling, which is in the early stages firm and somewhat elastic, and later becomes fluctuating. When the abscess is fully formed, the most prominent point may appear yellowish. Occasionally, in the course of caries of the cervical vertebræ, perforation of the posterior wall of the pharynx occurs without being preceded by any such severe symptoms as have just been described as due to post-pharyngeal abscess. We have thus known the expectoration of purulent matter with small fragments of carious bone, to occur in such cases without any previous symptoms of marked obstruction in swallowing or breathing.

Diagnosis.—The recognition of this affection is often difficult, and it is only by bearing in mind the possibility of its occurrence, and making careful examination with the finger, that we can avoid overlooking its existence, in cases where the symptoms are not clearly pronounced. In all cases, therefore, where difficulty in swallowing is superadded to dyspnœa, such an examination should be made. The affection with which it is most likely to be confounded is membranous croup, but the absence of the peculiar croupy cough and stridulous breathing, and the existence of dysphagia, retraction of the head, with immobility of the neck, fulness at the angle of the lower jaw, and, finally, the detection of the swelling at the back part of the throat, will render the diagnosis easy.

Prognosis.—The termination is always doubtful. When, however, the existence of the abscess is early recognized, and it is promptly evacuated so soon as fully formed, recovery frequently ensues. Even when connected with caries of the vertebræ, the prognosis, although of course unfavorable from the nature of the primary disease, is not necessarily fatal. In the case already referred to as having followed directly upon long exposure to severe cold, the child was very ill, with all the characteristic symptoms of this affection, for a week, after which the abscess burst spontaneously, and the child recovered.

Treatment.—The approach of a post-pharyngeal abscess can rarely be detected so early as to enable any preventive treatment to be adopted with success. Indeed, but little could be expected from the use of mild counter-irritants, or absorbent applications to the throat. In older children, if recognized before suppuration has occurred, some benefit might be derived from the use of one or two leeches to the angles of the jaw, or of a blister to the back of the neck. The use of small pieces of ice held in the mouth will also be found to afford relief. The main indication, however, is to watch for the occurrence of suppuration, and then to make as early an incision as possible. When the seat of the abscess is high up this may be done by an ordinary sharp-pointed bistoury, whose blade is guarded up to near the point by being wrapped with sticking-plaster. When the abscess is lower down it can sometimes be more safely reached and evacuated by a trocar and canula. As the opening should be small, there is danger of its closing with a reaccumulation of pus; and it is therefore advisable, as recommended by West, to press with the finger upon the sac of the abscess occasionally for a day or two. In cases dependent upon caries of the vertebræ, it is better to postpone opening the abscess until urgent symptoms are produced by it. Here also it is necessary to employ the other means of treatment suitable for that condition, and especially the use of some mechanical contrivance by which the weight of the head can be supported, and thus relief be afforded to the cervical spine. During the course of the disease every effort must be made to sustain the strength of the patient. If the interference with swallowing be extreme, nutritious enemata may be used until the abscess can be evacuated. In addition, we must use opiates in sufficient amount to quiet the excessive pain and restlessness.

CHAPTER II.

DISEASES OF THE STOMACH AND INTESTINES.

GENERAL REMARKS.

In our division of these diseases, we shall treat first of Indigestion, using this term to signify morbid conditions of the digestive function, which we suppose to be the result of functional disorder, or of mild, acute or chronic catarrh of the stomach. Under the title of Gastritis we shall describe the much more rare and dangerous form of disease, in which there is acute inflammation of one or more of the coats of the stomach, and which is seldom met with except as the consequence of the application of some direct irritant to the organ.

We shall then describe Simple Diarrhœa, in which we suppose the intestinal disorder to be either merely functional, or one of slight catarrhal inflammation of the mucous membrane. Next, under the title of Enterocolitis or Inflammatory Diarrhœa, we shall treat of that form of diarrhœa which is now by many writers styled acute or chronic catarrh of the intestinal mucous membrane, and the chronic forms of which we believe to be of the same nature as the disease designated by most of the observers whose experience was gathered in the vast field of the late war, chronic diarrhœa. We shall pass on then to Cholera Infantum, limiting this term to cases in which the disease is of a true choleraic type; and, lastly, we shall consider Dysentery. We have also added separate articles on the diseases of the Cæcum and Appendix Vermiformis, and upon Intussusception.

SECTION I.

FUNCTIONAL DISEASES OR MILD CATARRH OF THE STOMACH AND INTESTINES.

ARTICLE I.

INDIGESTION.

Definition; Frequency; Forms.—By the term indigestion, we mean that condition of the stomach in which its function of digestion is disturbed or suspended, independent of inflammation or other disease of the organ, appreciable by our senses; or in which there has been found after

death, in the few opportunities that have been met with to make such an investigation, the lesions which are now usually designated as mild gastric catarrh. The only anatomical alterations found in such cases, are reddening of the mucous membrane in spots by a fine injection, relaxation of its tissue, and the presence of a layer of tough mucus. It is a very frequent affection during the whole period of childhood, and is one of great importance on this account, and from the fact of its laying the constitution open, by the debility and cachexia which it produces, to various secondary affections. In our description of the disease, we shall distinguish between the forms which occur during infancy, and after the completion of the first dentition.

Causes.—The principal causes of indigestion in infants are an unhealthy state of the milk of the nurse, the use of artificial diet, and lastly, an impaired condition of the digestive function, which disables the stomach from digesting even the most healthful aliment.

The milk of the nurse may be too old for the child, for it has been found that a breast several months old, sometimes, though not always, disagrees with a young infant, in consequence, no doubt, of the milk being thicker and richer at that time than immediately after parturition. The breast-glands may continue to secrete colostrum for weeks or even months after parturition, and when this is the case the child is almost sure to suffer from indigestion and diarrhœa. The milk may be unwholesome because the nurse is in bad health, or because her diet is not properly regulated. That the diet of the nurse affects her milk, we have no doubt, though it has been denied by some persons.

We have known several children to suffer from indigestion, attended with vomiting, acid secretions, colic, and diarrhœa, in consequence of the nurse having indulged in a very rich diet, and particularly in vegetables and fruits. We do not mean to assert that all nursing-women should abstain from fruits, or even live on a very simple diet, for we have known some who could make use of the richest food, and eat abundantly of all kinds of vegetables and fruits, without the least injury to the child. But there are others who cannot do so without occasioning indigestion in their infants, because, probably, their children are unusually susceptible to the action of the materials absorbed from that kind of food. Again, it is clearly proved by recorded cases and by the opinions of various authorities, that the milk of the nurse is affected by her moral condition. Children have been known to suffer greatly, and even to die, from taking the milk of a nurse who had just before undergone a fit of violent anger. The depressing moral emotions, as anxiety, grief, fear, and despair, are well known to affect the milk secretion in such a way as sometimes to occasion indigestion.

The use of artificial diet for young infants, or as the expression is, "bringing up on hand or the bottle," is, we believe, by far the most frequent cause of indigestion during infancy. Very many children with whom this is attempted, die of indigestions, chronic diarrhœa, gastritis, entero-colitis, cholera infantum, and thrush. Very few escape frequent attacks of one or other of the diseases just named. Much depends, no doubt, on the selection and preparation of the food. It may be stated as

a well-established fact, that a diet consisting wholly or in a great part of farinaceous substances, very rarely fails to disagree with the child, and to produce indigestion and other disorders of the digestive system, which often prove fatal; while one in which cow's or goat's milk enters as the principal ingredient, though inferior to the natural aliment, and often productive of indigestion, is far less injurious than the one before spoken of.

A third cause of indigestion was stated to be the absence or loss of the digestive power of the stomach, independent of the nature of the food. This is a condition similar to the dyspepsia of the adult. It may be congenital or may result from causes brought into action after birth. It often remains as a consequence of previous indigestions from improper or excessive feeding. It exists during the invasion, course, and convalescence of various diseases. Dentition frequently diminishes or impairs the tone of the digestive function, so that the child is often unable, during that process, to digest aliment which had agreed with it perfectly well at other times.

The causes of indigestion after the completion of the first dentition are congenital feebleness of the digestive function; a certain want of power of that function, which remains often for years in children reared upon artificial diet, and in those who have been debilitated by frequent attacks of disease of any kind; the habitual use of improper diet; the eating of crude, indigestible food; the process of the second dentition; the want of due exercise in the open air; residence in large cities; and undue exercise of the mental faculties in the conduct of the education of the child.

Symptoms.—We shall describe first the symptoms of indigestion as it occurs during infancy, and secondly as it occurs during childhood, or after the completion of the first dentition.

Indigestion during infancy may be advantageously considered under two heads: as occasional or accidental, and as habitual. By the former we mean that which occurs in a healthy infant from a transient cause, such as repletion or a momentarily unhealthy state of the nurse's milk from some imprudence on her part as to diet, from some moral cause, or from sickness; and that which depends upon the passing influence of dentition. By habitual indigestion, we mean the form of the affection which is long continued in consequence of a persistence of the cause.

The symptoms of *occasional* or *accidental* indigestion in infants are: paleness and contraction of the face; restlessness and peevishness; moaning and crying, or in some cases, screaming; nausea, shown by excessive paleness, often by very great languor, and by occasional retching, which may either subside without vomiting, or as more frequently happens, terminate in that act; flatulent distension and hardness of the abdomen, especially in the epigastric region, often accompanied with eructations; and in many of the cases simple diarrhœa. These symptoms usually come on soon after nursing freely, or after a very hearty meal of artificial food, in a child previously in good health. The attack seldom lasts more than a few hours or one or two days. The vomiting which almost always takes place, and which relieves the stomach from the offending cause, very often accomplishes the cure.

Habitual indigestion in infants causes a train of symptoms which are different from and much more severe than those just described. Of these the most important are: frequent attacks of nausea and vomiting, and of simple diarrhœa repeated for days, weeks, or months in succession; paleness, or some other unhealthy tint of the cutaneous surface; continual restlessness and discomfort, with fretting or crying, particularly in the after part of the day and during the evening and night, in place of the natural ease and quiet of a healthy infant; constant fits of the most violent screaming from colic, sometimes lasting for hours; dull and languid expression of the countenance, or else an uneasy, contracted look, like that produced by continued suffering; more or less emaciation; failure of the natural growth in stature and size, so that the child is small and puny for its age; want of calorific power, causing the child to suffer unusually from cold, as shown by frequent coolness of the hands and feet; irregular appetite, which makes it necessary to tempt by frequent changes of the food, or more or less complete anorexia; and lastly, the various symptoms that indicate an impoverished state of the blood and bad nutrition.

In some cases there are added to the above symptoms, or there follow as a consequence of the indigestion, those of gastritis or entero-colitis, to be hereafter described. Indigestion probably seldom proves fatal in infants, except from the occurrence of some inflammatory complication, as for instance, one of the diseases just named, or acute disease of some other principal organ.

Indigestion in children who have completed the first dentition may, as in the case of infants, be occasional or habitual. *Occasional indigestion* occurs in strong and vigorous, as well as in more delicate subjects. The attack generally begins, within a few hours or a day after the child has eaten some indigestible substance, with languor and chilliness in older children, and with languor and peevishness in those who are younger; after which there is headache, pain in the stomach in most of the cases, and very often a disposition to somnolence. If the child is attacked with vomiting soon after the appearance of these symptoms, and ejects the offending material, it will often seem perfectly well from that time. If, however, this does not take place, fever, sometimes of a violent character, is almost certain to make its appearance. The pulse becomes very frequent, rising to 120, 130, 160 or over, and being full and resisting; the skin becomes flushed, dry and very hot; the appearance of the tongue is not generally changed early in the attack; there is considerable thirst; the child is restless and uneasy, tossing from side to side, or it lies in an uneasy sleep, attended with frequent starting and jerking of the limbs or crying out; the abdomen is natural, or hard and distended over the epigastric region. When the symptoms just described make their appearance suddenly, by which we mean in the course of a few hours, in a child two, three, four or five years old, after it has eaten some indigestible substance, there is reason to fear an attack of convulsions. The probability of the occurrence of this accident is great in proportion to the earliness of the child's age, and the impressibility of its nervous system. The attack is particularly to be apprehended, and should be carefully guarded against,

whenever the fever is violent, especially if the pulse runs very high, when there are urgent complaints of headache, when the restlessness and agitation are very great, or when there is somnolence, with frequent startings or twitchings of the muscles. Convulsions sometimes occur without any previous warning, or after such slight signs of disorder as would fail to produce uneasiness in the parents or attendants.

The symptoms produced by occasional indigestion generally continue until nature relieves the stomach by vomiting or diarrhœa, or until the remedies proper in the case, the most important of which are evacuants, have been administered. It happens not unfrequently, that symptoms of gastric or intestinal disorder remain for some days after the violence of the attack has subsided, and in some instances the disturbance is so great as to occasion gastritis, entero-colitis, or dysentery.

Habitual indigestion in children who have completed the first dentition, is not at all an uncommon affection. It is a condition analogous to, if not identical with, the dyspepsia of the adult. The symptoms of this form are the following. The general appearance of the child is delicate, as shown by a pallid or sallow tint of the skin, instead of the ruddy complexion of health, by thinness and want of proper development of the limbs and trunk, and by softness and flaccidity of the muscular tissues. There is an habitual air of languor and listlessness, with absence of the usual gayety and disposition to play natural to the age, and the child often complains of being tired. The appetite is feeble or uncertain, being sometimes absent, and at other times too great; or it is peculiar, there being a willingness to eat of dainties, but a refusal of food of a simple character. The tongue presents nothing peculiar. It is, however, more frequently somewhat furred than clean and natural. The temper is usually irritable and uncertain. The child rarely sleeps well; on the contrary, the nights are restless and much disturbed, the sleep being broken and interrupted by turning and rolling, by moaning or crying out, and by grinding of the teeth. These latter symptoms, together with picking at the nose, which is a frequent accompaniment, are almost always referred by the parents and nurses to worms, and it is often impossible to convince them to the contrary, even though frequent and violent doses of vermifuges have failed to show the existence of entozoa. The state of the bowels is uncertain. In some instances they are very much constipated, requiring frequent doses of laxatives, or careful regulation of the diet, to keep them soluble; in others they are inclined to be loose, and when this happens, the stools are often lienteric. In others, again, constipation and diarrhœa alternate. The abdomen is usually natural, or somewhat enlarged from flatulent distension; complaints of pain are not uncommon. This form of indigestion, like dyspepsia in the adult, is generally a very chronic affection, seldom lasting less than several weeks or months, and sometimes persisting for years.

Diagnosis.—The occasional indigestion of infants is not likely to be mistaken for any other complaint. The suddenness of the attack, the character and quantity of the matters ejected from the stomach, the absence of symptoms indicating the invasion of any other disorder, the short

duration of the symptoms, and the rapid recovery, all render the true nature of the case very clear. That which occurs in older children, on the contrary, is not so easy of diagnosis. In many cases the invasion is not unlike that of scarlet fever. The vomiting, the rapidity of the pulse, the great heat of the skin, and in some cases a certain suffusion of the integument dependent on the activity of the circulation, all render the case doubtful for some hours, or for a day, after which time the difficulty ceases, from the development of the symptoms peculiar to the disorder. We believe that not a few cases of simple angina are mistaken for indigestion, owing to the absence of complaints of sore throat, and the neglect of the physician to examine that part. In such cases the vomiting and sudden attack of fever are ascribed, for the want of another mode of explaining them, to gastric derangement. The diagnosis can be made only by examination of the fauces. The diagnosis of indigestion accompanied by convulsions, will be considered in the article on the latter affection.

The habitual indigestion of infants is not likely to be confounded with any other disease. The absence of fever, of tenderness of the abdomen on pressure, or other acute symptoms, all indicate the dependence of the disorder on functional distress of the stomach. The same remarks apply to this form of the disease occurring in older children. Nevertheless, the practitioner should never neglect to make a careful examination, both of the physical and rational signs, of all the important organs of the body, as it sometimes happens that latent disease of some one of them is the cause of the gastric difficulty.

Prognosis.—The prognosis of occasional indigestion is nearly always favorable. It is rarely a dangerous disorder, unless accompanied by convulsions, or some other sign of violent disturbance of the nervous system. Under the latter circumstances, the prognosis should be very cautious, as the termination is not unfrequently fatal in consequence of injury done to the nervous centres. It should be recollected also that this form of indigestion sometimes becomes the exciting cause of inflammation of the stomach or intestines, in which event the prognosis will be that of those diseases.

Habitual indigestion in infants is a serious complaint, and ought always to awaken the solicitude both of the physician and parents; for though a simple functional disease of the stomach is probably not often fatal, it is exceedingly apt to prove so by the introduction of gastritis, chronic enteritis, entero-colitis, or thrush, or by its laying the system open to other diseases, and rendering it less able to withstand them should they happen to occur. In older children it is not, according to our experience, so dangerous a malady. We have never, as yet, seen it terminate fatally.

Treatment.—The treatment of *occasional indigestion* in infants ought to be very simple. The child has generally relieved itself by vomiting before the physician is called. If, however, it continues pale and languid, with vomiting or retching, after the stomach seems to have been emptied, the proper plan is to make use of remedies to calm the irritability of that organ. This can almost always be accomplished by giving a teaspoonful every ten or fifteen minutes of a mixture of lime-water and milk, consisting of one-third milk to two-thirds lime-water, or of equal proportions of each,

or the same doses of a mixture consisting of equal parts of lime-water and cinnamon-water. At the same time a small mustard plaster, weakened with wheat flour, or flannels wrung out of hot brandy and water, may be applied to the epigastrium, or a warm Indian mush poultice, in a flannel bag, laid over the whole abdomen. Should these means fail to relieve the sickness, from half a drop to a drop of laudanum, or ten drops of paregoric, may be administered, and repeated, if necessary, in two hours. The child generally recovers its usual health after the sickness has entirely ceased. If, however, it remain fretful and uneasy, if it cry much as though in pain, it is probable that a portion of aliment has passed, in a partially or wholly undigested state, into the intestine. The suspicion will be confirmed if the abdomen is found, upon palpation and percussion, to be swelled, hard, and resonant from flatulent collections in the bowels. Under these circumstances, a laxative ought to be given. The best dose is half a teaspoonful or a teaspoonful of castor oil, a teaspoonful of simple or spiced syrup of rhubarb, or, if there have been evidences of an acid state of the stomach, about a quarter of a teaspoonful of the best magnesia.

The *occasional indigestion* of older children demands a different and more energetic treatment. After ascertaining that the child has eaten something indigestible, we should inquire whether there has been vomiting. If there has been none, or if only slight, it will be proper to give an emetic immediately. The best one under the circumstances is ipecacuanha. This rarely fails to produce a full effect, and does not perturbate the system, or irritate the stomach, like tartar emetic. It may be given either in powder or syrup. The dose is familiar to every one. If the ipecacuanha be not at hand, we may use hive syrup, which is kept in almost every house, or a teaspoonful of powdered alum in honey or molasses, to be repeated, if necessary, in fifteen minutes. Alum is less apt to fail than either ipecacuanha or hive syrup. If the child continue unwell after the operation of the emetic, which is often the case, and particularly if the fever be considerable, a purgative should be given as soon as the stomach will bear it. The best dose is castor oil, which is the most speedy and least irritating. It may be given in orange-juice, which forms an excellent vehicle, or, if the child is old enough, in the froth of beer or porter. A dessertspoonful is generally enough. If the oil cannot be taken, we may give infusion of senna and manna, the fluid extract of senna mixed with spiced syrup of rhubarb, syrup of rhubarb alone, magnesia, to be followed by lemonade, salts and magnesia, or the former alone, or, lastly, a seidlitz powder. If the fever continue, and the cathartic fail to operate in four or six hours, a purgative enema ought to be given to hasten its effect. A bath at about 96° or 97° will almost always be found useful in these cases. The child should be kept in the bath from eight to twelve or fifteen minutes. The only circumstances which form an objection to this remedy are the facts of the patient being so irritable, or so fearful of the water, as to make it necessary to contend with him in order to succeed in using it. When this is the case, it had better not be employed, and sponging with tepid water and spirit should be substituted. If the child com-

plains of pain in the stomach, the application of a warm mush poultice over the epigastrium or whole abdomen will be found of much service.

When in this form of indigestion the febrile reaction is violent, as it often is, and particularly when there are signs of great disturbance of the nervous system, consisting of excessive agitation, complaints of severe headache, drowsiness, moaning or crying out in the sleep, or twitching and jerking of the muscles, the physician should beware of a convulsive attack. In such cases as these, the patient ought to take a purgative dose of calomel (from two to three grains), or a dessert-spoonful of castor oil, have a warm bath at once, and soon after an injection. The remedies ought to be prompt and energetic, for the case is pressing. A convulsion is always a dangerous event in childhood, and should be prevented if possible. If calomel has been given, a cathartic dose ought to be administered about two hours afterwards, in order to insure an action upon the bowels, and to carry the calomel out of the system. After the administration of an evacuant, a full dose of bromide of potassium (ten to fifteen grains) should be given, and as this remedy has the very great advantage of not arresting the action of the medicines previously administered, it may be repeated as frequently as indicated by the nervous symptoms. These means rarely fail to afford relief in a few hours. The diet should be absolute during the violent stages of the attack, and the usual diet is to be resumed only by degrees. The drinks may be plain water or gum-water, taken cold.

It not unfrequently happens that occasional indigestion is followed by gastritis or enteritis, or by habitual indigestion lasting for weeks or even months. These different sequelæ must be treated according to the plan proper for each.

The *habitual indigestion* of both infants and older children, requires a very different treatment from the occasional or accidental form. In both the indications are nearly the same. The most important are very careful regulation of the diet in all its details, the use of tonics and stimulants to restore tone and vigor to the digestive function, the employment of remedies to correct the state of the bowels, whether they be relaxed or constipated, and attention to securing the child proper exercise, exposure to the air, and suitable clothing.

If the symptoms of the disorder occur in a child at the breast, the milk of the nurse should be carefully examined, in order to ascertain whether it be good. If found to possess any unhealthy qualities, the nurse ought to be changed at once. Attention to this point alone will almost certainly cure the child. It needs no other remedy.

If the patient is fed wholly or in part, it is essential to regulate the diet to suit the state of the digestive function. Milk ought in all cases to form the basis of the food, unless it has been found by patient trial to be absolutely repugnant to the stomach. We have often found that infants who had been thought quite incapable of digesting cow's milk, could do so very readily when it was very much weakened with water. The usual proportions for an infant of a few months old, are half and half, or two parts milk for one of water. When these are found to disagree, it is well

to try three, or even four or five parts of water to one of milk, and if the stomach digest this, as it often will, the proportion of milk may be slowly and cautiously increased to the usual standard. If we conclude that milk cannot be digested by the child, it is best to try cream. Of this, one part to three or four of water may be given. When neither of these can be taken, some of the farinaceous substances may be tried; arrowroot, sago, barley, tapioca, oatmeal, or rice. We are clearly of opinion, however, that these articles prepared with water alone, never agree with children when they are continued for any considerable length of time. Some infants of six or eight months old, it may be remarked, who cannot digest more than very small quantities of milk, will take and digest well, very delicate broths made of chicken or mutton, or small quantities of the lightest meats, as mutton, chicken, or very tender beef, minced up extremely fine, and given by teaspoonfuls.

In cases of this kind we have found a diet consisting of gelatin, milk, cream, and arrowroot, prepared in the manner directed in the article on thrush, to suit better than anything else. We have met with a number of children, whom it was necessary to feed to the amount of a pint or a pint and a half a day, in addition to their being nursed occasionally, who could take neither milk and water, cream and water, milk and arrowroot, oatmeal gruel, rice gruel, nor indeed anything that was tried, without vomiting, colic, and severe diarrhœa, who digested perfectly well and throve admirably upon the preparation alluded to. We have now used it during many years, and have recommended it for a great many children, and do not hesitate to say that it agrees with a larger number than any diet we have employed or seen employed.

The diet of older children laboring under chronic weakness of the digestive function is as important as that of infants. Two chief ends should always be borne in mind in selecting it, digestibility and nutritiousness. The former is all-important, for without it, the stomach, constantly irritated by improper food, has no chance of regaining its tone, while the latter is necessary in order to sustain the strength of the child, and allow it to carry on its growth. We have generally found it most prudent, and often really necessary, to specify as to the substances to be given at each meal. The morning and evening meal ought to consist of bread and milk, mush and milk, or of milk, warm water and sugar (called in this country children's or cambric tea), and bread and butter, and nothing else in most of the cases. It is sometimes proper to allow a soft-boiled egg, particularly if the child be very fond of it. The dinner ought to consist of light broths containing rice, with bread or toast, or of the plain meats, as mutton, beef, chicken, turkey, birds, or fine game. No vegetable ought to be allowed in most of the cases except rice, as all others, even the potato, are very apt to disagree. We believe that the potato is more digestible when roasted than when boiled. If the child require anything between breakfast and dinner, it may have what is allowed at breakfast, or dry bread and nothing else. There are various articles of diet which should be absolutely forbidden, amongst which are hot and sweet cakes, and hot bread of all kinds; sausages, not unfrequently given to children in this

country; corn-beef, ham, veal, pork, goose, ducks, fish; all manner of dessert, excepting rice-pudding, or curds-and-whey, often called junket; sweetmeats, candies, fruits, except some of our finest summer ones; and to conclude, everything which long observation and experience have shown to be unsuitable to a dyspeptic stomach.

It is sometimes very difficult to find anything to agree well with the child. In one case of a child three years old that came under our observation, neither milk, bread, nor meat, could be taken. The casein of milk seemed to be absolutely indigestible, as it would be rejected from the stomach many hours, or even a day or two, after the milk had been taken, in the form of masses of dry, fibrous cheese, of an oblong shape, nearly or quite as large as a peachstone. After trying various articles, we found that the child digested raw oysters, soda-biscuit, and rennet-whey, and upon these articles alone she lived for two weeks, at the end of which time she had improved so much as to be able to take the white meat of chicken very finely minced. She gradually regained her previous health.

After regulating the diet, such remedies as tend to invigorate the digestive functions ought to be prescribed. The most important of these are the vegetable and mineral tonics, and mild stimulants. We have found quinine, iron, and small quantites of port wine or brandy, to succeed better than anything else. To a child under two years old, from a quarter to half a grain of quinine, and to one over that age, a grain may be given three times a day, and continued for two, three, or four weeks. It is best given to young children diffused, without being dissolved, in a mixture of equal parts of syrup of gum and ginger; while to those who are older it may be administered in pill. The best preparations of iron are the syrup of the iodide, or the pure metallic iron, prepared with hydrogen. Of the former, half a drop to one drop for infants, and from two to four drops for older children, may be given three times a day; of the latter a quarter of a grain for infants, and half a grain to a grain for those who are above that age, may be given three times a day. The metallic iron is best administered in pill, or suspended in syrup of gum arabic. When there is any suspicion of a scrofulous taint in the child's constitution, or when it is disposed to have chronic irritations, excoriations, or ulcerations of the nostrils, otorrhœa, or papules or pustules about the eyelids or other parts of the body, it is useful to give the iron in compound syrup of sarsaparilla, of which half a teaspoonful three time a day is quite enough. Under these circumstances, and particularly when the dyspeptic condition is accompanied with frequent nausea or occasional vomiting, with frontal headache, and with constipation, seeming to indicate a disposition to tubercular deposit in the system, we have found cod-liver oil the most efficient of all the remedies that we have tried. It has often removed with great rapidity the dyspeptic symptoms, invigorated the general health, and, in fact, restored the patient to health. The dose is from half a teaspoonful to a teaspoonful twice or three times a day, at the age of six or eight years. It is best taken in a small quantity of malt liquor, or floating on strong mint-water, or syrup of ginger. In very young children, and in older

ones also, when the latter refuse to take it in the ordinary methods, the following formula for its administration will be found one of the best:

℞.—Ol. Jec. Aselli, ... f℥ss.
P. G. Acaciæ, ... q. s.
Ol. Cinnamomi, vel Ol. Gaultheriæ, . . . gtt. vj.
Sacch. Alb., ... q. s.
Aq. Cinnamomii, ... ad f℥iij.
Ft. mistura.

Dose, a dessertspoonful three times a day, after eating.

The recent introduction of the use of pepsin in the treatment of disorders which, like the one under consideration, are characterized by a want of digestive power, is a most valuable improvement in their management. It is nearly always perfectly well received by the stomach, and in very many cases will enable the child to take and thoroughly digest the proper amount of suitable food, which before would have inevitably caused evidences of gastric embarrassment, with the rejection of a considerable part of the meal in an undigested state by vomiting or stool.

Pepsin may be administered in the form of powder—the best preparation of which is that now sold under the name of saccharated pepsin—and the proper dose of which for a young child is two or three grains taken immediately after meals. Or we may use the liquor pepsinæ, which is a solution of this substance in glycerin and water, acidulated with muriatic acid. The proper dose of this latter preparation is from ♏xx to f℥ss., taken diluted with a little water, also directly after meals.

The combination of small doses of muriatic acid is unquestionably of advantage in increasing the digestive power of the stomach. We have thus found the following mixture of much service in the chronic indigestion of children:

℞.—Acid. Muriatic. Diluti, ... gtt. xxv.
Liquor Pepsinæ,
Elix. Calisayæ, āā, ... f℥j.—M.

Dose, from a half teaspoonful to a teaspoonful, according to the age of the child.

In connection with these remedies, a little port wine or brandy, and the former is preferable in children over a few years old, on account of the possibility of their contracting a taste for the brandy, may be allowed twice or three times a day, or at dinner only. To young children, one or two teaspoonfuls of brandy may be given in the course of the day, mixed in water; of the port wine, from a teaspoonful to a tablespoonful, according to the age and strength of the patient, may be repeated morning, noon, and night.

If the bowels are inclined to constipation, they should be kept soluble by laxative enemata, and by the use of rhubarb or aloes; when relaxed, the frequency of the discharges may be controlled by the cretaceous mixture, by anodyne enemata given once or twice a day, by the aromatic

syrup of galls (to be described under the head of entero-colitis), or by some of the astringents in common use.

In cases where the evidences of a catarrhal state of the mucous membrane of the stomach and intestine are weaker, we have frequently found excellent results to follow the administration of small doses of nitrate of silver (gr. $\frac{1}{24}$ to gr. $\frac{1}{12}$) given in solution in thin syrup of acacia.

In all cases of chronic indigestion in children, it ought to be regarded as an essential part of the treatment to secure to the patient a proper amount of exercise in the open air. In summer the child should pass several hours of every day in the air. It ought, indeed, if the heat of the sun can be avoided by proper shade, to pass the whole day in this way. In winter it is, of course, impossible to carry this system to the same extent, but the child should nevertheless be taken out at least once a day; this may be done in the coldest, and even in damp weather, if sufficient clothing be worn. If a child comes back from a walk with warm limbs, and with its cheeks in a glow, there is little danger of cold. The quantity of clothing must depend on the constitution and idiosyncrasy of the patient. Some need twice as much as others. The proper amount is best determined by the temperature and coloration of the surface after a walk.

AND IMMUNITY 1257

HOAGLAND, R. J. **Mononucleosis and Heart Disease.** *Amer. J. Med. Sci.* 1964, July, v. 248, No. 1, 1–6. [18 refs.]

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SIMPLE DIARRHŒA.

UNDER this title we shall describe a mild form of diarrhœa to which children are very subject, in which the pathological condition appears to be one of mere functional disorder, or of very moderate hyperæmia or catarrh of the intestinal mucous membrane. We might, indeed, assume with some, that the disorder is at all times one of mild catarrh of the bowels, but we deem it best, in a practical point of view, to consider it as being sometimes one of functional disturbance only, since many observers of high authority declare that they meet with cases of even fatal diarrhœa in which no anatomical alterations are found after death, and since we ourselves have met with so many cases in practice which follow a different course in symptomatology, duration, and their effects upon the constitution, from the form of disease which we shall treat of as entero-colitis or inflammatory diarrhœa.

CAUSES.—The causes of the disease during infancy are *unfavorable hygienic conditions*, as the habitation of unwholesome, ill-ventilated, damp, and filthy dwellings, or of contracted and crowded quarters of cities and towns; an *unhealthy state of the milk* of the nurse; the use of *artificial diet* at too early an age, especially that of an improper kind; *cold; dentition;* and lastly, great *atmospheric heats*. The most important of these are improper alimentation, by which we mean the use of artificial diet, and par-

ticularly one consisting chiefly of farinaceous substances to the exclusion of a proper amount of milk, and dentition. For a fuller account of the influence of these different circumstances on the digestive organs of children, the reader is referred to the remarks on the causes of entero-colitis, and to the article on thrush.

The chief causes of the disease after the first dentition are, according to our experience: the habitual use of *improper food;* the *loss* of digestive power, which often follows a severe indigestion, or an attack of some acute disease; the *debility of constitution* which attends sudden and rapid growth; the *want* of proper exercise and exposure to the air; the predisposition which exists in some children from *hereditary* causes; and the disturbing influence of the *second dentition.*

The system of indiscriminate diet allowed to children in this country is, it seems to us, a fruitful cause of gastric and intestinal complaints. We believe that, as a general rule, children over two and three years of age, are allowed amongst us to eat of the food prepared for the older members of the family. Now, any one who will reflect upon the variety of dishes habitually placed upon an American table, ought not to be surprised to see children permitted a choice amidst such profusion, pale, thin, delicate, exposed to frequent indigestions, attacks of diarrhœa and entero-colitis, to gastric fevers, and the host of minor ills attendant upon feeble digestive powers. We are acquainted with some families in this city, the children of which, from the age of two years, are allowed habitually to breakfast upon hot rolls and butter, hot buckwheat cakes, hot Indian cakes, rice cakes, sausages, salt fish, ham, or dried beef, and coffee or tea: and to dine upon a choice of various meats and a great variety of vegetables, which latter they often prefer to the exclusion of meat, and then to make a rich dessert of pies, puddings, preserves, or fruits; and lastly to make an evening meal of tea and bread and butter, almost always relished, as the term is, with preserves, stewed fruits, hot cakes of some kind, or with radishes, cucumbers, or some similar dish. Add to such meals as the above, the eating between whiles of all kinds of candies and comfits, which many children here regularly expect in larger or smaller quantity, cakes both rich and plain, fruits to excess and at all hours, from soon after breakfast to just before going to bed, raisins and almonds, and nuts of various kinds, and the wonder is, not that we are a pale, thin, dyspeptic, and anxious-looking race of people, compared with Europeans, but that we have any health at all, when our children are allowed to make use of the indiscriminate and unwholesome diet just described. Such a system undoubtedly occasions frequent attacks of the disease under consideration, and unless the diet be changed early in the attack, it is very apt to become chronic. It has been stated that simple diarrhœa sometimes followed as a consequence of indigestion. We have known such a result to occur in children previously in fine health, and to continue for several weeks or months. In these instances, the disorder appears to depend in good measure on the loss of the digestive power of the stomach. This seems proved by the great influence which the character of the food has upon the malady, which is always aggravated by the use of any articles except those universally ac-

knowledged to be the most digestible, and also by the frequent coexistence of lientery when the food is not of the lightest kind.

We have several times met with cases which we could ascribe to no other cause than debility and want of power of the digestive organs, dependent upon too rapid growth. That sudden and rapid growth may produce feeble digestion, or, in other words, a dyspeptic state, is, in our opinion, proved by the following consideration. It is attended with loss of appetite, emaciation, paleness, languor, and weakness, and frequent attacks of diarrhœa, or a chronic form of that disorder; all of which symptoms are greatly influenced by the regimen of the child, and are most readily removed by attention to that point, and by the use of tonics and stimulants.

The other causes enumerated need but little comment. We will merely remark that we have several times observed a predisposition to weakness of the digestive organs, transmitted apparently from parent to child. As to the influence of the second dentition, we have no doubt that it is a frequent cause of the complaint, and we believe that it is too little attended to by practitioners.

Anatomical Appearances.—It has already been stated that we look upon this disorder as one of purely functional disturbance in many instances. We are led to take this view by the fact that it is so often unattended by any of the ordinary signs of inflammatory action, and because some very competent observers affirm that they have failed to find in a certain proportion of cases of fatal diarrhœa, any lesions appreciable to the senses. Thus, M. Billard says (*Mal. des Enfants*, p. 392): "Many children at the breast have diarrhœa without enteritis; they lose color, become etiolated, fall into a state of marasmus, and yet at the autopsy not a trace of inflammation of the intestines is found." M. Bertin (*Mal. des Enfants*, 2ème ed., p. 574) states that of 57 cases of gastro-intestinal disease observed by himself, there were four in which not a trace of inflammation, or any other appreciable lesion of the digestive tube, could be found. MM. Rilliet and Barthez, in their first edition (t. i, p. 491) assert that in about every twelve children affected with more or less abundant diarrhœa, and in whom we might expect to find colitis, there will be one in whom the gastro-intestinal tube will be found in a state of perfect integrity. They add that this conclusion is deduced from a comparison of nearly three hundred autopsies. We do not find this statement given in their second edition, but we do find there (t. i, p. 693) the following paragraph: "Quite frequently, especially in early infancy, in cases in which the symptoms have pointed to some disease of the gastro-intestinal tube, an autopsy reveals no lesion of the solids, or only changes of minimum importance. The secretions alone are vitiated." One must suppose, therefore, that the class of cases which we describe as simple diarrhœa, are sometimes quite independent of any anatomical changes in the tissues, recognizable by our ordinary methods of examination, or that those changes are so slight and so evanescent as to disappear after death; or that they are those only of the mildest forms of catarrhal inflammation. It is not unlikely, it seems to us, that further and more minute investigation, especially

with the microscope, will reveal tissue-changes which are not discoverable by the unassisted senses.

When the anatomical changes, constituting the catarrhal state, are found in children who presented during life the symptoms of simple diarrhœa, they will be such as are described by Niemeyer in the following passage: "Catarrh rarely affects the entire intestinal canal. It is most frequent in the large intestine, less so in the ileum, and rarest in the jejunum and duodenum. The anatomical changes left in the cadaver by acute catarrh, are sometimes pale, at others dark redness, swelling, relaxation, and friability of the mucous membrane, which is sometimes diffuse, at others limited to the vicinity of the solitary glands and of Peyer's patches, and a serous infiltration of the submucous tissue. Occasionally, after death, the injection has entirely disappeared, and the mucous membrane appears pale and bloodless. Swelling of the solitary glands and glands of Peyer is an almost constant appearance; they distinctly project above the surface of the mucous membrane. The mesenteric glands also are usually found hyperæmic and somewhat enlarged. The contents of the intestines consist at first of plentiful serous fluid, mixed with detached epithelial and young cells, subsequently of a cloudy mucus, which is adherent to the wall of the intestine, and contains epithelial structures."

The best description that we are acquainted with of the anatomical appearances found in the intestines in fatal cases of diarrhœa, not in children, to be sure, but in adults, is that given by Dr. Woodward in his work on *Camp Diseases* (Philadelphia, 1863). In that work (page 216), under the head of simple diarrhœa, he says that this form of diarrhœa is to be regarded as usually the result of irritation of the intestinal mucous membrane, produced by the ingestion of improper food, or other causes mentioned, and expressing itself in increased secretion throughout the intestinal tract. The irritation, he goes on to say, may even amount to inflammation. Opportunities for post-mortem examination occur but rarely. "They reveal little that bears on the nature of the disease, except congestion of the intestinal vessels of variable intensity." At page 246, will be found a description of the histology of the intestinal lesion in chronic diarrhœa, including the changes observed in specimens but moderately diseased, which latter would probably be the analogue of what we might expect to find in the simple diarrhœa of children we are now describing. We must refer the reader to the work itself, as the passage is too long to be quoted in full here; but we cannot help thinking that Dr. Woodward's descriptions would apply also to the changes induced in children by like causes, and leading to similar forms of disease.

Symptoms.—We shall describe first the symptoms of simple diarrhœa in infants, and afterwards those which characterize the disorder in older children. In infants the appearance of the diarrhœa is usually preceded or accompanied by slight disturbance of the *temper* and *comfort* of the child. There is some degree of *restlessness*, *peevishness*, and disposition to cry; the child sleeps less than usual, and often starts and moans during sleep; all of which symptoms are more marked, as is the case indeed in nearly all the ailments of children, during the night. Though the symp-

toms described are observed from time to time, and particularly during the night, they are not always present, as the infant will occasionally through the day seem perfectly well and comfortable, with the exception, perhaps, of slight paleness and languor, almost always perceptible upon its countenance. There is no *fever* in these cases, or at least nothing more than unusual warmth of the hands, feet, and abdomen at night. If a marked febrile reaction take place, there would be reason to suspect the existence of some degree of entero-colitis. The *mouth* often becomes, after a few days, a little warmer and less moist than usual; the *tongue* is generally moist and only slightly coated; and the *appetite* is commonly diminished, as shown by the child's nursing with less eagerness and at longer intervals than before. In very mild cases the *stools* are at first, and sometimes throughout the attack, feculent; the only differences from their ordinary characters are that they are more frequent, thinner, more copious than usual, and that the odor is changed so as to become acrid and offensive. In severe cases, they contain less feculent matter, become yet more fluid and sometimes watery, and exhibit small particles of a greenish color scattered through them; or the whole of the discharge is of a deep green color, and it is intermixed with portions of mucus. In many of the cases, whitish lumps, evidently consisting of undigested curd, are observed mixed with the other substances upon the napkin. The number of stools varies from two, three, or four, to six or eight in the twenty-four hours. The number last mentioned is seldom exceeded, so long as the diarrhœa remains simple. The *abdomen* is seldom distended or painful to the touch. The *general appearance* of the child almost always shows the effects of the malady upon the constitution after a few days. The countenance becomes paler and thinner; the eyes look somewhat hollow; the edges of the orbits are more defined, and often present a pale bluish circle; slight emaciation takes place, and the flesh of the child becomes softer and more relaxed than before the attack. The *duration* of the disorder is generally short, as it seldom lasts more than three or four days or a week. It may terminate in complete restoration to health, without having exposed the life of the child to danger, or, if the causes which gave rise to it continue in action, if the child is of delicate constitution or the treatment not correct, and especially if this is of too perturbating a character, it is very apt to run into entero-colitis and expose the patient to all the dangers of that disease.

In older children (after the first dentition), the disease is much less frequent than in infants, and presents a different train of symptoms. Often it is nothing more than a slight disorder of the bowels, amounting to three, four, or five stools, thinner and more abundant than usual, accompanied by slight colicky pains, and unattended by fever or other signs of sickness, which, after continuing one, two, or three days, ceases, and the child regains its usual health. Some children are particularly liable to these attacks, and suffer from them every few weeks, or after any indiscretion in diet; whilst in others they are rare, let the diet be what it may.

There is another form of simple diarrhœa, however, of which we have seen a number of cases, much more troublesome than the one just described. It occurs in children from two and a half to seven and eight years of age,

lasts a considerably longer time, and is much less under the control of remedial measures. This form of the disease has never, in the cases that we have seen, been accompanied by fever, or by any constitutional symptoms rendering it necessary to confine the child either to the bed or house. The only symptoms besides the diarrhœa which we have observed, have been some degree of paleness and moderate emaciation; slight weakness, shown by an indisposition on the part of the child to play with its usual spirit, by an inclination to lie about from time to time through the day on the sofa or floor, and by complaints of "being tired;" irritability of temper and peevishness; irregular appetite; picking of the nose; and restless, disturbed sleep at night, attended with moaning, crying, starting, and grinding of the teeth; all of which symptoms generally convince the mother that the child is suffering from worms. The abdomen is sometimes slightly tumid, but remains natural as to tension, and is not painful on pressure. There is no pain except slight colic in some cases. The stools have generally numbered from three to five, and in a few cases as many as six or eight a day. They are semifluid in consistence, often of a very offensive odor, and consist usually of feculent matter, which is sometimes clay-colored, more frequently dark-brown, and, in other instances, deep yellow or orange in color. They are often also of a frothy character. In some of the cases that we have seen, there was lientery whenever the aliment was otherwise than of the lightest and most digestible kind. In all, the diarrhœa was evidently greatly influenced by the diet, showing, it appeared to us, a manifest dependence of the malady upon the condition of the stomach, which seemed to have lost to a great degree its digestive power.

The *course* of the disease in this form is variable. In some it lasts a few weeks, and then, under the influence of diet and remedies, ceases, to recur and run the same course after a short period. In others it may last a much longer time in spite of all treatment that we attempted. We have known it to thus continue between three and four months, with occasional slight remissions, brought about apparently by remedies which a day or two after would lose their effect.

Diagnosis.—The diagnosis of simple diarrhœa will rarely present any difficulties, since there is nothing with which it could be confounded, except the dirrrhœa from tubercular ulceration of the bowels, or entero-colitis. From the former it is to be distinguished by the history of the case, and by the signs of tuberculosis in other parts of the economy; from the latter, by the absence of signs of inflammatory action.

Prognosis.—The prognosis is favorable so long as the disease remains simple. The physician should never forget, however, the disposition which is inherent in it to pass into entero-colitis, nor fail to make the possible occurrence of this transition one element in his prognosis. During infancy it is always more serious than after that period, from the feebler power of resistance on the part of the constitution at that age to disease, which undoubtedly allows this simple affection to prove fatal in some instances, probably from the shock to the nervous system. After infancy it is rarely a dangerous disorder, both because of the greater stamina existing at that

age, and from the fact that the disposition to the extension of disease is less strong.

Treatment.—The *prophylactic management* of simple diarrhœa is the same as that which is proper for entero-colitis, and as that affection will be treated of at considerable length in a future article, we must on account of our limited space, refer the reader there for information on this point.

After the disease is established, the treatment must consist first in attention to the *diet, exercise,* and state of the *gums* of the child. In many cases, careful regulation of the diet and exercise, and lancing the gums when they are much distended and vascular from the pressure of the advancing teeth, will suffice to arrest the disorder in a few days, without the necessity of resorting to drugs, which ought certainly to be avoided whenever it is possible to do so. If the child is at the breast, we must ascertain whether the milk of the nurse is good, by inquiry as to its appearance, specific gravity, reaction, and by examination with the microscope, and by reference to her health, diet, temper, etc., all of which circumstances more or less affect the mammary secretion. If we conclude that the milk is good, or that it has been disturbed in its healthy properties only by a transient cause, the child must be continued at the breast, with the precaution, however, of not allowing it to nurse quite so much as usual. An infant suffering from any kind of diarrhœa, had better be restricted entirely to the breast, unless it be clear that the supply of milk is quite insufficient. If we determine that the milk is unhealthy, the nurse must either be changed, or the child weaned; of course the former alternative is infinitely preferable if the child is under a year old, or even under eighteen months, if it seem to have a rather delicate constitution.

If the case occur in a child already weaned, or in one fed partly on artificial diet, the regulation of the kind, preparation, and quantity of aliment is of the utmost consequence. It ought to consist chiefly of milk or cream weakened with water, unless it has been clearly shown by previous trial that these articles do not agree with the child. We prefer before any kind of diet that we have ever employed, or known to be employed, that made from cow's milk, cream, arrowroot, and gelatin, in the manner described at page 332. The proportions of the milk, cream, and arrowroot must vary with the age and digestive power of the patient. As a general principle, during the existence of diarrhœa, or at least in the early stage of it, and before the strength has been reduced by the disorder, the proportions of cream and milk ought to be somewhat less than in health. Not only so, but the total quantity of food in the day should be diminished, unless the ordinary amount seems to be really necessary for the sustentation of the strength. If it be found, after patient trial, that the child will not take, or does not digest this kind of food, we may try arrowroot or rice-water, with a little cream, or thin gruel or panada, alternated with very carefully prepared chicken- or mutton-water. If the child is six or eight months old, it often suits well to allow it a piece of juicy beef or a chicken-bone to suck, or from one to several teaspoonfuls of meat of chicken or mutton minced very fine.

For older children with a common attack of simple diarrhœa, the diet

should consist for a few days of boiled milk with bread, of gruels made of boiled milk and arrowroot, rice-flour, sago, tapioca, or common wheat flour, and of small quantities of light broths. Meats are, for the time, improper, and all vegetables, with the exception of rice, yet worse.

In the case of infants it is best to recommend a continuation of the ordinary exercise, unless the weather be cold and damp. Indeed, in good weather, exposure to the air and proper insolation are more important during the existence of this disorder than even during health. The same remarks apply to older children, with the exception that they ought not to be allowed to fatigue themselves, particularly in warm weather, as this tends to aggravate the complaint.

When the disorder occurs in a teething child, the gums ought always to be examined by the physician, and if found swelled, vascular, of a deep red color, and hot, with the outline of the advancing tooth perceptible, they should be freely incised to the tooth. If, on the contrary, the tooth is too deep to be felt, and yet the gum is red and swelled, we would advise only a slight and superficial scarification in order to relieve the tension.

The *therapeutical management* of the disease should be as simple as possible. The fewer drugs we can succeed with in the gastro-intestinal complaints of infants and children, the better. When, however, the diarrhœa continues for some days in spite of attention to the points already mentioned, and earlier if the discharges are either large, frequent, very watery, or weakening to the child, we must resort to some of the means which have been found most useful in checking the inordinate action of the bowels. The most important are a careful employment of laxatives, and the use of opiates and astringents. Formerly we generally commenced the treatment by the exhibition of a teaspoonful of castor oil, containing from half a drop to a drop of laudanum, for young infants, and two drops for older children: but of late years we have usually preferred the spiced syrup of rhubarb, in a teaspoonful dose, with laudanum, as above recommended. Castor oil sometimes purges more than we like; rhubarb rarely does so. These doses given for two evenings in succession have oftentimes sufficed to effect the cure. Dr. West recommends very highly in cases of simple diarrhœa, in which the evacuations, though watery, are fecal, and contain little mucus and no blood, small doses of the sulphate of magnesia and tincture of rhubarb. His formula at one year of age is as follows:

℞.—Magnes. Sulphat., ... ʒj.
Tinct. Rhei, ... fʒij.
Syr. Zingiber., ... fʒj.
Aquæ Carui, ... fʒix.—M.
Dose, a teaspoonful.

We often use with excellent effect the sulphate of magnesia, with laudanum, as follows:

℞.—Magnes. Sulphat., ... ʒj.
Tr. Opii Deodorat., ... gtt. xij.
Syrup. Simp., ... fʒss.
Aquæ Menth. vel Cinnamom., ... fʒijss.—M.

Dose, at one or two years a teaspoonful every two or three hours. For older children, the proportion of the magnesia and laudanum should be doubled.

If the diarrhœa persists after these means have been used for two or three days, or gets rapidly worse, we must resort to some of the astringents. The one most commonly employed is the chalk mixture, which is officinal in our Pharmacopœia. A teaspoonful of this is to be given after each loose evacuation, or three or four times a day. If the case prove obstinate, it will be found useful to add to each dose of the chalk preparation, a small quantity of laudanum or paregoric, or some astringent tincture, the best of which is the tincture of krameria. When the chalk mixture fails entirely, powdered crab's-eyes will sometimes succeed; or we may resort to the aromatic syrup of nutgalls. The formulæ and doses for both these remedies will be found in the article on entero-colitis. If the discharges are small and frequent, mixed with mucus and somewhat painful, it will be found that small opiate injections (from one to two drops of laudanum in a tablespoonful of starch-water for young infants, and from three to six drops in double that quantity for older children), or the use of Dover's powder in combination with chalk or sugar of lead, will often succeed in arresting the disease. One of the most valuable astringents in the bowel affections of young children is bismuth, which we are much in the habit of giving in the form of subnitrate in doses of from two to five grains, according to the age, from three to six times in the course of twenty-four hours. For further and more complete information in regard to astringents, we must refer the reader to the article on entero-colitis, where they will be fully discussed.

The chronic form of simple diarrhœa which we have attempted to describe, occurring in children who have completed the first dentition, has always proved difficult to manage. From the experience we have had, we believe that the best mode of treating it is by proper regulation of the diet, and by the use of tonics and stimulants, and occasionally of opiates. We were led to adopt this plan in consequence of having failed entirely to control the symptoms by the treatment generally successful in simple diarrhœa, and by the opinion which we came at last to form, that the disease depended in great part on a loss of the digestive power of the stomach and duodenum. The diet must be adapted to the idiosyncrasies of the individual; what we should seek is such a one as will be easily digested by the patient, the materials of which shall not appear in the stools, and one which does not manifestly increase, if it fail to moderate, the frequency of the discharges. The one which we have found to succeed best, consists of boiled milk with stale bread for breakfast and tea, and the tenderest meats, as very fine beef, mutton, chicken, or birds, with rice, as the only vegetable, for dinner. If the child likes flour or rice pap, it may have either in place of the bread and milk. If it will take none of these, it may have milk, warm water and sugar, with bread; or well-boiled mush with milk, or milk toast. Should it refuse the dinner recommended above, we may substitute delicate soup, or some of the milk preparations. Raw meat, given in the manner recommended in the article on entero-colitis, should also be tried, and will at times prove very beneficial. Between meals it ought to be allowed nothing but dry bread. All rich food, dessert, fruits, all vegetables except rice, candies and comfits, all kinds of cake and

hot bread, in fact everything except the articles which we have mentioned, or similar ones, ought to be rigidly, systematically, and perseveringly forbidden. Until this has been done for many days, or for several weeks, the disease has always, according to our experience, obstinately persisted.

We have already said that we have not found the ordinary remedies for simple diarrhœa to exert much effect upon this form of the disease. On the contrary, the treatment for dyspepsia, that is to say, a simple but nutritious diet, exercise, and the use of tonics and stimulants, has always removed it in a longer or shorter time. The tonics which we have employed are port wine, quinine, and iron. From a dessert to a tablespoonful of port wine was usually given in water three times a day, in connection with iron. The preparations of iron used were Vallet's mass, of which from half a grain to a grain was given in pill three times a day; the solution of iodide of iron in the dose of first one, and then from two to four drops, three times a day, or the solution of the nitrate of iron in the dose of from two to five drops, three times a day, in water, continued for one or two months. We have sometimes combined with each dose of the solution of iron a drop of laudanum, especially if there were pain; or the opiate might be given by injection every evening. The quinine was generally administered alone in the dose of a grain three times a day, for one, two, or three weeks. It has not, however, proved so useful as port wine and iron.

Another tonic which we have found very useful in some cases of this kind, of late years, is one containing nux vomica and compound tincture of gentian, as follows:

℞.—Tr. Nucis Vomic., ... fℨss.
Tr. Gentian Comp., ... fℨiij.
Syrup. Symp., ... fℨv.
Aquæ, ... fℨij.—M.

Dose, a teaspoonful three times a day after meals, for children of three or four years of age.

Wine of pepsin, in half teaspoonful doses, three times a day, is also a good remedy in such cases, or we may use the powdered saccharated pepsin, in doses of two to five grains, taken soon after each meal.

We have also found in some obstinate cases excellent results to follow the administration of nitrate of silver (gr. $\frac{1}{20}$th to gr. $\frac{1}{12}$th) given in solution in syrup of acacia or in pill, according to the age of the child.

In the case attended with all the symptoms usually thought to indicate worms, the use of wormseed oil was followed by the expulsion of several very large lumbricoides. The child did not recover, however, for some weeks afterwards, and not until he had taken port wine and quinine for a considerable period. In other cases in which the verminous symptoms were also strongly marked, and in which the same remedy was given, no worms were expelled.

SECTION II.

DISEASES OF THE STOMACH AND INTESTINES, ATTENDED WITH APPRECIABLE ANATOMICAL LESIONS.

ARTICLE I.

GASTRITIS.

Gastritis, in the sense in which the term was used some ten or twenty years since, viz., to express an individual and special inflammatory disease of the stomach, of common occurrence and of supposed great severity and importance in childhood, is now well known to be a rare affection. It is doubtful, indeed, whether it ever forms a special visceral inflammation, except in consequence of the direct application to the organ of some irritant substance, such as the mineral acids or arsenic, or, as Rilliet and Barthez found, in a few instances, certain remedial agents, as tartar emetic, kermes mineral, and croton oil. In the form of catarrh, acute or chronic, of the mucous membrane, on the other hand, it is doubtless one of the most common affections of childhood, constituting an important element in a great many diseases, and especially in the severe forms of indigestion, in simple and inflammatory diarrhœa, in cholera infantum, and in many of the wasting diseases of childhood, which result from the use of improper artificial diet in infants, and of crude and indigestible articles of food in older children.

We had almost abandoned the plan followed in our former editions, of devoting a special chapter to this subject, but on further consideration, think it will be best to treat of it separately, since, as stated above, cases do occur in practice in which the stomach is the chief, if not the only seat of disease, and which can be properly designated and described only under the title of gastritis.

Causes.—It has already been stated that the most violent and typical cases of gastritis, as a distinct disease, are the result of the application to the organ of some special irritant, as the mineral acids, arsenic, boiling water, or of certain remedial agents, and particularly of tartar emetic, kermes mineral, or croton oil. These latter agents, the drugs just mentioned, cannot produce this effect unless used in large doses, or when continued for too long a time. The quantities of the antimonial preparations formerly administered, were always thought by us to be dangerously large, and we were not at all surprised to find that MM. Rilliet and Barthez, from their experience in former years in the Children's Hospital in Paris, cited them as one of the causes of acute gastritis. In the *Journal für Kinderkrankheiten*, for the years 1859, 1860, and 1861, in the third, fourth, and

fifth annual reports of the Public Institute for Children's Diseases, of Vienna, by the Director, Dr. Luzsinsky, may be found in the third report three cases, in the fourth three cases, and in the fifth two cases of gastritis caused by the accidental drinking of concentrated lye.

The milder forms of gastritis are vastly more common than the ones above referred to. They are generally associated with disturbances of the intestinal tube also, and constitute by far the majority of the cases which come under the observation of the physician. They are caused very generally by improper alimentation; by the same causes, indeed, as those which determine indigestion. In infants, an unhealthy state of the mother's or wet-nurse's milk, the use of too rich a preparation of cow's milk, milk obtained from an unhealthy cow, or a food composed of too large a proportion of farinaceous material, are the most common causes. In older children, an unwholesome meal, as a surfeit of cakes and candies, tough meats, unripe, or an excess of ripe fruits, the swallowing of a quantity of skins of grapes, of orange-peel, of the seeds of oranges, or such like imprudences or accidents, of all which we have seen examples, will sometimes occasion symptoms which we can refer only to acute catarrh of the stomach. In such cases the child may escape any serious consequences if it rejects, by vomiting, the improper food, soon after it has been taken. Or it may have an attack of cholera infantum or cholera morbus, and either recover its usual health in a short time, or pass through a longer or shorter illness, as the result of these disorders; or, lastly, the unhealthy food may be retained for a longer time than usual in the stomach, and acting as a local irritant on the gastric mucous membrane, may set up a true and more or less severe form of the disease we are considering.

Anatomical Appearances.—Death is so rare a consequence of gastritis alone, except in the form produced by the direct application of irritants to the organ (and even in such, recovery appears to be the rule, since all the eight cases referred to as reported by Dr. Luzsinsky, recovered), that it is difficult to present a description of the lesions characteristic of this variety of the disease. M. Billard, however (*Mal. des Enfants*, p. 353), gives a case from M. Denis, and one observed by himself. M. Denis found the mucous membrane of a deep brown color, of a fetid odor, reduced here and there to a state of putrilage, and everywhere easily removed in softened strips. A fluid of the color of lees of wine, was found macerating the changed mucous membrane, and this he could ascribe only to gangrene from excessive inflammatory action. The case observed by Billard occurred in a girl three days old, who was brought to the infirmary with a quantity of blackish blood passed into the napkins, and also vomited. The child died on the following day. The mouth and œsophagus were healthy, but the mucous membrane of the stomach was completely destroyed, not far from the cardiac orifice, over a space as large as a thirty sous piece. The centre of this space was stained with blackish blood, and its edges, irregularly fringed, were blackened and looked as though they had been burned. Outside of this dark circle, the mucous membrane was thickened, of a violet-red color, and easily reduced to a pulp. The whole surface of the organ was lined with semifluid matters, of a bistre color,

mixed with sanguinolent striæ and the mucous membrane beneath these matters was very thin and discolored, especially near the pylorus. The small intestine was stained yellow with bile, and contained fragments of coagulated blood. The large intestine was healthy. The liver was bloodless and pale; the spleen small and but slightly injected. No clue is given as to the cause of this grave lesion.

The gastric lesions belonging to catarrh of that organ are very often met with, as we have already stated, but are almost always associated with changes in the intestinal mucous membrane. They are observed in severe indigestion, in simple and inflammatory diarrhœa, and in cholera infantum. For a full account of the histology of this lesion, we must refer the reader to the essay on Gastritis and Acute Gastric Catarrh, by Dr. Wilson Fox, in the *System of Medicine*, edited by Dr. J. Russell Reynolds. We shall, however, quote the shorter description given by Dr. Niemeyer (*op. cit.*, vol. i, p. 476), of acute gastric catarrh. He says: "We seldom have the opportunity of seeing the remains of acute gastric catarrh in post-mortem examinations; when we do, the gastric mucous membrane is found reddened in spots by a fine injection; its tissue is relaxed, and its surface covered with a layer of tough mucus. But more frequently, especially among children who die with the symptoms of cholera infantum, the autopsy gives negative results, except as to appearances which will be described hereafter. This does not appear strange when we remember that the capillary hyperæmias of other mucous membranes, which we have been able to observe directly during life, leave no trace after death, and that a relaxation and partial loss of epithelium, which we have regarded as the most probable cause of the extensive transudation in cholera infantum, may be very readily overlooked in the dead body, and can very rarely be observed with certainty."

The description of the anatomical appearances in gastritis will not be complete without some reference to a lesion which, some ten or twenty years since, was thought to be one of great importance in children. This lesion, known by the names of softening or gastro-malacia, was supposed by some to constitute a distinct pathological entity, and to be the result in most cases of inflammatory tissue-changes determined by many different causes. Even then, however, not a few observers believed that the lesion was a post-mortem change, and not the consequence of changes caused by disease during life. This latter opinion has continually gained ground, until now it is generally believed that, when present in a marked degree, it is in fact a cadaveric change. Niemeyer (*op. cit.*, vol. i, p. 476) says that the gastro-malacia or softening of the walls of the stomach, found on autopsy in children, is always a post-mortem appearance, and that "if a child dies who has had vomiting and purging from abnormal fermentation in the stomach, and if there are still fermenting substances left there, the fermentation will not be arrested by the gradual cooling of the body. When the circulation ceases, the stomach can no longer resist the decomposition, which then extends to it also, just as the stomach that has been cut out of an animal and filled with milk, softens if left only for a short time in a warm place. Hence physicians who consider softening of the

stomach as a post-mortem appearance, may also predict it with certainty when a child that has died of cholera infantum had eaten milk, or any other easily decomposed substance, shortly before death."

That a certain degree and kind of softening does, however, attend upon catarrhal inflammation of the gastric mucous membrane, as a result of faulty nutrition of the tissues during life, is probably quite as true as that the extensive white softening of one or more of the coats of the organ, not unfrequently met with, is the consequence of a post-mortem change. Thus Dr. Wilson Fox (*loc. cit.*, p. 858) asserts, that the softening of the mucous membrane which accompanies acute catarrh is totally distinct from the post-mortem softenings which are distinguished by the transparency of the tissues. "It rarely exists," he says, "to any marked degree, except in extreme cases, but there is always a certain diminution of resistance to the finger-nail or to the scalpel, which materially assists, when conjoined with opacity and thickening, in distinguishing this condition. Louis's test of the extent to which it can be torn from the submucous tissue is a less available one, and applies rather to the states of post-mortem solution than to this condition."

Symptoms.—It is very difficult to give an accurate account of the symptoms of inflammation of the stomach, for the following reasons: they have not as yet been studied with a sufficient degree of care; gastritis is, as was stated in the early portion of this article, rarely idiopathic, but almost always a secondary affection in the course of other maladies; the symptoms which betray it resemble so closely those of intestinal diseases, as to make it very difficult, if not impossible, to draw a distinction between the two; and lastly, in the great majority of cases, gastric complaints coexist with intestinal.

The most important symptoms are vomiting, diarrhœa, loss of appetite, thirst, epigastric tenderness, sometimes tension of the abdomen, and slight febrile reaction.

Vomiting is the most important of the different symptoms of gastritis. It is not, however, according to MM. Rilliet and Barthez, invariably present. It was observed by them particularly in cases following the administration of active remedies, while in those which occurred spontaneously, it was much less common. It shows itself especially after the taking of food or drink. Sometimes when the stomach is empty, there is simply nausea and retching. In severe cases the vomiting is frequent, and accompanied by violent straining and pain. *Diarrhœa* exists in most cases, whether the attack be one of simple gastritis, or accompanied with enteritis. The *appetite* is generally lost or greatly diminished. *Thirst* is commonly acute, and often intense. The *tongue* is described by some writers as being generally red, and sometimes smooth and glazed. The authors above quoted, state, on the contrary, that it presents nothing peculiar in most cases. It was generally moist, only slightly colored, covered with a white or yellow coat of variable thickness, and in some rare instances, red on the edges and tip, or gluey, or even dry and harsh. As a general rule, the *abdomen* is normal, according to the same authors, though in some cases there is more or less swelling and tension. According to most writers there

is generally tenderness on pressure in the epigastrium. Infants and young children are commonly restless and uneasy, as though in more or less pain, while those who are older complain of burning in the region of the stomach. It is well to remark that MM. Rilliet and Barthez state that tenderness on pressure often exists, not at the epigastrium, but in one of the iliac fossæ, or at the umbilicus, even when the stomach alone is inflamed. The condition of the circulation, and indeed all the symptoms, depend so much upon the nature of the concomitant malady, that it is difficult to ascertain what are their real characters in simple gastritis. Most writers agree that *fever* usually accompanies the disease, and that it is commonly of the remittent type. It is certain, however, from other observations, that it is not always present.

In very violent cases there are added to the symptoms just described, those indicative of an adynamic state of the nervous system: prostration, cool or cold skin, with perspiration; weak, rapid pulse; singultus; sometimes convulsions, and death. The symptoms which have just been detailed as indicating the presence of gastritis, do not generally exist alone. They are much more frequently than not associated with other symptoms, which show the presence of intestinal disease in the form either of simple or inflammatory diarrhœa. That they do sometimes, however, exist alone, and that, too, independently of the action of irritating drugs, or of corrosive poisons, we cannot ourselves doubt, since we have several times seen them follow attacks of simple indigestion. In such cases, we have met with all the symptoms usually supposed to indicate an inflamed state of the gastric mucous membrane,—repeated and obstinate vomiting, epigastric tenderness, entire loss of appetite, and more or less acute fever. We have, to be sure, never seen a post-mortem examination of such a case, for we have never yet known one to prove fatal. Whether we call such an attack gastritis, acute catarrh of the stomach, or *embarras gastrique*, matters not much. It is the condition which has long been looked upon as indicating an inflammatory state of the gastric mucous membrane, and until we have more positive evidence than has yet been adduced, that inflammation has nothing to do with it, we shall deem it best to retain the old title.

Diagnosis and Prognosis.—The *diagnosis* must rest chiefly on the existence and frequency of vomiting, on the presence of epigastric pain or tenderness, of swelling and tension of the abdomen and excessive thirst, and on the absence of other disease which might account for the illness of the child.

The *prognosis* will depend on the severity of the gastric and constitutional symptoms, and on that of the concomitant disease, when the attack is secondary. When there is incessant and obstinate vomiting, so that not even water in small quantities can be retained after several hours of sickness, when the tongue is red and glazed, or dry and brown, and when adynamic symptoms make their appearance, and emaciation makes rapid progress, it is much to be feared that extensive organic change has taken place, and that the case will prove fatal.

Treatment.—The two most important points in the treatment are the withdrawal of the causes that may have produced, or may tend to keep

up the disease, if these can be detected, and strict attention to diet. Whenever, therefore, the symptoms have made their appearance after the exhibition of powerful drugs, as tartar emetic, kermes mineral, or cathartics, their use ought to be instantly suspended. The child should be put on the strictest diet. If at the breast, it must be allowed to nurse only at rare intervals, and to take but little at a time. If fed on artificial diet, it should be restricted to barley- or arrowroot-water, to very weak milk and water, or to small quantities of milk diluted with lime-water, in the proportion of a third or a half of the latter. This is one of Dr. Chambers's favorite prescriptions, and is an admirable one. Nothing solid and no rich liquid nourishment ought to be allowed, unless the child is in a state of weakness and debility from previous or concomitant disease, such as to make it absolutely necessary to endeavor to maintain its strength. Billard even recommends that the child be sustained by means of nutritive enemata, while the digestive function is allowed a total rest.

Antiphlogistics are useful and proper when the disease occurs in a strong and healthy child, when it is associated with fever, and when there is nothing in the nature of the accompanying disease, if it be a secondary case, to prevent their employment. The most suitable mode of depletion is by leeches, which should be applied to the epigastrium. It is best to take but a very moderate quantity of blood, for fear of exhausting the patient. After the use of the antiphlogistic remedy, a warm bath will be found of great service in moderating the heat of the skin and rendering the child more comfortable. Small pieces of ice ought to be put into the mouth occasionally as a refrigerant, or small quantities of iced drinks may be allowed from time to time. As soon as the bleeding from the leech-bites, if leeches have been employed, has ceased, a warm light mush poultice to the epigastrium is a valuable and useful remedy. Some writers recommend the use of blisters to the epigastrium. We should much prefer a warm poultice or the occasional application of a mustard poultice. *Opiates* are useful in allaying nausea and vomiting, and appear to exert a favorable influence on the progress of the disease.

When vomiting is frequent and troublesome, it may generally be allayed by the administration of lime-water and milk, given in teaspoonful quantities every fifteen minutes or half hour; by observing the precaution of allowing the food and drink to be given only in the smallest quantities (from a teaspoonful to a tablespoonful) and at considerable intervals; by the application of warm cataplasms over the abdomen, or a spice-plaster to the epigastrium; or, lastly, by the exhibition of a few drops of laudanum or paregoric, to be repeated if necessary. If the child becomes weak and exhausted, with coolness and abundant moisture upon the limbs, we must resort to the administration of some kind of stimulant. The best is weak brandy and water, given in very small quantities; or we may employ wine-whey, or milk punch, or the aromatic spirit of hartshorn.

ARTICLE II.

ENTERO-COLITIS OR INFLAMMATORY DIARRHŒA.

Definition; Frequency.—By entero-colitis or inflammatory diarrhœa, we mean that form of diarrhœa which presents, during life, in febrile reaction at some period of its course, in marked constitutional disturbances, and in the mucous, muco-purulent, or muco-sanguineous stools, the proofs of inflammatory changes in the intestinal mucous membrane; and which exhibits, after death, the tissue-changes in the small and large intestines which are regarded as the products of inflammation of those organs.

The disease is one of the most common and one of the most fatal of childhood. Few young children die in the foundling hospitals abroad, or in the hospitals and almshouses of this country, from insufficient or improper food, but die of this affection. Many, a large majority, we think, of the deaths accredited to cholera infantum belong to this disorder. The true choleraic disease is constantly passed through with safety, but is followed by a long, obstinate, exhausting diarrhœa, which is in truth an inflammatory diarrhœa occurring as a sequel to cholera.

A large proportion of the cases of summer diarrhœa are, from the beginning, cases of this kind; or they commence as merely functional disturbances of the intestine, and run, sooner or later, into the disorder we are now considering. It is one of the most important diseases of young children, especially in this country, where our long summer heats, and the filthy condition of many parts of some of our most famous cities, give it a degree of prevalence and fatality which raise it to the rank almost of a pestilence.

We believe that most of the cases of diarrhœa in children, no matter what may have been the exciting cause at the start; whether a constantly improper diet, as in hand-fed children; whether ill-judged experiments in new foods by the mother or nurse; whether the accidental use of unwholesome food; whether summer heats, exposure to unhealthy and foul exhalations, crowding, malarial or epidemic causes, dentition, residence in cities, or what not, are prone to end, and nearly certain to end, if they become chronic, in this disease. This opinion is the result of our experience in private practice, in this city, during thirty years. It is curious, too, and it is confirmatory of the correctness of this opinion, that in our armies during the late war, diarrhœa, whenever it became chronic, exhibited lesions which are best indicated by the term entero-colitis, if we are to use a name based upon the anatomical lesions of the disorder.

Entero-colitis, then, is undoubtedly one of the most frequent of children's diseases, though it is impossible to determine accurately the mortality it occasions in this city, from the returns as at present made by our physicians.

Thus during the seven years, 1862–1868 inclusive, there were 7273 deaths under five years of age in this city, from the three diseases, cholera infantum, diarrhœa, and dysentery (not to include a comparatively small number returned as due to colic, marasmus, inflammation of the stomach and bowels, aphthæ, etc.). Of these, as will be seen by inspection of the accompanying table[1] (see p. 382), by far the greater proportion, namely, 5963, are recorded as due to cholera infantum. Our extended opportunities of observing the diseases of children in this city have, however, led us to the conviction already expressed in the remarks which preface this article, that the great majority of these cases should in reality be entitled entero-colitis, while the true choleraic disease, to which alone the term cholera infantum should be restricted, is a comparatively infrequent affection.

We may appreciate yet more accurately the importance and frequency of the disease, by reference to the statements of MM. Rilliet and Barthez, who say (1ère édit., t. i, p. 483), that, taking into consideration all the cases they observed, including tubercular cases, they find that of every two children that die, one presents a more or less serious lesion of the large intestine. They add: "If it be recollected that this holds true particularly in regard to younger children, it will be seen that it is rare for a child to die between two and five years of age, without having either colitis or softening of the large intestine." Bouchut states that entero-colitis is one of the most dangerous affections of children at the breast: "It is the most common of all those incident to that age" (p. 210).

We shall describe two forms of the disease, the *acute* and *chronic*. The acute form is accompanied by active and inflammatory symptoms from the first, and runs its course in a few days or weeks; the chronic form is unaccompanied by acute symptoms, and lasts several weeks or months.

Causes.—The two most important causes of this disease amongst us, are improper alimentation and the heats of summer. The improper alimentation consists in an unhealthy state of the nurse's milk, or, what is much more common, of some improper kind of artificial nutriment; of the latter, the kind of food most apt to produce the effect, is one composed exclusively or in considerable proportion of some of the feculent substances, which constitute so large a portion of the diet of children throughout the civilized world. To prove the truth of this assertion, it is only necessary to quote the opinions of those who have most carefully studied the subject. M. Valleix (*Guide du Méd. Prat.*, t. iv, p. 60, 61, and *Bulletin Gén. de Therap.*, article Acute Enteritis of Adults and New-born Children, March, 1845), clearly asserts, that the most frequent cause of muguet, which he believes to be essentially connected with enteritis, is a too exclusively feculent alimentation. In the article last cited, while speaking of the great importance of this cause, he says: "What proves that my assertion is not hypothetical is, first, that all the deaths from enteritis in chil-

[1] We are indebted to the courtesy of Mr. Chambers, the clerk of the Board of Health in this city, for the opportunity of collating portions of this table from the monthly returns of mortality calculated by him.

TABLE SHOWING THE MONTHLY MORTALITY FOR THE LAST SEVEN YEARS FROM YEARS OF LIFE; COMPARED WITH THE TOTAL MONTHLY MORTALITY

Month.	1862.			1863.			1864.			1865.		
	Mortality.		Mean Temperature.	Mortality.		Mean Temperature.	Mortality.		Mean Temperature.	Mortality.		Mean Temperature.
	Cholera Infantum, Dysentery, and Diarrhœa.	Total		Cholera Infantum, Dysentery, and Diarrhœa.	Total		Cholera Infantum, Dysentery, and Diarrhœa.	Total		Cholera Infantum, Dysentery, and Diarrhœa.	Total	
Jan.,	1 2 4	1314	32.46°	0 3 3	1061	38.25°	1 0 5	1302	33.28°	1 6 3	1373	26.78°
Feb.,	1 3 1	1080	32.70°	5 3 2	1122	35°	0 3 0	1434	35.97°	2 2 1	1550	32.59°
March	2 2 3	1204	40.25°	0 2 7	1172	37.26°	4 1 5	1894	40.5°	3 1 2	1868	47.94°
April,	3 1 4	1213	50.61°	2 5 6	1488	49.80°	2 2 6	1377	50.58°	5 3 4	1411	56.46°
May,	9 4 5	1343	63.70°	5 1 6	1060	64.63°	10 5 8	1529	67.20°	10 6 7	1227	63.39°
June,	20 3 8	1002	69.14°	14 2 5	961	68.76°	74 11 14	1245	72°	184 10 20	1690	76.73°
July,	300 21 31	1767	75.23°	313 17 38	1859	77.07°	259 24 32	1643	76.08°	364 52 41	1838	77.82°
Aug.,	217 19 22	1755	76.70°	464 25 28	2044	79.46°	250 27 31	1956	79.40°	245 42 23	1759	74.74°
Sept.,	60 4 9	1037	69.36°	105 15 9	1453	64.73°	28 16 10	1251	65°	44 14 7	1040	72.68°
Oct.,	15 5 4	1235	58.32°	14 4 5	1104	56.08°	9 8 4	1144	54.75°	15 12 5	1084	54.88°
Nov.,	0 2 5	1021	45.20°	5 0 1	1061	47.72°	2 2 1	1212	45.80°	9 8 3	1285	45.35°
Dec.,	0 1 2	1124	36.06°	3 2 1	1404	35.41°	2 2 4	1595	36.77°	0 2 3	1044	37.39°
Total,	803			1120			862			1139		

HOLERA INFANTUM, DYSENTERY, AND DIARRHŒA, DURING THE FIRST FIVE ROM ALL CAUSES, AND THE MEAN MONTHLY TEMPERATURE.

1866.			1867.			1868.					
Mortality.			Mortality.			Mortality.					
Cholera Infantum, Dysentery, and Diarrhœa.	Total	Mean Temperature.	Cholera Infantum, Dysentery, and Diarrhœa.	Total	Mean Temperature.	Cholera Infantum, Dysentery, and Diarrhœa.	Total	Mean Temperature.	Mean Mortality for Seven Years from Cholera Infantum, Dysentery, and Diarrhœa.	Mean total Mortality for Seven Years.	Mean Temperature for Seven Years.
0 1 4	1402	29.31°	3 0 4	1376	25.89°	2 2 1	1249	30.12°	7 1/7 2 3 3/7	1296 5/7	30 87°
1 2 0	1156	34.14°	3 2 3	1042	40.21°	0 0 0	1063	26.65°	1 5/7 2 1/7 1	1206 5/7	33.89°
3 0 3	1082	40.85°	3 1 2	1094	38°	1 1 1	1096	41.12°	2 3/7 1 1/7 3 3/7	1344 3/7	40.85°
6 3 4	1034	56.06°	1 2 0	1088	54.13°	9 5 2	1357	48.24°	4 3 3 5/7	1281 1/7	52.27°
8 1 4	1304	61.37°	7 2 3	1260	59.44°	4 1 6	917	59.66°	7 4/7 2 6/7 4 3/7	1234 3/7	62.77°
68 2 10	1168	73.04°	38 6 5	980	72.19°	71 8 7	1201	71.99°	67 6 9 6/7	1178 1/7	71.97°
427 21 34	2047	80.37°	423 23 31	1795	76.48°	423 14 32	1900	80.94°	358 3/7 24 3/7 34 1/7	1837	77.71°
366 36 41	2401	72.5°	265 26 25	1294	75.10°	327 19 34	1570	78.42°	304 6/7 27 5/7 29 1/7	1825 3/7	76.62°
89 15 13	1362	69.42°	88 13 9	1012	68.21°	128 14 24	1353	68.80°	77 3/7 13 11 4/7	1215 3/7	68.31°
55 3 15	1828	58.35°	24 0 10	1177	57.65°	20 2 3	955	54.08°	152 4 6/7 6 4/7	1218 1/7	56.3°
6 0 4	1037	48°	6 2 5	871	47.79°	3 2 0	878	46.91°	31 2 3/7 2 5/7	1052 1/7	46.68°
2 2 3	982	33.63°	1 2 2	974	31.78°	1 0 3	1154	32.16°	9 1 4/7 2 4/7	1191	34.7°
252			1040			1057					

dren that I have seen, occurred in those who had been placed upon this kind of regimen, and, second, that the disease did not occur in any of those observed by me in private practice, for whom I had directed an exclusively milk diet up to four, five, or six months of age." He adds that M. Trousseau had arrived at similar opinions, after studying the same diseases at the Necker Hospital; and that he, on account of the danger of a system of diet disproportioned to the digestive powers, recommended that children be confined almost exclusively to the breast until after the first dentition is completed. Barrier, speaking of the follicular diacrisis (*op. cit.*, t. ii, p. 40), states that the artificial food given to children at the period of weaning is a frequent cause of the affection, and that of all the different kinds of food habitually employed at that period, feculent substances are the most injurious. We have frequently known entero-colitis to follow the employment of artificial diet, either alone, at the period of weaning, or in children who were partly nursed. Children fed wholly on artificial diet from birth rarely escape, according to our experience, attacks of the disease, which in many prove fatal. We have, on several occasions, seen children recover rapidly from such attacks, after suffering more or less for weeks, by the suspension of a diet consisting wholly or in too large proportion of farinaceous materials, and the substitution of one composed of milk and cream, prepared with gelatin, and containing a very small quantity of arrowroot, rice, or wheat flour (see article on thrush, page 332). It is not merely the quality, but the quantity also of artificial food that proves injurious to infants. Overfeeding has always been recognized as a fruitful source of bowel complaints in early life. Another cause is the preparation of the food in too thick and rich a manner, thereby overtasking the stomach, intended during the early months to receive only the thin milk supplied by nature. The custom, therefore, of feeding infants on thick oatmeal gruel, with but little or no milk, on what is called cracker victuals (pounded crackers with water and sugar, or milk), on thick bread and milk, on preparations of rice of too solid a nature, or, indeed, on any kind of diet not consisting chiefly of milk, and in which feculent substances enter merely as secondary constituents, may safely be asserted to be the most frequent cause of the disease under consideration.

An unhealthy character of the milk of the nurse is also known to be a cause both of simple diarrhœa and entero-colitis. When the granule-cells which exist as a physiological element in the colostrum secreted during the first few days after childbirth, continue to be present after that period, the infant is almost certain to suffer from entero-colitis, and not unfrequently to die, unless weaned or transferred to another nurse. So, also, when the milk departs widely from the normal characters which it should possess, as described at page 338, when the nurse is liable to vivid moral emotions of any kind, or when addicted to intemperance, the child is very apt to suffer either from the disease under consideration, or from simple diarrhœa.

That the heats of summer are a most fruitful cause of this disease, no one can doubt who will glance at the table given at pages 382 and 383, where the mortality from cholera infantum, dysentery, and diarrhœa,

under five years of age, in this city, during the seven years from 1862 to 1868 inclusive, is given.

The table shows at a glance, the number of deaths from these diseases enumerated, during the period of life specified, in each month of every year, with the mean temperature of each month, and also the total mortality at all ages and from all causes in each year. The reader must not forget what we have already stated, that there is every reason to suppose that a large majority of the cases reported under the head of cholera infantum are, in fact, cases of entero-colitis,—at least what we have proposed to call entero-colitis, as opposed to the less frequent choleraic disease to which we restrict the term cholera infantum. It will be seen, in this table, that the two months of July and August furnish by far the largest proportion of deaths. In these two months, when the mean temperature is noted between 70° and 80° Fahr., the deaths from this disease ran up to three and four hundred and upwards; whilst in June and September, when the temperature ranges between 60° and 70°, the deaths average between 60 and 80, and rarely rise over 100; and in January and December, with a temperature of from 30° to 40°, they number from between 3 and 5 to 10 and 15. The effect of season is here so striking that it must interest all, and can leave no doubt, we think, in the mind of the reader, but that the elevated temperature of summer is the main cause, in this city, of the fatal intestinal disease we are considering. Whether heat alone may act upon the system of the child to produce this result, or whether it acts always by determining noxious gaseous products from the decomposition of animal and vegetable substances thrown into our streets, has not yet been demonstrated. From the well-known fact, however, that those children suffer most who reside in the more filthy and crowded part of the city, whilst the disease is very much less common in the open country, and in the cleaner and better ventilated parts of the city, we may safely conclude that it is not heat alone that usually causes the disease, but that the emanations arising from garbage of various kinds, and the imperfect ventilation of houses built in narrow and crowded streets, have much to do in its causation.

We referred, in the general remarks at the beginning of this chapter, to the resemblance of the chronic diarrhœa of our armies during the late great war, in its mode of causation, symptoms, anatomical lesions, and the effects of treatment, to the chronic form of entero-colitis in childhood.

Any one who will refer to the work of Dr. Woodward, already quoted, or to the essay on *Camp Diarrhœa and Dysentery*, by Dr. S. B. Hunt, in the *United States Sanitary Commission Contributions relating to the Causation and Prevention of Disease, and to Camp Diseases, etc.* (New York, 1867); or to the *Investigations upon the Diseases of the Federal Prisoners confined in Camp Sumter, Andersonville, etc.*, by Joseph Jones, M.D., published in the volume just alluded to; will find ample proof that improper diet, with heat, overcrowding, and want of cleanliness, will give rise to chronic diarrhœa, the essential lesions of which are to be found in radical blood-changes, perverted nutrition, and a localization on the alimentary canal in the form of entero-colitis, very much like the disorder we are describing. Dr. Wood-

ward says, in fact, in speaking of the nature of this affection (chronic diarrhœa), at page 251: "From the account given above of the pathological anatomy of the disease, there can be little doubt that this affection is to be regarded as consisting essentially of a chronic inflammatory process, involving primarily the mucous membrane of the ileum and colon. It may, in fact, be described simply as a chronic ileo-colitis, with a tendency to ulceration." Dr. Hunt (*loc. cit.*, p. 294) says: "The essential fact in the pathology of all these various forms of flux is the same, and autopsies reveal no distinction between cases of diarrhœa and dysentery. They are alike an inflammation of the colon or of the small intestine, or of both, attended by ulceration of the mucous membrane. The solitary follicles of the colon are seen to be enlarged simply, or ruptured, with punched-out ulcerations following. The intestinal wall is thickened and changed in color to a red, brown, black, or greenish hue."

It may seem, at first view, visionary and wild to compare the chronic entero-colitis or inflammatory diarrhœa of childhood to the same disorder in armies and camps; and yet we think there is a most striking analogy between the two as to causation, symptoms, anatomical lesions, pathology, and the results of treatment. The main causes are the same: improper diet; elevated temperatures, the high temperature of the summer season in children, and of the Southern States in the armies; overcrowding, with foul air in camps and cities: the symptoms are very much alike, a most obstinate diarrhœa, with great constitutional suffering and emaciation; the same lesions are present, only less advanced and extensive in most cases of children; and very much the same results follow treatment: as in both diet is found to be more important than drugs, and removal North in the armies, and in children removal from crowded cities or low hot regions of the country to more elevated and cooler tracts, are found necessary. In children, as in armies, if, at the beginning of the attack, the patient is removed from the causes which have produced a simple diarrhœa or a cholera infantum, the case is likely to go no further; but, if the same causes are continued in operation, the simple diarrhœa passes gradually into the chronic inflammatory form of entero-colitis, and at last the patient recovers only when he is removed to a more favorable locality, when the diet is changed to a more healthy one, or, in the child, when he drags through a long hot summer, and the cooler weather of October or November, and a diminution of the exhalations caused by the summer heats in cities, bring at last, in the course of nature, the change which was essential to his recovery.

After the causes just enumerated, the one which appears to exert the strongest influence is *dentition*. That the evolution of the teeth, though a physiological process, is a powerful predisposing cause of diarrhœa and enteritis, cannot be doubted at the present time. It is one recognized by many of the most able writers and observers of the day, and by most practitioners. MM. Rilliet and Barthez agree with Trousseau in the opinion that the simple diarrhœa so apt to occur in children at the epoch of the first dentition, is often the origin of chronic intestinal lesions which finally reduce them to extreme debility and emaciation. They say that

careful investigation will generally show that nearly all the cases of inflammation and softening date either from the epoch of dentition, from the period of weaning, or from the time at which some considerable change in the character of the regimen was made. M. Bouchut states that of 110 children in whom the first dentition was going on, 26 escaped any indisposition, 38 suffered from restlessness, colics, and occasional diarrhœa, so mild as to excite no alarm in the parents, whilst 46 had abundant diarrhœa. In 19 of the last series it appeared coincidently with the fluxion of the gums, occurring at the time of emergence of each tooth, and disappearing entirely in the intervals; in the remaining 27, in all of which the process of dentition was difficult, the diarrhœa persisted and gradually assumed the characters of entero-colitis. M. Legendre and M. Barrier (*loc. cit.*) both agree in ascribing very great effect to the influence of dentition in the production of diarrhœa and entero-colitis. The former asserts the diseases referred to to be much the most frequent between the ages of six or seven months and two or two and a half years, which includes exactly the period occupied in the first dentition, while they are only met with exceptionally after three years of age.

The act of *weaning* is very apt to result in the production either of simple diarrhœa or entero-colitis, in consequence, no doubt, of the irritation set up in the gastro-intestinal surface, by the change of food made at the time. The diarrhœa which occurs at this period was formerly, and is still, not unfrequently, called *weaning-brash*. Dr. Stokes (*Cyclop. of Med.*, Art. Enteritis) says of this disease that it "is manifestly an acute enteritis, produced by the change of food, and in which nature seeks to relieve the inflammation by a supersecretion."

Entero-colitis is prone to occur as a secondary affection in many of the acute diseases of children. It is by far the most common in the course of the eruptive fevers, particularly measles, and in that of typhoid fever. It is also a frequent complication of the latter stages of pneumonia.

That children of feeble constitution and lymphatic temperament are more disposed to the disease than others, is sufficiently proved by the evidence of various observers. Lastly, that the incautious and excessive use of perturbing systems of medication, addressed to the digestive tube, often occasions diarrhœa and entero-colitis, is fully proved by the researches of MM. Rilliet and Barthez, and by our own experience.

Morbid Anatomy.—Seat of Disease.—It has been already stated, that the alterations of the large intestine are, as a rule, much more frequent and serious than those of the small intestine. It appears from the researches of MM. Rilliet and Barthez, and Legendre, that enteritis rarely exists alone; whilst colitis by itself, or combined with enteritis, is quite frequent. M. Legendre states that inflammation of the small intestines never occurs without corresponding lesions of the large bowel, while in 28 cases of diarrhœa, he found the large intestine alone diseased in 9. From a table of different intestinal lesions, given by Rilliet and Barthez (*op. cit.*, t. i, p. 692), it appears that they have met with 45 cases of erythematous, pseudo-membranous, ulcerative or pustular enteritis; with 113 of the same forms of colitis; with 90 of follicular enteritis; 64 of follicular colitis;

and with 28 of softening of the small, and 35 of softening of the large intestine. Dr. J. Lewis Smith (*op. cit.*, p. 367), offers an analysis of the post-mortem appearances in 82 cases of intestinal inflammation in children. The upper part of the small intestine, embracing the duodenum and jejunum, was found inflamed in 12 cases, while in 51 cases it was free from inflammation and of a pale color. The ileum was inflamed in 49 cases, and the cæcal portion, including the ileo-cæcal valve, was the part in which the inflammation was uniformly most intense, and to which it was often confined; in 13 cases there was no enteritis whatever, and in 16 there was no inflammation of the ileum, so that the ileum was inflamed in all but 3 cases where enteritis was present. On the other hand, in all the cases excepting one, namely, in 81 out of 82 cases, there were lesions indicating inflammation of the mucous membrane of the colon. In 39 the inflammation had affected nearly or quite the entire extent of this portion of the intestine; in 14 it was confined to the descending portion entirely, or almost entirely; in 28 cases, the records state that colitis was present, but its exact location is not mentioned.

We may add, that, in the quite numerous autopsies we have made after death from this disease, we have invariably found the large intestine involved, the inflammatory lesions being in some cases limited to it, while in others they also extended into the small intestine.

It is, therefore, clearly established, that in the inflammatory diarrhœa of children, inflammation of the large is considerably more frequent than that of the small intestine, and much more apt to exist alone. The lower end of the ileum is the portion of the small intestine which presents the most advanced and severe lesions; while in the large intestine the lesions are most marked in the caput coli, sigmoid flexure, and descending colon.

In our description of the lesions of entero-colitis, we shall divide them into those found in the acute and chronic forms of the disease respectively; a division made for the sake of correspondence with the description of the symptoms, although the lesions found in the two stages differ from each other only in extent and degree.

Thus, in the acute stage, the lesions consist of increased vascularity, thickening and softening of the mucous membrane of the intestine, and enlargement of the intestinal follicles; while in the chronic form there is discoloration, thickening, with infiltration and induration of the walls of the intestine, and more or less extensive destruction of the mucous membrane from follicular ulceration.

In the acute stage, the increased vascularity (inflammatory hyperæmia) may present itself as a uniform, more or less intense redness of the mucous membrane; an appearance which may sometimes exist in the duodenum, but far more frequently is observed in the lower end of the ileum and in the colon. More frequently it takes the form of arborescent congestion, occurring in patches surrounding the enlarged follicles. The peritoneal surface may also be more or less vascular, and quite frequently there are little patches of redness and arborescent vascularity, corresponding to the bases of the inflamed mucous follicles.

The thickening of the mucous membrane usually corresponds to the

degree of vascularity, and when the latter is but slight, may be scarcely appreciable; while in other cases, and especially when associated with much enlargement of the mucous follicles and œdema of the submucous tissue, the thickening is highly marked. The inflamed portions of the mucous membrane are also more or less softened, so that they can be detached from the subjacent coats more readily than in health. In some instances the softening is so extreme that it is impossible to raise up the mucous membrane in strips at all. These lesions are all most frequent and marked in the lower part of the ileum, and in the descending part of the colon. In addition to these changes in the color, thickness, and consistence of the mucous membrane, the mucous follicles are prominently enlarged. In the normal state, the isolated follicles of the mucous membrane of the intestine, in young children, appear as minute grayish-white bodies, and present a grayish point, the excretory orifice, which is only visible with the aid of a lens. In the course of entero-colitis, however, the morbid development which they undergo causes them to present the following characters. The isolated glands are enlarged, and seem, therefore, more numerous than in the healthy condition; they appear in the form of lenticular grains seated in the texture of the mucous membrane, sometimes projecting from its surface, sometimes not, and in other instances appearing to be situated beneath it; the excretory orifices of the follicles are often enlarged and tumid, and easily distinguished under the form of a grayish or blackish point in the middle of the gland; in other cases the orifices cannot be distinguished until slight pressure is made upon the crypts, when a drop of turbid mucus may be seen exuding through the open point. The color of the distended follicles is dull white, rosy, or yellowish; they are generally from one-third to two-thirds of a line in diameter. Dr. Horner (*Amer. Jour. Med. Sci.*, Feb. 1829) speaks of them, in this state of development, as resembling "small grains of white sand sprinkled over the mucous membrane, and about the size of a millet-seed."

The agminated glands or patches of Peyer are found in the same state of increased development; they are tumefied, and project above the level of the surrounding mucous membrane, and the orifices of the follicles are congested, so as to appear as dark points, giving to the patch a dotted, punctated appearance, which has been compared to the freshly-shaven chin.

A little later the enlarged follicles present minute, oval, or round yellowish spots upon their summits, which soften down and allow the contents of the follicles to be discharged. The enlarged orifice of the follicle will then admit a small probe, and may even measure one-half a line in diameter. It leads into a little cavity, which is the follicular sac. The mucous membrane which overhangs this cavity like a fringe, is thus undermined and partly cut off from its vascular supply, so that we may find a process of ulceration advancing in it until the base of the distended follicle is exposed, appearing as a small, oval, or round shallow ulcer.

These various conditions of the follicles may all be seen at the same time in a single portion of intestine. The enlarged patches of Peyer often have the appearance of being ulcerated, but a careful examination will generally show that this is not the case. The appearance depends upon the en-

largement of the orifices of the glands, upon unequal tumefaction of the surrounding mucous membrane, and upon the presence, in the patch, of small, irregular grayish points, consisting of pultaceous matter, which makes the patch look more uneven and projecting than usual. If, however, the pultaceous layer be gently rubbed with a piece of linen, it can easily be detached, when the mucous membrane beneath is found red, softened, and thickened, but not ulcerated. In comparatively rare cases, however, there are superficial erosions of the mucous membrane, covering the prominent patch.

The exact date at which the ulceration of the follicles begins, is as yet undetermined, and probably varies greatly in different cases. It frequently happens, however, that death occurs, especially from the supervention of a choleraic condition, whilst they are still merely in a state of enlargement. When, on the other hand, the disease passes into the chronic form, the lesions which we have above described become more and more extensive. This is especially the case with the lesions of the large intestine, for it is even more true with regard to chronic than acute entero-colitis, that the chief seat of the disease is in the colon.

In chronic entero-colitis, the intestine is often contracted, and the peritoneal surface may present patches of discoloration. The thickening and infiltration have now affected the submucous and muscular coats, and have been followed by induration of the tissues, so that the walls of the intestine are often abnormally rigid. This is especially true with regard to the lower part of the descending colon and the rectum. The mucous membrane is seen to be riddled, not with mere superficial erosions, but with true ulcers, affecting the whole thickness of the membrane. These ulcers, when isolated, are from one to one and a half lines in diameter, oval or circular in shape, and either have sharp-cut edges, as though the piece of mucous membrane had been cut out with a punch, or the mucous membrane bounding them is undermined. Frequently, however, these ulcers coalesce, and at the same time extend in depth, so that large, sinuous, irregular ulcers are formed, with thickened, slate-gray, undermined edges, and having for their base either the submucous or muscular coats, which may be covered with a pultaceous, apparently pseudo-membranous layer, of a grayish-white color. These ulcers surround and include irregular islets of mucous membrane, which are swollen, infiltrated, vascular, and discolored. That the large and deep ulcerations just described, even when most extensive, take their start from the mucous follicles, is proved by the frequent presence amongst them of other ulcerations of more recent date and smaller size, which present all the characters of the follicular ulcer, and show clearly the origin of the larger and more advanced ulcerations. Occasionally there is a marked deposit of pigment in the bases of the ulcers, and in some cases small coagula of blood have been found adherent to their bases.

We have already had occasion to allude to the marked analogy between the disease under consideration, and the form of camp diarrhœa described by Woodward (*op. cit.*); and one of the most powerful arguments in favor of the essential identity of the two affections, is the perfect correspondence

between their anatomical lesions. We present below a summary of the microscopical changes in the intestine during the development of these lesions, as determined by the careful investigations of Dr. Woodward (*op. cit.*, p. 246). In the early stage, attended merely with thickening and softening of the mucous membrane, microscopic examination shows marked multiplication of the connective-tissue cells about the base of the follicles, and soon the tissue is occupied by great groups of small, rounded, or slightly polygonal cells. The delicate layer of muscular tissue immediately beneath the base of the follicles, presents, at first, enlargement and proliferation of its nuclei, whilst later it often ceases to be recognizable, being obscured by the luxuriant cell-growth. In the most intense cases, the cell-growth here described as attained toward the surface of the membrane, may take place throughout its whole thickness, and even involve the subjacent muscular layer.

A similar proliferation takes place in the connective tissue, which lies between the follicles. The epithelial layer, which invests the mucous membrane, and is prolonged into the tubular follicles, either is the seat of rapid cell multiplication, or is exfoliated and replaced by round granular cells from the adjacent connective-tissue cells. The epithelial lining, near the orifice of the follicles, appears to undergo these changes most readily and with the greatest rapidity.

The *closed* follicles also present rapid cell multiplication, which affects the parenchyma of the follicle, as well as the connective tissue of its capsule and the surrounding cellular tissue. Microscopic examination then shows the follicle distended with small, rounded, granular cells, and imbedded in a luxuriant growth of similar cells, which render it almost or quite impossible to draw the line where the follicle terminates and the surrounding connective tissue begins. "Ulceration usually appears to originate in the rupture of one of the closed follicles, and the discharge of its softened contents into the intestinal cavity. This is followed by the liquefaction of the intercellular substance, and the consequent liberation of the broods of minute cells, into which the surrounding connective tissue has been transformed. Hence results one of the punched-out ulcers described above. In the subsequent extension of the ulceration, by which large, irregular, sinuous ulcers are produced, the progress seems to take place chiefly in the submucous connective tissue, the superficial part of the mucous membrane resisting the process until undermined, and its nutritive supply cut off. Hence arises the excavated undermining character of the edges of the ulcers. From the anatomical point of view, it will therefore be perceived that the morbid process, in the cases in which there is no ulceration, is essentially the same as in those in which ulceration is present. The one lesion is only a later stage of the other."

Not unfrequently there will be found one or more intussusceptions of the ileum. These are usually readily restored, and have evidently occurred during the act of dying. Smith has, however, "in a few instances, found intussusceptions, which sustained the weight of two feet or more of intestine, without being reduced, and which, from being in their interior more vascular than the contiguous membrane, had probably occurred some

hours or days before death, but being sufficiently pervious to allow the food to pass, the symptoms of obstruction were lacking."

The *Mesenteric and Mesocolic Glands* are nearly always enlarged, the most marked enlargement corresponding to the lower end of the ileum and the descending colon. The enlarged glands are of a pink color, and rather more soft and succulent than normal.

Stomach.—In the great majority of cases the stomach is quite healthy; in a few instances, however, there may be found congestion of the mucous membrane, slight enlargement of the mucous follicles, or softening of the mucous membrane, probably cadaveric in most cases.

Liver.—Many authorities, apparently led by the presence of symptoms supposed to indicate disturbance of the function of the liver, have assumed that there is in most cases of entero-colitis some morbid condition of this organ, but extended observation has disproved this view.

Thus Hallowell (*Amer. Journ. Med. Sci.*, July, 1847) found, that in 14 cases, the liver was affected in but 1 case, when it was enlarged; and Smith (*op. cit.*, p. 370) has published the result of 32 post-mortem examinations in regard to this point, which confirm the same conclusion. Thus, he states, "there was no evidence from the post-mortem appearances of the liver in these cases of any congestion, or torpidity, or hyperactivity, or perverted secretion. The size of the liver was in some cases very different in those of about the same age, but probably there was no greater difference than usually obtains among glandular organs within the limits of health. In most of the cases the liver was examined microscopically, and the only fact worthy of note observed was the variable amount of fatty matter. Sometimes it was in excess, sometimes in moderate quantity or rather deficient, and sometimes in greater amount in one portion of the organ than in another."

The thoracic viscera present no constant or important lesion, though in a certain proportion of cases, there may be found more or less hypostatic bronchitis with collapse of portions of the lungs.

When death occurs during the acute stage, the brain presents no lesions dependent upon the disease. When the case has been protracted and attended with much wasting of the solids and fluids of the body, the brain also diminishes in size, and there is frequently found marked excess of subarachnoid effusion in cases where the fontanelles have closed; while if these spaces still remain unossified they become markedly depressed. These appearances are, however, purely passive in their character, and depend upon the wasting of the brain.

Pathology.—The pathology of inflammatory diarrhœa is involved in great obscurity. We are now pretty well acquainted with the physical conditions under which the disorder is most apt to be developed. Early age, the period of dentition, high temperatures, improper food, residence in cities, and especially the crowded occupation of small and ill-ventilated buildings, in narrow courts and alleys, where unhealthy exhalations arise from the decomposition of filth and dirt of all kinds, are the chief conditions which precede the outbreak of the disease. But how these conditions act to produce their effect is still a matter of doubt. To attempt to reason

upon a matter so full of difficulty seems almost useless, and yet we shall venture to place before the reader some thoughts we have had upon the subject.

There are two broad generalizations which we think may be safely assumed to be true. 1. An unhealthy food, one incompetent to furnish to the body what it needs for the purposes of nutrition, as farinaceous food or unhealthy milk, is sure to produce the disorder we are considering, no matter how favorable may be the circumstances, in all other respects, in which the child is placed. 2. The best breast-milk in the world, or the most correct artificial diet, will not save a child from this disorder who is located in an ill-ventilated house in a dirty and filthy quarter of a large city during hot weather. Here the heat to which the child is exposed, the heavy air loaded with foul exhalations which it breathes, determines a condition of the health in which the digestive organs can no longer digest properly the food offered them. In both cases the same result is produced. In the first, the stomach cannot change the originally improper character of the food into healthy material. In the second, the diseased and enfeebled organ loses the power to digest even proper food. In both the alimentary canal is filled with the products of an improperly digested food. Whether these unhealthy products in the alimentary canal act chiefly as local irritants to the mucous membrane, and thus determine the tissue-changes met with; or whether, as Rilliet and Barthez suppose, some morbid condition of the blood is brought about, which of itself gives rise to the changes in the mucous membrane through a morbid action of the diseased blood on the nervous system, and particularly on the sympathetic nerves, we cannot say. Most probably they act in both ways, and the resultant effects are the consequence of the two trains of diseased action set up, the local and the general.

In either case a constitutional condition is brought about, the essential feature of which is a slow innutrition or inanition. It is altogether probable, moreover, that a condition partaking of the scorbutic, must be induced, so that we have, after the disorder has lasted for several days or weeks, the general debility of a slow inanition, and blood-alterations which resemble those of scurvy.

Symptoms; Duration.—In infants the *acute* form of entero-colitis generally begins with restlessness and fretfulness. The mother observes that the child sleeps less than usual and for shorter periods, and that its sleep is uneasy and broken by sighing or moaning, or by occasional expressions of pain flitting across the face. It takes the breast less frequently, and is satisfied to nurse for a shorter time, showing thereby an evident diminution of appetite. At the same time it is apt to reject its milk in larger quantities than usual, and this is often observed to have a very acid smell. After these symptoms have lasted a few days, and sometimes without them, the peculiar symptoms of the disease, the diarrhœa and other abdominal symptoms, make their appearance, and are accompanied by febrile reaction in most cases.

In older children the acute form may come on suddenly, with diarrhœa, loss of appetite, thirst, sometimes vomiting, abdominal pain and fever from

the first; or, as happens very frequently, the case begins with slight diarrhœa, unaccompanied by fever or other signs of sickness, and it is not until after several, or eight, ten, or even more days, that signs of inflammation make their appearance.

After the disease is established, the most important symptoms are the following. The *diarrhœa*, which is the most prominent and characteristic, presents various characters. In order to appreciate this symptom as its importance requires, the practitioner ought always to see the napkins of the child at least once, and often more frequently, in the day. It exists in almost all cases of entero-colitis, in the erythematous and follicular inflammations, and in the ulcerations and softening which accompany or succeed simple inflammation. It is seldom absent, and yet that it is so sometimes, is proved by the facts mentioned by MM. Rilliet and Barthez, who state that they have calculated, from their cases, that it is wanting in about one of every twelve cases of inflammation or softening of the intestine. They add, however, that it is absent only in slight attacks, and is always present when the disease is severe. It varies greatly as to the frequency, abundance, and character of the stools. It varies also in its mode of progress, so that it presents great differences as to all these points from day to day, and at different portions of the same day. We may remark, in general, however, that in proportion to the severity of the inflammation, so is the diarrhœa violent and constant, and that it usually increases as the signs of inflammation become more and more marked. It is rare to have severe diarrhœa when the anatomical lesion is of slight extent, though this does sometimes happen. The *number* of the stools, as has been stated, is exceedingly variable. This depends in great measure upon the violence of the case; for, while in those which present the symptoms of an inflammation of small extent the stools seldom amount to more than six or eight a day, in those in which the evidences of more extensive and severer inflammation are present, there will be fifteen, twenty, twenty-five, or even more per diem. The *consistence* of the stools may vary between that which characterizes them in a state of health, and that of the thinnest serous fluid. The *materials* of which they are composed consist chiefly of mucus, bile, serum, small portions of feculent matter, portions of undigested casein or other food, and blood. M. Bouchut (*loc. cit.*, p. 219) describes those of very young children as presenting the following characters:

1. They are semifluid, homogeneous, greenish, and similar to cooked vegetables; neutral.

2. Semifluid, homogeneous and green; often acid.

3. Semifluid, heterogeneous, greenish, and mixed with yellowish fragments of ordinary fæces; neutral.

4. Semifluid, heterogeneous, greenish, and mixed with fragments of undigested casein; acid.

5. Diffluent, greenish, heterogeneous, composed of a large quantity of water, in which float yellowish and greenish or whitish particles; acid.

6. Diffluent, greenish, like the preceding, and mixed with gas of a mawkish and sometimes sourish smell.

7. Diffluent, completely serous.
8. Bloody stools are very rare at this age.

Such are the appearances of the stools in children who have not completed the first dentition. After the epoch of the first dentition the disease becomes much more rare, and when it occurs, is generally of a milder character, so that the discharges differ less from their healthy characters. Under these circumstances, they are usually less frequent, not often exceeding six, eight, or ten in the day, and retaining generally their yellow color or becoming brownish; they are commonly of a semifluid consistence, and may be called bilious. When, on the contrary, more frequent, they become fluid, abundant, mixed with mucus, and are either of a light yellow or brownish, or more rarely, of a greenish color. In some cases there are, in addition to the substances mentioned, pus, which indicates ulceration of the lower portion of the intestine, and fragments of false membrane. Moreover, it is very common in older children to observe traces of blood in the stools, sometimes in considerable quantities. We may remark that we have several times met with stools containing blood in children within the year, but much less frequently than after that age. The presence of blood generally coincides with small and frequent stools, attended with much straining, and often severe pain, and almost always indicates follicular inflammation and ulceration of the large intestine.

The serous fluid alluded to sometimes constitutes the whole of the discharge, so that the napkins are merely wetted through, without any or but a very small quantity of solid matter being left upon them. This kind of stool is very frequent in the cholera infantum of this country. The *odor* of the stools is important. In the beginning, while the discharges still retain some of their natural characters as to color and consistence, it is often very offensive, but as the case goes on, and the greenish color predominates, it is either sour, or becomes very slight. In some violent cases, in which the discharge consists of a watery, dark-brown fluid, the odor is fetid.

After diarrhœa, the most important symptoms are those which concern the *form*, *size*, and *tension* of the *abdomen*, and the presence or absence of *pain* or *tenderness* on pressure. In infants the abdomen is more distended than usual; but, according to Bouchut, the tension depends on the muscular effort made by the child to resist the hand of the physician. He says that when it is carefully examined, while the attention of the child is attracted in some other direction, it is found to be soft and supple, and rarely painful to the touch. In older children it is, in many acute cases, but not at all, enlarged, sometimes tense and sonorous, and very generally painful to the touch. The seat of pain is variable, but generally it is one of the iliac fossæ or at the umbilicus. It is seldom acute, though the child not unfrequently shrinks away and cries out, as though it were excessive, from fear of the examination. It is easy to distinguish when the pain is real and when apparent, by withdrawing the attention of the child, by some device, from the examination, in which case it will cease to notice the palpation; or by touching some other part of the body, when, if the crying and shrinking depend on fear or nervous excitation, they will be as violent

as when the abdomen is touched. Pain to the touch is an important symptom, as it is very generally indicative of acute enteritis. *Gurgling* is rare, according to MM. Rilliet and Barthez, in ordinary entero-colitis, though very generally present in typhoid fever.

Vomiting is very common in young infants, and is generally repeated several times a day. In severe and rapid cases it is a very troublesome and alarming symptom. In older children it is much less common, and is never really violent, except in some of the most acute cases. In them it is confined to the first few days of the attack.

After the diarrhœa is fairly established, young infants are almost always either very irritable, peevish, and restless, or weak, languid, and subdued. Their slumber is short, and disturbed, and generally they sleep much less in the twenty-four hours than when in health, unless under the influence of anodynes. Older children are generally somewhat restless and irritable, but much less so than infants. There is seldom any disorder of the intelligence, though in acute cases there is sometimes slight delirium, or headache. *Fever* exists in all acute cases. It is seldom continuous in infants except for the first few days, after which it almost always assumes the remittent type. It is marked by increased frequency of the pulse, which rises to 120 and 140, or in bad cases much higher; by heat of skin, often intense during the exacerbations; by thirst and diminished appetite; and by dryness and heat of the mouth. In older children the pulse is not generally so high as in infants, and in many of the mild cases the fever is very slight or there is none at all. In acute cases, however, it is sometimes continuous, and marked by rapid pulse and great heat of skin.

The *tongue* is generally normal, though sometimes red on the edges and tip in acute cases. It is seldom dry, except during the fever. The *appetite* is almost always lost, and the *thirst* generally increased, though to a less degree than in diseases of the stomach.

The *countenance* presents nothing peculiar, except that the features are, according to MM. Rilliet and Barthez, drawn down towards the inferior portion of the face. Emaciation always takes place as the disease progresses, and in very severe cases occurs with the greatest rapidity, so that in a very few days the child will be reduced from an appearance of vigor and strength, to that of the greatest debility. As this occurs the flesh loses its firmness, the skin hangs in folds upon the trunk and limbs, and is dull and dirty in its tint, the eyes become sunken and surrounded with bluish circles, and the whole appearance of the child is that of misery and exhaustion.

In infants, it is very common to meet with erythema of the buttocks and thighs, produced by the contact of the acrid stools and urine with those parts. This symptom is said by Bouchut to exist in five-sixths of the cases. We feel quite sure that it does not exist in so large a proportion of those which occur in private practice, though we have met with it in numerous instances. When severe it is generally accompanied by papules, which ulcerate after a time and form superficial ulcerations upon the skin. These ulcerations sometimes run together, and become of considerable size and depth. In the form of the disease met with in the children's hospitals

n Paris, erythema and ulcerations of the heels and internal malleoli are lso met with, and constitute a serious complication in the case. They are aid to depend on want of cleanliness, and the rubbing together of the feet f the child, unprotected by covering. We have never met with them in rivate practice.

The *duration* of the disease is stated by the French writers to be gener- lly about fifteen days, at the end of which time convalescence is usually stablished. It may be shorter or longer. According to our own experi- nce it is entirely uncertain. Most of the cases that have come under our otice have been rather shorter. The disease subsides gradually. The umber of stools diminishes; they become less abundant and more con- istent, and return to their natural color and odor; the pain on pressure, nd the enlargement and tension of the abdomen disappear; and as this ccurs, the fever subsides, the appetite returns, the temper improves, and he child enters into full convalescence.

The *chronic form* of entero-colitis generally follows the acute, though it ometimes presents many characteristic features from the first. It differs rom the acute form chiefly in the absence or the much slighter degree of ever and other constitutional symptoms in the early stage. The diarrhœa s less abundant and less frequent. At first the child retains its spirits and many of the signs of health. But gradually its strength fails, the temper ecomes irritable, the complexion grows dark, sallow, and unhealthy, the kin becomes dry and harsh, and, in consequence of the emaciation which akes place progressively with the other symptoms, hangs in folds around he shrunken extremities, or is drawn tightly over the joints and other sseous protuberances. The tongue is generally moist and natural, though n some cases red and dry, whilst in others it, together with the lips, par- akes of the pallor which pervades all parts of the body. The abdomen s usually distended and sonorous on percussion, and may be painful or ot on pressure in different cases, or in the same case at different periods of he disease; its parietes sometimes offer no resistance to the touch, so that he intestinal convolutions may be readily felt by the hand, or even be- ween the fingers; and in some cases we have seen them so thin and re- axed, though the abdomen was more prominent than natural, that the utlines of the intestines, and even their peristaltic movement, were visible pon the exterior. The appetite generally persists in spite of the gravity f the disease, and is sometimes increased. The stools, as has been stated, re not so frequent as in the acute form, seldom numbering over six or ten n the day and night. They consist of the products of an imperfect diges- on, and contain not unfrequently the alimentary substances in the state n which they were swallowed, mixed with mucus, serum, pus, and some- mes blood. Their consistence varies constantly, but they are usually emifluid. Their odor is seldom natural, and often extremely offensive.

The *course* of the disease is very irregular. Even in the worst and most rolonged cases intermissions or remissions occur, so that the child will ften improve greatly for days or weeks, and then suddenly relapse into s bad a condition as ever. In favorable cases these remissions become ore and more frequent, and the symptoms gradually improve, until at

length the child is restored to health. In fatal cases death is occasioned by the utter deterioration of the general health which finally occurs, and the child perishes, worn out by long illness, or, as more frequently happens, some complication arises which hurries on the fatal event. Thrush is a frequent complication of chronic entero-colitis, and doubtless often hastens the death by the impediment which it occasions to the nursing or feeding of the child. Vomiting has almost always occurred towards the close of the fatal cases that we have seen, especially in those in which extensive thrush was present.

The *duration* of this form is of course very uncertain. It may last for weeks or months. We have known it to last two and three months in several cases, and in two others it lasted with occasional intermissions, in one a year, and in the other eighteen months.

Diagnosis.—The diagnosis of acute entero-colitis is not difficult. There is no disease with which it is likely to be confounded. The characteristic features of the malady are the diarrhœa and other abdominal symptoms, and the absence of signs of other disease. The secondary cases are distinguished by the occurrence of the usual symptoms of entero-colitis during the progress of the primary malady.

The chronic form is not likely to be mistaken for any other disorder, unless it be the diarrhœa which occurs in tubercular disease, from which it is to be distinguished by the presence in the latter of the signs of tuberculosis of other organs.

Prognosis.—Acute entero-colitis is always a serious disease in infants. The prognosis will depend in great measure on the circumstances under which the affection has been developed. It is much more unfavorable in a child fed on artificial diet, either wholly or in part, than in one who is nursed at a fine breast of milk. It is more unfavorable also in weak and delicate than in robust and vigorous children, and in those of poor people, who live in crowded and unhealthy portions of cities and towns, whose habitations are small, damp, and ill-ventilated, and whose food is coarse and insufficient, or improper, than in those placed in more fortunate and more healthful hygienic conditions. It is a more dangerous disease in summer than in winter. In hospitals for children it is a very fatal disorder, owing to the bad hygienic conditions under which the inmates are placed. In children who have passed through the first dentition, the prognosis is, as a rule, favorable. The disease is seldom dangerous in such cases when it occurs as a primary affection, while, as a secondary affection, on the contrary, it is much more apt to be serious.

The unfavorable symptoms are: great frequency of the stools; collapse; violent vomiting or retching; and dangerous cerebral symptoms, as coma, rigidity of the limbs, paralysis, or convulsions.

Treatment.—The *prophylactic treatment* is very important. It includes attention to *habitation*, *diet*, *dress*, and *exercise*. The most frequent causes of entero-colitis are high summer temperatures, residence in an unhealthy locality, and improper diet. A child may have been born of the most healthy parents; may be living, if an infant, on the most healthy food in the world, the milk of a perfectly sound woman, or, if it have been weaned,

on the best possible substitute for breast-milk, one selected by the most consummate medical art; and yet, if it be the unfortunate resident of some low, crowded, and unclean part of any of our cities in the summer season, it has but small chance of escaping inflammatory diarrhœa or cholera infantum, to be followed by chronic diarrhœa. Or, a child may be living in the best part of these cities, with every advantage that wealth and the medical art can give, and, if in the period of the first dentition, and the summer heats be great, it will be only too apt to have some form of the disease we are considering. Under the latter circumstances, its chance of escaping the disease will be vastly greater than under the first-named conditions, but the true prophylaxis is, where the parents are so situated as to be able to do that which is best for the child, removal from the city during the hot season (from the early part of June to the last week of September) into some cool and healthy region of country. We have long thought that the best region to spend the summer in is a somewhat high and cool part of the country, where the breezes have full sweep, and where the topography is such that water runs off rapidly, or sinks fast into the soil. The seaside, if it be a point where there are no marshes and no malaria, and where the supply of milk and other wholesome food is abundant, is an excellent place. We have seen more remarkable sudden effects from the removal of a dangerously sick child to the seaside, than from a change to the interior; but, nevertheless, for a continued residence of three months, we prefer a high interior locality.

On the other hand, if a child be placed in the most favorable possible condition as to locality, and the diet be a radically bad one, a deficient or unhealthy breast, improper artificial diet, or a foolish allowance on the part of the mother or nurse to the child of a variety of vegetables, of fruits, and especially of berries like currants or gooseberries (and we have known such things), it can scarcely escape the penalty of a fit of illness more or less severe.

A child who is so unfortunate as to get a sharp attack of entero-colitis in June or July, is very apt to continue more or less sick during the rest of the summer, so that the true prophylaxis is to take it away from the city early in June to avoid this danger, and not to return until after the September heats are over.

As the reasons for decisive medical action in any disorder cannot be too strongly demonstrated, and as this subject of removal is a very important one, we think it well to advert here to the results of experience in this matter in the diarrhœa and dysentery of our armies during the late war. Here we have the experience of intelligent army medical officers in vast numbers of cases,—cases, too, so grouped together as to give opportunity for the most accurate observation. In the *Sanitary Memoirs of the War of the Rebellion, collected and published by the United States Sanitary Commission* (Chapter VII, *Camp Diarrhœa and Dysentery*, by Sanford B. Hunt, M.D., p. 291), will be found a most valuable essay on the causes and treatment of diarrhœa and dysentery, which no one can read without being impressed with the similarity (saving the ages of the patients) of those diseases to the one we are describing. At page 304, Dr. Hunt

says: "But in others the disease progressed, became follicular, and finally ulcerative. In the treatment of these, great difficulty was experienced, from the fact that the patient was still exposed to the causes of this malady; and it came to be a fixed doctrine at Southern and Southwestern stations that confirmed cases had no security for cure except by removal to the North. This soon became a governmental policy, and hospitals were established in New England, along the Lakes, and in the Northwest, to which chronic cases were sent in great numbers. Among patients not thus removed, but treated in Southern hospitals, much vacillation and irresolution were exhibited in the prescriptions of surgeons, as happens in all diseases, the treatment of which by drugs is usually unsuccessful. To trace the history of an individual case was to find that the prescriber had run the round of all remedies, from opium to astringents, from astringents to quinine, from quinine to bismuth, and from bismuth to nux vomica, from nux vomica to mercurials, returning almost always to opium as the drug, which at least alleviated, if it did not cure."

The *dress* ought to be suited to the weather. It is best to keep on the child, even in hot weather, a very thin and soft flannel shirt, with short sleeves. This should never be removed. A young infant should wear all summer long a thin and light flannel petticoat. A child a year old may may have the flannel petticoat removed for a few days when the temperature rises to above 85° or 90°, when it suffers evidently from the heat; but so soon as the temperature falls to 85° or below, the petticoat should be replaced. This happens only for a few days in our summer season, and the change should be made with great care, and only under the supervision of an intelligent and watchful mother or nurse.

Exposure to the open air is another point in the prophylactic treatment which is of great importance. In country houses in the summer, a young infant may get nearly as much air as it needs, but in cities the air of houses is much more dull and stagnant, and the child ought to be carried out into the streets and squares for several hours morning and evening. If possible, it should be taken to drive into the open country. Short excursions, by rail or boat, for the children of the poor, who cannot escape from the city in summer, are very useful in carrying the child safely through the summer. But in all such jaunts after health, the parents should so arrange matters that the child shall be as little fatigued as possible. The best plan is to go in the morning and return in the evening, resting through the middle of the day at some point where the child can take rest and midday sleep, which are quite as important as fresh air. Included in this subject is that of *exercise*. This becomes very important when the child is old enough to walk and run, for then an ignorant or thoughtless woman might think the more exercise the better, whereas it is necessary to watch such children very carefully, since, if they are allowed or enticed to take undue exercise, the resulting fatigue becomes a positive cause of diarrhœa. A child of two or three years old should never be induced to take long and continuous walks; it ought to frisk and play, not walk straight ahead, like a man in training; for that kind of exercise, we have remarked, never suits children well.

It has already been stated that one of the most frequent causes of the alady is the attempt to bring up the child on artificial diet, and particularly on one of an improper kind. It is clear, therefore, that to avoid the isease it is necessary that the child should, if possible, be nursed. If this annot be done, the diet ought to be wisely selected and regulated in all its etails by the physician. The one most proper is evidently that which most osely resembles the natural aliment of the infant. For directions as to iet, we must refer the reader to the remarks upon diet, where we have iscussed this point quite fully.

Diet in the Attack.—After the disease has made its appearance, the diet ould be very carefully regulated. This constitutes, in truth, the most portant point in the treatment. If the child is nursing, it ought to be nfined entirely to the breast, and should the nurse have a large quantity milk, and the stools exhibit considerable quantities of undigested casein, must be somewhat restricted as to the frequency and length of time it is lowed to nurse; in other words, it must be moderately dieted for two or ree days. Should there be the least suspicion that the milk of the nurse unhealthy, it ought to be examined as before directed, and, if found unealthy in any respect, a new nurse must be provided. If the disease mes on shortly after weaning, and persists for several days in spite of reful diet and treatment, it is safest to restore the child to the breast. hen this cannot be done, we must select that form of artificial diet hich seems most suitable. The best is, in our opinion, the cow's milk epared with the solution of gelatin in the manner already recommended, t made very weak for a few days. We have often found it necessary, der these circumstances, to add four and even more parts of water to e milk, instead of two or equal parts, as is the usual custom.

In older children the diet, for a few days, ought to consist of simple lk and water, or of thin preparations of arrowroot, rice flour, sago, pioca, or wheat flour, made with milk, or milk and water, with small antities of bread, or, if the child refuse such articles, panada, or light icken- or mutton-water may be allowed. The quantity of food, whatr it be, must be determined very much by the child's instincts. When e appetite continues, we can seldom go wrong in allowing as much of se simple foods as the patient will take. Still, the physician ought to ow accurately the amounts that are given, and if he finds the patient king a full healthy average, or more, it will be best to restrict the quany somewhat, and offer water frequently, on the supposition that the little tient is taking its liquid food more from thirst than hunger; or else inease the water of the food, if he have reason to believe that the solid tter is in too large a proportion.

THERAPEUTICAL TREATMENT.—We have found a large number of the ld cases that have come under our notice to recover under very simple atment. When the patient is an infant at the breast, before the period dentition, the simple direction not to allow it to nurse as much as usual; use of a warm bath morning and evening, if the skin be heated and child restless and fretful; the administration of a small dose of castor (half a teaspoonful to a teaspoonful), or of spiced syrup of rhubarb in

the same quantity, with a half drop to a drop of laudanum, at the beginning of the attack, to remove any undigested food that may be lying in the bowels, followed in one or two days, if the disorder continues, by some simple astringent remedy, generally suffices to effect a cure. When, on the contrary, the case depends on an unhealthy or insufficient milk, when the child subsists entirely on artificial food, and when the disease coincides with the process of dentition, the attack is kept up and aggravated by these causes, and it is more difficult to obtain a cure. In the former case the diet is, of course, of all importance; in the latter the gums must be carefully examined, and if found to be swelled and inflamed, and the teeth near the surface, they should be freely incised. After these matters have been attended to, the kind of treatment will depend on the character of the general symptoms and the violence of the enteritic disorder.

When the pain is violent, the discharges frequent, painful, and mixed with mucus, muco-pus, or blood, and the abdomen tense and painful to the touch, moderate local depletion by leeches may be used with advantage and safety in vigorous children. The leeches are best applied over the lower part of the abdomen. About six or eight American leeches, or two foreign ones, may be applied at the age of one or two years, so as to take about two ounces of blood. Of late years, however, we have not employed depletion so much as formerly, but use instead warm baths, poultices to the abdomen, or warm stupes, and refrigerant medicines. Small doses of the sulphate of magnesia and laudanum are very useful; or we may employ spirit of nitrous ether, or solution of the acetate of ammonia with paregoric or laudanum, or the following mixture:

℞.—Sodæ Bicarb., ... ℥ss.
Mass. Hydrarg., ... gr. iij.
Tr. Opii Camph., ... gtt. L vel f℥j.
Syrup. Simp., ... f℥ij.
Aq. Menth., ... f℥xiv.—M.
Dose, a teaspoonful every three or four hours.

The warm bath, used at a temperature of 95° to 97°, twice or thrice a day, is most excellent. It is a good plan to wrap the child, immediately on being taken out of the bath, in a warm muslin sheet, and over this a light blanket, and let it lie on the lap or bed for twenty minutes or half an hour. During the past two years, the external use of cold water in febrile diseases has been extended widely, and among the affections in which it has been applied are entero-colitis and cholera infantum. We have ourselves limited the use of water to tepid bathing or cool sponging when the temperature was considerably elevated; but excellent results have been obtained by some observers, both here and in Europe, by the use of cold baths (72° to 78° Fahr.), repeated several times during the day when the febrile temperature rose to 103° or 104°. If the temperature should remain elevated, despite the use of repeated cool spongings and the warm bath, the cool baths may be tried, though we should not recommend them quite so cold as above mentioned.

The hot poultice or stupe recommended above should be covered with oiled silk, secured by a towel pinned around the body, changed every three or four hours, and kept on for the greater part of the day, or for several days.

Calomel has been so highly recommended and so long employed in these cases, that we feel some hesitation in saying how often it has disappointed us. Certainly we have found in many children that it was of no evident use, and in the old-fashioned doses of a grain or half a grain, we think it only adds to the irritation of the bowels. In doses of the twelfth and eighth of a grain, with chalk and opium, every two or three hours, we formerly thought it was sometimes useful, but we cannot resist the impression which years have given us, that the useful agents in these instances have been the chalk and opium, and especially the opium.

We still have confidence in, and employ, the mixture of blue mass and soda above recommended. It does not irritate, as we have known the larger doses of calomel to do; but, on the contrary, when given for thirty-six or forty-eight hours, under the circumstances mentioned, it is frequently followed by an improvement in both the number and character of the stools.

Before quitting this question of the use of mercurials in diarrhœa, we wish to quote the results at which some of the more modern observers have arrived, with the remark, as we pass on, that our own conclusions were much the same ten years ago as those expressed above. We shall do this even at the risk of being tedious, for we think the point a very important one. In the first place, we shall quote the opinion of one of the ablest of the United States army surgeons, as to the use of this drug during the late war. The writer (*Outlines of the Camp Diseases of the United States Armies as observed during the Present War*, by J. J. Woodward, M.D., Philadelphia, 1863), in the article on Chronic Diarrhœa, a disorder closely akin in many of its symptoms and anatomical lesions to the entero-colitis of children, says, at page 262: "Among the remedies liberally employed in chronic diarrhœa is one which can only be mentioned with disapprobation. This is the mercurials, which are too frequently administered to gentle salivation in the form of blue pill or calomel, combined with opium and ipecacuanha. The authority of some of the most distinguished American medical writers is in favor of the employment of mercurials in the chronic diarrhœa of civil life; yet when it is remembered that even those modern writers, who most warmly advocate their general employment in the treatment of inflammation, recommend them to be discontinued as injurious whenever the process has gone on to ulceration, it would appear that even sound mercurialists would avoid using them in the form of chronic diarrhœa which is most common in the army.

"Practically it will be found that although in some cases mercurials may succeed, as much less dangerous remedies would have done, in checking the progress of the disease, yet that in the majority of cases their employment is accompanied by an increase of the debility, the loss of appetite, the anæmia, and the general constitutional symptoms, without any dimin-

ution in the frequency of the stools. They are, therefore, to be regarded as dangerous and inefficient, and their use in these cases has been completely abandoned by those surgeons who are most successful in the treatment of the disease."

Dr. T. K. Chambers, of London (*Clinical Medicine*, London, 1864, p. 517), in considering the treatment of diarrhœa in which the stools exhibit the products of acute inflammation, says: "The drugs I have most trust in are calomel, ipecacuanha, and carbonate of soda. Of the first and second equal quantities, and a double quantity of the third, may be made into powders, of which from four to six grains, according to the child's age, may be given every three hours. This is a traditionary powder, but it is right to say that I have in a good many instances lately left out the calomel, and the case has done just as well, if not better, without it."

Dr. J. L. Smith, of New York (*op. cit.*, p. 379), says nothing whatever about mercurials in his article on the treatment of inflammatory diarrhœa, from which we are led to suppose that he does not use them. He however quotes Dr. E. H. Parker as giving, when the condition approaches that of dysentery, a mixture consisting of about ten grains of blue mass rubbed up in two drachms of syrup of rhubarb, to which is added one half teaspoonful of paregoric, and four ounces of chalk mixture. Of this the dose is a teaspoonful every two or three hours. Dr. Parker says that the "blue mass certainly does not act like the calomel, not producing in purgative doses so great prostration, and in small doses it does not lessen the proportion of fibrin in the blood, as is the case with calomel." Dr. Smith's comment on this is: "I have never used this mixture, having been generally satisfied with the effects of the castor-oil mixture."

It is unnecessary to say any more upon the use of mercurials, and especially of calomel. We have quoted enough to show that our own opinions find us in very good company.

We regard *opium* as one of the most valuable remedies we have in the treatment of this disease. In a former edition of this work it was stated that some writers objected to its employment in the early stage as injurious, but that we had not been deterred from using it, except in cases presenting manifest signs of cerebral irritation in connection with the febrile symptoms; but that when there has been nothing more than irritability, restlessness, and insomnia, when there was evident pain during the discharges, and when the latter have been very frequent, we had always made use of some of its preparations without hesitation, and certainly without injury, but, on the contrary, with very great benefit. Our longer experience confirms us in this view and practice. The propriety of using large doses of opium in the early stages of cholera infantum may well be questioned, as it has come to be by some of the best observers in Asiatic cholera; but this matter will be considered under the head of that disease. In the disorder under consideration, which is one of an inflammatory catarrhal type, we have never seen the moderate use of opium do anything but good. When the nervous symptoms are very marked, if they be of the kind which denotes disturbance of the reflex functions of the nervous system rather

than those indicating cerebral disorder, we find nothing which answers so well our purpose as this remedy. When, however, there is unusual quiet, tending towards drowsiness or stupor, with contraction of the pupils, we make use of it only with great caution and in very small doses. We are glad to find that Dr. Stokes also employs opium without hesitation. He says, "It is a remedy that requires caution in its exhibition, but one of great utility." It generally lessens the number of discharges, and very often diminishes the heat of skin and frequency of the circulation, by allaying the irritability of the nervous system, while at the same time it greatly promotes the comfort of the child. We have used it in the form of laudanum or paregoric, given in combination with a laxative early in the case, or by enema, and afterwards in that of the Dover's powder or powdered opium. For a child under six months old half a drop of laudanum is enough to give by the mouth. Of the Dover's powder about a sixth or eighth of a grain may be administered mixed with two grains of chalk, to be repeated every two or three hours, until three or four doses have been taken, or until the child shows some degree of drowsiness from the action of the opium, after which it ought to be suspended for six or eight hours, and then resumed. Or the opium may be given in the form of laudanum combined with the sulphate of magnesia as recommended above. The old-fashioned castor-oil emulsion, in the proportion of one drachm in a one or two-ounce mixture, with half a drop of the deodorized laudanum to each teaspoonful of the mixture, is often very soothing and beneficial. When there is marked tenesmus, with frequent small evacuations, opium may also be used with great advantage by the rectum, either to the exclusion of any in the mixture, or in addition to that, taking care to graduate the quantity by the degree of drowsiness that may be induced. At one year two drops in one or two teaspoonfuls of water or thin starch-water may be used two or three times a day. In such cases, suppositories are sometimes retained better than enemata. A twelfth to a sixth of a grain of powdered opium, made up with cocoa butter, may be given instead of the injection.

Generally speaking the acute constitutional symptoms either subside or disappear under the above treatment, and very often the diarrhœa also ceases and the child recovers. When, however, the diarrhœa persists, it is necessary to resort to two other classes of remedies, upon which great reliance is placed in the treatment of this affection. These are *astringents* and *absorbents*, of which the most important are prepared chalk, powdered crab's-eyes, bismuth, acetate of lead, rhatany, kino, and catechu. The chalk may be used in the form of the officinal mistura cretæ, a teaspoonful of which is given after each loose evacuation, or several times a day. When the case is severe, the efficacy of this remedy is much increased by the addition of tincture of krameria, in the proportion of a drachm to two or three ounces of the mixture, of some opiate preparation, or of ten or fifteen drops of the aromatic syrup of galls (to be described presently) to each teaspoonful. Chalk may be used also with great advantage, as stated above, in powder, combined with Dover's powder.

The powdered *crab's-eyes* will sometimes arrest cases in which prepared

chalk fails to produce any effect. It is generally employed in mixture. The formula we employ is the following:

℞.—Ocul. Cancror. Pulv., ... ℥j.
Pulv. Acaciæ, ... ℥ij.
Sacch. Alb., ... ℈j.
Aquæ Fontis, Aquæ Cinnamom., ää . . . f℥iss.—M.

A teaspoonful to be given four, five, or six times a day.

M. Bouchut recommends the following prescription of Hufeland's:

℞.—Ocul. Cancror. Pulv., ... gr. x.
Aquæ Fœniculi, Syrup. Rhei, ää . . . f℥ss.—M.

Give a teaspoonful every hour.

Subnitrate of bismuth has been highly recommended, for a number of years past, as a remedy in diarrhœa. Dr. Woodward (*op. cit.*, p. 258) quotes Assistant-Surgeon Dr. John B. Trask, U.S.A., as lauding it very highly in the chronic diarrhœa of the armies during the late war, and in California and Oregon, especially in those cases in which there is nausea or other disorder of the stomach. Dr. Woodward states that "he has given it a fair trial, and while he is far from regarding it as a specific, believes it to be a most valuable article in both simple, irritative, and in chronic diarrhœa." Dr. Trask prefers to give the whole quantity for the day in a single dose; but Dr. Woodward states that this view does not correspond with the general experience on the subject. It may be given in doses of one to two grains, to children one year old, every two or three hours. It can be administered in powder with sugar alone, or combined with prepared chalk, or in mixture with simple syrup, or ginger or acacia syrup, and some aromatic water. We have employed it quite frequently, but, on the whole, have not found it so effective as we had been led to hope.

Acetate of lead has been highly extolled by many writers in the treatment of the diarrhœas of children. We have had but little experience in its use, and are, therefore, unable to offer an opinion in regard to the influence which it may exert. It may be given in doses of from a sixth to an eighth of a grain, alone, or combined with chalk or Dover's powder, every two hours. *Krameria*, *kino*, and *catechu* may be exhibited alone, in the form of infusion or solution, or they may be given in conjunction with the chalk mixture. We have frequently employed the tincture of krameria in the latter way, and believe it adds very much to the efficacy of the remedy. About one or two drachms may be added to two ounces of the mixture, and the usual dose given. We have used, with much advantage, either alone or with chalk or crab's-eyes mixture, an aromatic syrup of *galls*, in the dose of from fifteen to forty drops three or four times a day, or, when the discharges are very frequent, every two or three hours. It is prepared according to the following formula:

℞.—Gallæ Opt. Pulv., ... ℥ss.
Cinnamom. Pulv., ... ℥ij.
Zingib. Pulv., ... ℥ss.
Spts. Vini Gall. Opt., ... Oss.—M.

Let the ingredients stand in a warm place for two hours, and then burn off the brandy, holding some lumps of sugar in the flames. Strain through blotting-paper.

Dr. Eberle (*loc. cit.*, p. 221) highly recommends the root of the *geranium maculatum*. He says it makes an "agreeable and efficient astringent," and is less apt to derange the digestive organs, and occasion irritation of the mucous membrane of the bowels, than kino. He uses it in the form of a decoction made with milk, by boiling an ounce of the fresh root in a pint of milk until half is evaporated. The dose is from a teaspoonful to a tablespoonful four or five times a day, according to the age of the patient.

The *nitrate of silver* is highly recommended as a remedy of late years by several writers. It is given both internally and by enema. The modes of administration will be described in the remarks on the treatment of the chronic form of the disease.

Revulsives are often of much service in the treatment of this, as of almost all the diseases of childhood. When there is much restlessness and irritability, with heat of the head and trunk, and coolness of the extremities, it will be found that mustard foot-baths or sinapisms to the extremities, often allay these symptoms, and greatly comfort the little patient. When the abdomen is tense and painful, and the discharges preceded or accompanied by movements or crying indicative of pain, the application of a poultice of mush and mustard from time to time, to be followed by a simple mush poultice, sometimes acts very usefully.

Tonics and *stimulants* are often necessary in weak and delicate children from an early period in the attack, and in those who are stronger, after the disease has lasted for some time, and the acute symptoms have ceased, and been followed by weakness and exhaustion. The best tonic is, probably, *sulphate of quinine*, in doses of from a quarter of a grain to a grain three times a day, continued for one, two, or three weeks if necessary. Old *brandy* has answered better in our hands as a stimulant, than wine, wine-whey, or any of the tinctures. It may be given to the youngest children in doses of from five to ten drops every two hours, or a teaspoonful may be added to a wineglassful of sweetened water, and a teaspoonful given whenever the child will take it. We have been obliged, in several cases, to continue the use of the brandy for three, four, and five weeks. At the time when we are obliged to resort to this class of remedies, it is almost always necessary also to pay attention to the improvement of the diet. The proportion of milk to water ought to be increased, if it has been small heretofore; and we should employ every means to induce the child to take a sufficient quantity without overloading the stomach. At this stage small quantities of animal broths are proper, or the child may be allowed to suck pieces of juicy meat, or to eat very finely minced meat of chicken or mutton. The diet is in fact a most important part of the treatment at this period. Dr. Stokes says of it, that "many children are lost by the practitioner neglecting this point."

Occasionally, indeed quite frequently, vomiting becomes a most troublesome symptom in entero-colitis. When it occurs at rare intervals, and without much distress to the patient, it needs no attention, since it is to be supposed that the physician has already arranged the hygienic and therapeutical treatment so as to suit the ordinary conditions of the disorder. But when vomiting becomes frequent and violent, so that the child rejects

a large proportion of all that is given to it, and when, between the acts of vomiting, the little thing refuses almost everything that is brought to it, all its usual foods, medicines, and sometimes even water, it is evident that the child has a more or less positive sense of nausea which causes loathing of food, and the symptom becomes a serious complication which requires special attention and treatment. In such cases, there is no use in forcing food or drugs which it loathes upon the child, unless all other means have failed, when of course, we must attempt to make it take concentrated foods in small doses. The better plan, at first, is to change the diet in toto—to abandon milk and all its preparations for two or three days, if these excite disgust—and give light beef or chicken tea, just touched with salt, or raw beef, or, if this also is refused, cold extract of beef in one or two tablespoonful or wineglassful quantities, or pieces of juicy and rich beef very slightly cooked, to be sucked. Or we may try small portions of yelk of egg, hard boiled, or what we have often found was eagerly taken in such conditions, wine-whey, of which we have given, in the second year of life, as much as a tumblerful in twenty-four hours, and this without the slightest effect of undue stimulation, febrile heat, or excitement. Sometimes, when the child refuses its ordinary milk persistently, or vomits it so soon as taken, it will drink willingly, and retain very well, lime-water and milk, in the proportion of one of the former to two or three of the latter, with just enough brandy to change the taste. We know that some medical men object entirely to the use of stimuli in children on two grounds: 1. That alcohol has no remedial power whatever, or that it is positively injurious in all cases. 2. That its use tends to produce that pernicious taste for stimulants which engenders the habit of drunkenness. To the first objection we can only reply that our observation and experience have led us to a different conclusion, and that, when employed in certain conditions of the vital powers, which we have carefully endeavored to describe, stimuli are of the highest value as a therapeutic means. To the second we reply that we have never, so far as very careful observation goes, produced a drunkard by any use we have made of them. We agree that physicians ought to be very careful not to employ them in any attractive form, as a long-continued remedy, in children over six or eight years of age. When we desire to use any form of alcohol in a chronic case in children over the age mentioned, we always give some of the bitter tinctures or elixirs. When possible, we always order the oldest and most delicate brandy that can be procured. As to the quantity, this must depend on the age of the patient, the instinct and idiosyncrasy of the child, and the degree of severity of the case. At the age of six months, from ten to fifteen drops may be given every two or three hours in two or three ounces of the lime-water and milk; and at one and two years, from twenty to twenty-five drops in from four to six ounces of the milk food every two, three, or four hours. It may be a sign of the old Adam in the poor little sufferer, but we have often known children to take, for days together, milk with brandy in it, who would not touch the milk without this addition. We cannot but think that in such cases it is an instinct for a useful agent, like the appetite of patients in typhoid or typhus fever, in certain of their

phases, for wine or brandy, which disappears when the necessity for it passes away, as has been so well described by Dr. Corrigan, of Dublin, in his able little essay on the treatment of Irish typhus.

Under these circumstances, all medicines which disgust the child must be laid aside. A bitter, or nauseous, or gritty dose will, in such states, surely cause vomiting, as will, in older persons, under such conditions, an odor or taste, or even an idea. We have seen a little infant, sick with diarrhœa, who was sitting languidly upon the floor, made to gag and retch, by chancing to pick from the floor a piece of softened bread. The impression produced upon the tactile sense of the fingers by the wet and mushy substance caused sickness at once, as the filing of a saw sets the teeth of a delicate nature on edge, and brings water into the mouth. All offensive and bitter doses must be abandoned therefore. We have often used, in such cases, the following prescription with much benefit:

℞.—Liq Morph. Sulphat., ... ♏xxxij.
Acid. Sulph. Dil., ... ♏xv.
Curaçoa, ... ʒij.
Aquæ, ... ʒxiv.—M.

Dose, a teaspoonful every hour or two hours, at the age of six months to a year.

For older children, the proportions of the opiate and acid must be increased. When the nausea subsides or passes away, or when the child becomes drowsy, the intervals between the doses must be lengthened, and as the symptoms disappear, the other remedies necessary for the diarrhœa may be resumed, and so too of the food. Dr. J. L. Smith, of New York, states that the best remedy he has used for vomiting is the neutral mixture, as follows:

℞.—Potass. Bicarbonat., ... gr. xxv.
Acid. Citric., ... gr. xvij.
Aquæ Amygd. Amar., ... ʒj.
Aquæ, ... ʒij.—M.

One teaspoonful to a child from eight to twelve months old, repeated according to the nausea or vomiting.

Creasote is also sometimes very useful. Dr. Smith says that in the Nursery and Children's Hospital of New York, this remedy is used, given in the proportion of an eighth of a drop in a teaspoonful of lime-water, in a teaspoonful of milk or breast-milk, and has been found successful in a certain proportion of cases.

Treatment of Chronic Entero-colitis.—The management of the hygiene of the patient is more important than any other part of the treatment, in this, as in nearly all the diseases of the digestive organs in children; for cases will often recover when the diet, drinks, and exercise are properly regulated, without the use of any drugs whatever, whereas, most assuredly, but a small proportion of them would terminate favorably under the best and wisest therapeutical medication, were the hygiene of the child neglected. The remarks that have been made as to the diet most proper in the acute form will apply here. If the child have been weaned only a

few weeks before the time at which we are consulted, and the case is at all serious, it is better to advise the procuring of a wet-nurse. We have several times known cases of the disease which had resisted the most carefully managed artificial diet and therapeutical treatment, recover in a few days after the child had been restored to the breast. It is often, however, impossible to follow this course, from the refusal of the parents to obtain a nurse, or of the child to take the breast of a stranger, and we are obliged to rest content with artificial food. We believe that the kind of diet which suits the largest number of children is one of milk. During a number of years past, we have found the gelatin food, already described, to answer better than any that we have ever essayed. It ought to be made very light and thin. About a scruple of gelatin should be dissolved by boiling in half a pint of water. Towards the end of the boiling, a gill of cow's milk, and a teaspoonful of arrowroot made into a paste with cold water, are to be stirred into the solution, and from one to two tablespoonfuls of cream added just at the termination of the cooking. It is then to be sweetened moderately with white sugar, when it is ready for use. The whole preparation should occupy about fifteen minutes.

When cow's milk, mixed with water alone, or prepared in the manner just recommended, evidently disagrees, we have sometimes found cream with water alone, or better still, with the solution of gelatin in water, in the proportion of one part of cream to five or six of the latter, to suit very well. In other cases very carefully prepared beef tea or chicken or mutton water, given several times a day or but once, according to the taste and fancy of the child, will answer better. It sometimes happens that the child will refuse everything that has been mentioned, and yet the prostration and emaciation are such as to make it essential to procure some aliment that it will consent to take. We have, under such circumstances, given small portions of bread and butter, or stale sponge-cake, with weak brandy and water, if the child is old enough to swallow solid food. If the white of an egg be stirred in a small glass of water, the child will usually drink it freely without recognizing the presence of the albumen, and we are thus enabled to administer a considerable amount of nutritious food by giving the whites of two or three eggs in the course of the day. Sometimes the child will eat small quantities of meat, and when this has been the case, we have not hesitated to allow a chicken-bone, with a little meat attached to it, or a piece of ham, or better still, a portion of roast beef, or of the tenderloin of beef-steak, to be held in the hand and sucked; or we may give the white meat of chicken cut up very fine, or torn into the finest shreds. Of the latter about a teaspoonful is sufficient for the first day, given with a little brandy and water. The quantity can be gradually increased afterwards. We have of late years also given small quantities of raw beef in many cases, minced very fine and flavored with salt, or prepared in the manner described below,[1] and have found it to be readily di-

[1] The use of raw meat in the diarrhœa either of infants deprived of their mothers' milk, or of weaned children, was recommended by Weisse, of St. Petersburg, as long ago as 1840 (Oppenheim's Journal). Of late years it has been extensively used with excellent results, and is highly praised by Trousseau and other eminent

gested and to agree well with the little patients. There is another article which we have sometimes given when children have been exhausted for want of food, and when they require constant change in order to be tempted to take it. This is the yelk of a *hard*-boiled egg, which has the advantage of being very nutritious if digested, and of not being injurious should it happen to pass into the bowel in the crude state, as it falls into a state of fine powder, which is not irritating to that organ.

The quantity as well as character of the food is of the utmost importance, and should be strictly regulated by the physician, and attended to by the mother or nurse. As a general rule the child may be allowed as much as it wants of proper food, since the appetite is almost always greatly diminished, and it is not likely, therefore, that too much will be taken. If, however, there is disposition to nausea or vomiting, or if the appetite remain as good as usual, the quantity must be restricted. The difficulty in most cases is to get the patient to take enough, and not to prevent it from taking too much, for we have very often ascertained, upon careful inquiry, that the quantity was entirely too small to support the strength of the constitution. A hearty child six months old, fed solely on artificial food, will generally take a quart of food in the twenty-four hours, while at a year old it will take usually fully a quart or three pints of fluid nourishment, besides eating small quantities of solid food. Now, we have frequently known children laboring under chronic entero-colitis, not to take more than one or two gills of food in the day, which is manifestly much too little. When this is the case, therefore, we should always endeavor to stimulate the appetite and digestion by means of tonics and stimulants, and by causing to be presented to the child such a variety of food as may entice it to take a larger quantity than before.

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authorities. The administration of the muscular tissue itself appears much more useful than any form of beef essence or soup, probably for this reason among others, that these fluids pass too quickly through the intestinal canal. The best meat for the purpose is the fillet of beef, though fine mutton may also be used. It should be cut very fine, and according to Trousseau, pounded in a mortar and strained through a sieve or cullender; the pulp, thus separated from the cellular texture of the meat, may be rolled into small balls in salt or powdered sugar.

The quantity upon the first day should not exceed three drachms, given in divided doses; but it may be doubled on the successive days, until young children may take from six to ten ounces a day. Under this regimen the diarrhœa frequently ceases, and the children quickly recover their plumpness and natural spirits.

Trousseau calls attention to the fact that the stools are frequently red and fetid at first, even when the nature and abundance of the diarrhœa have already undergone a favorable change.

In a second article upon this subject (Jour. für Kinderkrankheiten, January and February, 1858), Weisse calls attention to the fact that in many children who had been treated by raw beef, tapeworms have been developed. As these worms were all specimens of tænia solium, which is not indigenous in St. Petersburg, it is probable, as suggested by Von Siebold, that they had been conveyed in the undeveloped state in the flesh of oxen, brought from distant points. We are not aware that this unfortunate consequence has been observed frequently in other localities, and certainly in the quite numerous cases in which we have ourselves administered raw meat to children, no entozoa have been developed.

In connection with this most important matter of the food, we will again quote from Dr. S. B. Hunt (*op. cit.*, page 305), to show the results of his experience in the use of foods in chronic inflammatory diarrhœa in the army. For the sake of any non-professional reader, we will state that by albuminoid food Dr. Hunt refers to meat, meat-broths, eggs, etc.; and by antiscorbutic food he means tomatoes, fresh fruits, onions, etc. Dr. Hunt says, "The value of drugs was, perhaps, overestimated in this, as in all other diseases of assimilation, and only a careful avoidance of the original causes of the malady, and an equally careful recognition of their continued existence in the system, could secure any degree of success. The scorbutic and malarial taints were almost uniformly present, the former very frequently in as pronounced a form as the latter. The bowels, enfeebled by the inflammatory process, were unable to perform their normal function of the digestion of starches, and the diet, therefore, became necessarily albuminoid. A full nutritious diet of albuminoid and antiscorbutic food assumed the first importance in the treatment. Coupled with this came pure air and absolute cleanliness. And, with these hygienic measures alone, when they could be properly enforced, it was possible to treat chronic diarrhœa and dysentery with a fair degree of success, even in the great heats of a Southern summer." These views confirm what we have said above, that milk, meat, raw or cooked, broths, eggs, gingerbread, tomatoes, bread and butter, and we may add currant-jelly, make the best food for children over two and three years of age. Even in children of eight months and a year or upwards of age, milk and beef or chicken tea ought to form the chief diet. The starches, such as arrowroot, barley, wheat preparations, etc., do not answer, except in very small quantities cooked in milk. We saw one child, a year old, weaned in August in consequence of the illness of the wet-nurse, whose life was apparently saved in dysentery by Liebig's cold extract of beef, and by its fortunately having developed a strong taste for the sucking of large pieces of rapidly and slightly cooked beefsteak.

The *therapeutical treatment* of the chronic form consists principally in the administration of tonics, astringents, and absorbents. Of these the most important are the bismuth, powdered chalk and crab's-eyes, and the different vegetable astringents, which have already been noticed in the remarks on the acute form. These are to be given in the manner there recommended, and it is therefore unnecessary to repeat what has already been said. In addition to these there are some remedies which are particularly adapted to the chronic form of the disease. Amongst them is *nitrate of silver*. Dr. Eberle (*op. cit.*, p. 251) says he has found its internal administration to produce the happiest effect in a few instances. His prescription was a grain of the nitrate dissolved in an ounce and a half of gum arabic water, with the addition of twenty drops of laudanum. The dose was a teaspoonful three times a day. He adds that he has never "known the slightest inconvenience to result from the use of this article in chronic mucous inflammation of the bowels, when administered in a mucilaginous solution and in very small doses." It has been much used of late years in France. MM. Trousseau and Pidoux recommend its internal use in

the chronic diarrhœas of children occurring during dentition, after bismuth, powdered crab's-eyes, and diet have failed to effect a cure. Their formula is as follows:

℞.—Argent. Nitrat., ... gr. ½.
Aquæ Destillat., ... fʒvj.
Syrup. Sarsap., ... fʒijss.—M.
To be given in eight or ten doses.

At the same time, they employ an enema composed of a grain of the nitrate in three ounces of distilled water. It is highly recommended also in these cases by Hirsch, of Königsberg. His formula is as follows:

℞.—Argent. Nitrat. Crystal., ... gr. ¼.
Aquæ Destillat., ... fʒij.
Acaciæ Pulv., ... ℈ij.
Sacch. Alb., ... ʒij.—M

A teaspoonful of this mixture to be given every two hours, and an enema, consisting of a quarter of a grain of the salt, with mucilage and a little opium, to be administered (*Ranking's Abst.*, No. vi, p. 61). We have employed this remedy in the proportion of from half a grain to a grain in a gill of water, by injection, morning and evening, for several days, with very decided benefit, in three cases of diarrhœa following summer-complaint, in which the stools were frequent, mucous, sometimes streaked with blood, and accompanied by tenesmus. We have also given it frequently internally in mucilaginous solution, as above recommended, with excellent results.

Dr. Woodward (*op. cit.*, p. 264) says, in his article on the treatment of the chronic diarrhœa, which was a true entero-colitis, that "by far the most valuable local measure is the employment of solutions of the mineral astringents as enemata." He mentions sulphate of copper, nitrate of silver, sulphate of zinc, and acetate of lead, but thinks that the sulphate of copper and nitrate of silver are probably the most efficient. The strength he recommends is of one or two grains to the ounce of water, of which from one to six ounces may be thrown into the rectum two or three times a day. He advises that, when the rectum rejects the injection immediately, twenty to forty drops of laudanum be added to each enema, that the injection be thrown carefully into the bowel, and the nozzle of the syringe be withdrawn as gently as possible, in order that the fluid may be retained at least for some little time. We quote these statements, not to induce the use, in children, of solutions of one or two grains to the ounce, but to draw attention to one of the means, the ability and advantage of which bore the test of the vast army experience in this most severe and troublesome disease. In children it is best to begin with a grain to four ounces, and, if this gives no pain, or but little, and does not produce the hoped for benefit, the proportion may be doubled, or, after two or three trials, brought up to that of a grain to an ounce.

Another excellent remedy in the chronic diarrhœas of children, one from which we have sometimes obtained very satisfactory effects, is the

syrup of the *nitrate of iron*. It is given in doses of from two to five drops three times a day, in sweetened water, at the age of one or two years.

The following formula is recommended by Dr. Eustace Smith. We have used it ourselves in several chronic cases, and have been much pleased with its effects:

℞.—Liq. Ferri Pernitrat., ... fʒss.
Acid. Nitric. Dil., ... fʒss.
Syrup. Zinzib., ... fʒj.
Aq. Anethæ, ... ad fʒiij.—M.
A teaspoonful every six hours at one year of age.

We have found a teaspoonful every three or four hours not too much at three and four years of age.

Creasote also has been recommended of late years, and is highly thought of by some practitioners. It may be given in doses of from a quarter to half a drop every three or four hours at a year old. We have used this remedy in the following combination especially in cases attended with nausea, flatulent distension of the bowels, or a very fetid state of the discharges:

℞.—Creasoti, ... gtt. viij.
Sodæ. Bicarb., ... gr. L.
Sp. Lavandulæ Comp., ... fʒij.
Pulv. Acaciæ, Sacchari, āā, . . . q. s.
Aquæ, ... q. s. ad fʒiij.—M.
Dose, a teaspoonful three or four times a day.

Bouchut recommends enemata of from ten to twelve grains of extract of *rhatany*, or six to ten of *tannin*, in about five to seven ounces of some vehicle.

Sulphuric acid has been found very useful in the treatment of this affection, and by some authors as, for instance, Pollak (*Trans. Amer. Med. Assoc.*, vol. viii, p. 260) has been given in large doses as the sole remedy.

We have never used it in this manner, but for some years past have been in the habit of employing it in the following mixture with excellent results. In cases of diarrhœa, showing a disposition towards dysentery, as often occurs in entero-colitis, and especially when the stomach has been irritable, so as to bear other medicinal substances badly, we have found this combination very beneficial.

℞.—Acid. Sulph. Arom., ... gtt. xlviij.
Tinct. Opii, ... gtt. xij, vel xxiv.
Syrup. Krameriæ, ... fʒss.
Aq. Fluvial., ... fʒijss.—M.
A teaspoonful every two hours.

It should never be forgotten in the treatment of chronic diarrhœa in children, that the most important point of all is the regulation of the diet and other hygienic conditions. We are fully convinced that we have seen several children saved from death by attention to these points, and by the persevering and careful employment of tonics and stimulants. It often

happens, after the disease has lasted for some weeks or months, that the powers of the stomach are almost wholly lost. The child either refuses food or takes so little that the quantity is evidently insufficient to carry on the vital processes, or the greater part of what is taken is rejected by vomiting, or lastly, much of it passes off through the bowels, and appears in the stools in an undigested state, forming what is called lientery. If this condition of things is allowed to continue, the emaciation and exhaustion make rapid progress, and the case must soon terminate fatally. Under these circumstances all the ingenuity and skill of the physician are required to find articles of diet of a kind to recall and tempt the child's worn-out and often perverted appetite, and which, at the same time, may be digestible and nutritious, and tend to restore vigor to the digestive function. If the stomach is frequently sick, it is best to abandon all remedies but those which are stimulating and strengthening, and especially to forbid all such as are in the smallest degree nauseous. We would indeed depend entirely on the use of repeated doses of the oldest and most delicate brandy that could be found, of which from one to two teaspoonfuls may be put into a wineglassful of cold water, and the whole given by teaspoonfuls in the twenty-four hours; or fifteen to twenty drop doses of the elixir of Peruvian bark every three or four hours may be used; or solution of pepsin, in half teaspoonful doses three times a day; or, two or three drops of tincture of nux vomica in sweetened water three times a day, if the bitterness does not cause nausea or increase the loathing. In such cases, wine of iron, in doses of twenty drops to a fourth of a drachm, with syrup of tolu and caraway water, will sometimes do exceedingly well; or the following, which has sometimes succeeded in our hands:

℞.—Tr. Ferri Chlorid., ... f℥j.
Acid. Acet. Dil., ... f℥j.
Liq. Ammon. Acetat., ... f℥ij.
Syrup. Simp., ... f℥ss.
Aquæ, ... f℥ij.—M.

Dose at four years, a teaspoonful, and under that age, half a teaspoonful, three or four times a day.

In some very obstinate cases, especially where there is any reason to suspect the existence of a malarial element in the case, from half a minim to one minim of Fowler's solution of arsenic, with the wine of iron, three times a day, has been very serviceable. Whilst this is being done, an occasional dose of anodyne, just enough to tranquillize without stupefying, may be given. If the rectum will retain it, it is better to give it by enema. In some cases we have found the aromatic syrup of galls, given with brandy, to be taken by the child without any difficulty or disgust.

Exercise by riding, and exposure to the air, which, however, must never be carried so far as to induce positive fatigue, are all-important. In some very severe and tedious cases, change of residence or travelling has been known to effect a cure after all remedies and other means had failed. In one case, in this city, which had lasted with but short intervals for two years, we obtained a perfect cure by persuading the parents to send the

child into an elevated part of the country in the month of May, where it was kept until July, after which it was removed to the seaside until the end of August. Nothing was done in the meantime except to regulate the diet most carefully, and to keep the child the greater part of the day in the open air.

ARTICLE III.

CHOLERA INFANTUM.

General Remarks.—In the early editions of this work we failed to draw with sufficient clearness the distinction between what we think ought exclusively to be called cholera infantum, and the much more common disorders which are properly styled simple and inflammatory diarrhœa or entero-colitis. In this we did but follow the practice of most American writers, and the custom of the day. Indeed, many physicians amongst us are still in the habit of designating the various intestinal disorders of children so frequent during the summer heats, under the common title of cholera infantum. We believe, on the other hand, that a large majority of the deaths registered in our mortality returns under this name, are the result not of a true choleraic disease, but rather of simple diarrhœa or entero-colitis. We have, however, only too often to contend with a disease in children which deserves the title of cholera, which is the analogue of cholera morbus, or even of epidemic Asiatic cholera, in the adult, and which is the disease we propose to consider in the present chapter.

Definition; Synonyms; Frequency.—We can define cholera infantum only by an enumeration of its most specific characters, and we shall do this very much in the words in which Dr. Aitken describes epidemic cholera. Cholera infantum, as we understand it, is characterized by the occurrence, almost solely during the summer months, in young and generally teething children, who have been previously either healthy or the subjects, for a longer or shorter time, of simple or inflammatory diarrhœa, of sudden muscular debility, occasional nausea, spasmodic griping pains in the bowels, depression of the functions of respiration, and an appearance of faintness; copious purging of thin serous fluid, or of large watery and fetid evacuations, succeeded by more or less obstinate vomiting, coldness and dampness of a part or of the whole surface of the body, coldness and lividity of the lips and tongue, cold breath, a craving thirst, a feeble rapid pulse, difficult and oppressed respiration, with extreme restlessness, diminished or suppressed urinary secretion, pallor of the entire surface of the body, a sunken and pinched countenance, weakness of the cry or partial aphonia, and collapse, more or less complete, which may prove fatal, or be followed by reaction, and a subsequent more or less severe and obstinate simple or inflammatory diarrhœa.

This disease is not so common as simple and inflammatory diarrhœa,

most cases of which have been hitherto, as stated above, improperly grouped under the common name of summer complaint. Though rare in Europe, in comparison with its frequency in this country, it is easy to recognize from the descriptions, the identity of some of the cases called by Billard follicular enteritis, by Barrier apyretic and febrile follicular diacrisis, by Rilliet and Barthez, in their second edition, choleriform gastro-intestinal catarrh, and by Copland, the choleric fever of infants, with the true cholera infantum of America.

It is impossible to determine its real frequency amongst us, for the reason that fatal cases of simple diarrhœa and entero-colitis, are so generally included in our mortality returns, with those of the true choleraic disease, under the common title of cholera infantum or summer complaint. That it is a frequent cause of death is shown, however, by the tables of Dr. Emerson (*Am. Jour. Med. Sciences*, vol. i, 1827), wherein it appears that from 1807 to 1827, 3576 deaths from cholera, under five years of age, were returned in this city; of course many of these deaths were from a true choleraic disease. This is the largest number of deaths from any one disease given in the table. The next largest item of mortality is under the head of convulsions, of which it appears that 3192 died in the same period of time. During the five years, from 1844 to 1848 inclusive, there occurred in this city, 18,599 deaths from all causes, under fifteen years of age. Of this total, 1611 died of the so-called cholera infantum, which is the largest number of deaths from any one disease, with the exception of convulsions. Of convulsions there died 1729. After cholera infantum the largest number of deaths was caused by marasmus (1060), dropsy of the brain (1041), pneumonia (772), and croup (756). Cholera infantum, therefore, in these tables, causes nearly as many deaths as convulsions during the first fifteen years of life, and rather more than twice as many as pneumonia. We also refer the reader to the table given at pages 382–383, obtained from the Board of Health of this city, exhibiting the mortality under five years of age from cholera infantum, diarrhœa, and dysentery, with the total mortality at all ages, and with the mean temperature of each month.

CAUSES.—In discussing the causes of cholera in children, we meet again the difficulty so often alluded to, viz., the custom in this country of classing in mortality returns, all the deaths from intestinal affections in childhood, under the common title of cholera infantum or summer complaint. Our own experience leads us to the conviction that the causes are the same as those of simple and inflammatory diarrhœa, acting with greater intensity. When that cause, or those causes, whatever they may be, act with moderate force, the result will probably be a simple or inflammatory diarrhœa. When, on the contrary, the causes are intensified in degree, the case will be apt to take the form of choleraic disorder. Thus *heat* is one of the most influential of these causes. So long as the atmospheric temperature is moderate, the resulting disorders will probably take the form of simple or inflammatory diarrhœa. But let the temperature rise to 85° or 95° Fahr., or even higher, as happens occasionally in our summers, and continue at that height for three or four days, and children previously well will be seized with the true choleraic forms of diarrhœa,

whilst those who are already suffering with simple or inflammatory diarrhœa, are prone to have these milder diseases assume suddenly the choleraic type.

A glance at the table above referred to, shows most plainly the effect of heat upon the mortality from bowel diseases in children, under five years of age. It will there be seen that, in the two months of July and August, when the mean monthly temperature is between 75° and 80°, the mortality from cholera infantum rises to between two and four hundred, and even over; whilst during the cool months, as January, February, November, and December, when the mean monthly temperature is between 30° and 40° generally, only one, two, three, or none at all, are reported. This table shows also, what we have so frequently remarked upon, that most of the fatal cases of bowel disease, in early life, are classed in the medical returns of this city, under the common title of cholera infantum, whereas, we are sure from our own personal experience, that many of these deaths would be more correctly referred to simple or inflammatory diarrhœa, or entero-colitis. Thus, in the very months when three and four hundred deaths are grouped under the title of cholera infantum, only from fifteen to twenty, or a little over, appear usually under the term diarrhœa.

Diet.—Improper diet is another frequent cause of choleraic disease in hot weather. Sudden weaning, a change in the character of the artificial food, the unfortunate use by accident, or by the carelessness of the nurse, of unwholesome milk, of improper vegetables, or, as not unfrequently happens, of green or unripe or unhealthy fruit, as apples, currants, gooseberries, or blackberries (instances of all of which we have ourselves met with), will sometimes bring on, in a very few hours, the most violent attacks of cholera, or convert a previously mild and comparatively safe diarrhœa into the more violent form of disease we are considering. These results are especially apt to follow such accidents or imprudences in large cities, where the hygienic conditions are always in summer of a kind to invite the more violent and dangerous forms of intestinal disorder. In fine, the conditions which have been ascertained to be most certain to produce epidemic cholera, when that disease is present in a locality, are those which develop cholera in children. To put before the reader the conditions most certain to cause cholera in children, we cannot do better than to quote from the *Report on Epidemic Cholera to the Citizens' Association of New York, in* 1865, the *localizing* causes of cholera.

These are:

1. Decaying organic matters, bone, hide, fat and offal houses, neglected stables, putrescent mud and filth.
2. Bad drainage, local dampness, malaria.
3. Obstructed sewers, filthy streets, gutters, stables, garbage, and cesspools.
4. Water and beverages in any manner contaminated by putrescent organic matter, particularly by any soakage from privies.
5. Neglected privies and putrefying excrement.
6. Overcrowding and neglect of ventilation.

It is just where these conditions are most rife that choleraic diseases in

children are most apt to occur. Amongst the poor, who inhabit the crowded quarters of cities, where the streets and alleys are small and narrow, where heaps of decaying vegetable and organic matters abound, where water is scant or scantily used, where ventilation, from the manner in which the streets are laid out, and from the crowding together of buildings, is necessarily imperfect, we have the most numerous and the severest forms of the disease. Add to these the small size of the houses, the low ceilings, the small and few windows, and the interior arrangement of the rooms, which is such that a thorough draught is unattainable, and we need not wonder at the prevalence of the disease. It is amongst the poor, too, that the food is often of necessity, as well as from ignorance and recklessness, of the most improper kind, and not unfrequently insufficient in quantity.

But not only the poor, in their unhappy lot, suffer from this disease. The children of the rich, with all the advantages of the most wholesome hygienic appurtenances which ease and knowledge can supply, are apt to contract it if they remain in town during the hot summer months. So well is this known, that most families in easy circumstances leave the city for the seaside or the interior, so long as their children are young, remaining absent usually from the middle of June to the middle or end of September. It is nevertheless true that, whilst all the residents in our cities during the summer season are liable to see their young children suffer from this disease, those who are so fortunate as to occupy large and airy houses in the best and cleanest quarters, and who follow a wise system of hygiene as to diet, water, dress, and exposure to fresh air, escape with much more certainty the disease than those who are compelled by the necessities of their position to submit to the unhealthy conditions mentioned above.

Dentition.—We believe this also to be a most powerful predisposing cause of the disease, and yet it would seem to be less influential than age, for the tables of Dr. Emerson show that it is about twice as fatal in the first year as in the second, though the process of dentition is certainly more active and continuous in the second than in the first year. We have rarely observed it before the beginning of the process of dentition, and it is certainly very rare after its completion.

Age, as has just been stated, exerts a strong influence in the production of the disease. In the tables of Dr. Emerson, the cases of cholera infantum and cholera morbus are included under the one head of cholera, but as all cases of the disease under five years of age are called cholera infantum, the want of the distinction does not make the statements less useful to us. From them it appears that there were 2122 deaths in the first year, 1186 in the second, and only 268 between the second and fifth. Between five and ten years, only 52 cases are noted, and these would of course be entitled cholera morbus. In the five years, from 1844 to 1848 inclusive, of 1611 deaths from cholera infantum under 15 years of age, 69 occurred in the first year of life, 529 in the second, 103 between two and five years, and only 10 after that age.

Sex.—There are no large tables of reference, by which to ascertain the

exact proportion in which the disease occurs in the opposite sexes. It would appear, however, from our own experience, to be much more common in males than females, since of 77 cases of which we have kept a record, 48 occurred in boys, and only 29 in girls.

Constitution.—The disease is most apt to occur in feeble, delicate children, and in those of nervous, irritable temperament.

Hereditary Predisposition.—Our own observation leads us to believe that the disease is apt to occur in certain families. It would seem probable that this peculiarity must depend on the fact that the constitutions of some families are particularly disposed to disorders of the digestive apparatus. We are acquainted with one family in this city, in which eight out of ten children, suffered more or less from the disease. Again, of these children four have grown up, married, and have children. Two of these families have each lost a child from the disease; in a third, the two children of the family have been exceedingly ill with it; while in the fourth, some of the children have been sick, though not to the same degree. Again, we have attended two children in a family, one not quite two years, and the other three months and a half old, who have both been very sick with the disease. The elder child was ill the summer before in the same way. The mother of these children was herself very ill with the disease on several occasions during her infancy, as was also her brother.

Anatomical Lesions and Pathology.—It will be readily understood that it is far from an easy task to define precisely what are the essential lesions in true cholera infantum, as we have described it. Having been confounded so long with ordinary inflammatory diarrhœa, the lesions usually attributed to it are precisely those we have detailed in our article on the latter affection. In those cases again where the true choleraic disease appears during the course of inflammatory diarrhœa, it is of course difficult to determine to which affection the lesions presented after death are in reality due. We must, therefore, seek for the true and proper lesions of cholera infantum in the comparatively rare cases in which this affection has appeared in the midst of good health, and has proved fatal during the acute stage. With this restriction then, it appears that the only anatomical changes which can be regarded as constant and essential to the disease, are enlargement of the mucous follicles, and, to a less degree, of the glands of Peyer; and softening, and in some cases erythematous inflammation of the mucous membrane.

There can be little doubt that the appearances thus indicated, depend upon the presence of an early stage of inflammation of the tissues of the intestinal walls, and of the mucous follicles. This view is supported by the similarity between these lesions and those found in cases of enterocolitis, proving fatal during the early stage, as well as by the fact that where the child survives the choleraic stage, and ultimately dies after a continuance of diarrhœa for some days, or even several weeks, the lesions are found to have developed into those ordinarily found in primary enterocolitis.

It is, however, necessary to consider briefly what additional element is present, in this form of disease, which impresses upon it such peculiar and

fatal features; or, in other words, what is the pathology of the collapse which characterizes cholera infantum.

It is a matter of much regret, that as yet we are wanting in careful microscopical examinations of the condition of the epithelium of the mucous membrane, and of the characters of the evacuations. We should anticipate, however, from the evident similarity between cholera infantum and sporadic cholera, or cholera morbus in the adult, that in the former as in the latter disease, such examination would reveal rapid proliferation and exfoliation of the cells of the mucous membrane.

In regard to the explanation of these lesions, we would refer the reader to the remarks upon the pathology of entero-colitis, where we have expressed our belief that the causes of these affections (heat, noxious emanations, unwholesome food), act in a complicated manner, by inducing a state of malnutrition in which the tissues are prone to undergo inflammatory changes, by loading the blood with noxious substances, which may irritate the glands which excrete them, and finally by interfering with digestion, so that the contents of the intestinal canal undergo changes which render them highly irritating.

We repeat that we recognize in cholera infantum the presence of the general alteration of nutrition, and the change in the entire blood-mass, as well as the local irritant action of the morbid contents of the intestines. But it is in the highest degree interesting and significant of the importance of this last element in the causation, that symptoms altogether indistinguishable from those of cholera collapse, may be produced by agencies acting directly and solely upon the coats of the stomach and intestines.

Attention has been lately directed to these analogous conditions by Sedgwick, in a highly valuable article, "*On some Analogies of Cholera, in which suppression of urine is not accompanied by symptoms of uræmic poisoning*" (*Med.-Chir. Trans.*, vol. li, p. 1, 1868), in which he has collected many such examples. Among the causes which are clearly established as capable of producing such an analogous condition, are poisonous doses of corrosive sublimate, arsenic, some of the mineral acids, especially nitric acid; and also of certain drastic purgatives, especially croton oil. In these cases the peculiar symptoms produced, which are uniformly described by accurate observers as most closely analogous to those of cholera collapse, are due exclusively to the direct irritant action of the substance upon the gastro-intestinal mucous membrane.

The same effects have frequently been observed to follow the eating or drinking of poisonous animal matters, such as tainted or simply unwholesome meat or fish, and milk which has undergone some injurious, but as yet unknown change, decomposing vegetables, and some of the poisonous fungi. In this last group of cases, the local irritant action of the substances swallowed, must certainly be regarded as the principal cause in the production of the symptoms, although it is quite possible that the ingestion of such putrid animal or vegetable substances should also cause an altered condition of the blood.

In like manner, there are numerous morbid conditions of the intestines, or their peritoneal covering (as perforation with subsequent peritonitis,

peritonitis from extension of inflammation, intestinal obstruction), which may be attended with symptoms closely analogous to those of cholera collapse.

We will also quote from Rilliet and Barthez, the following passage in regard to the remarkable memoirs upon *Inanition*, by Dr. Chossat, of Geneva, which show the analogy which exists between the results of experimental inanition and the chief symptoms of cholera infantum. "This is seen especially (1.) In the diminution of temperature, which conjoined with the loss of weight, is in inanition, as in cholera infantum, one of the principal causes of death. (2.) In the stupor which follows the jactitation as the temperature falls. (3.) In the colliquative diarrhœa during the last few days of life, the severity of which is proportioned to the rapidity of the fatal termination, and to the increase of the algidity."

It is not within the scope of the present work to discuss, critically, the various theories which have been advanced to explain the *modus operandi* of such causes in producing a state of collapse analogous to that of cholera, as well as the pathology of true cholera collapse.

It is, however, evident, that the mere drain of fluid from the alimentary canal, although it undoubtedly has much influence upon the course of the disease, cannot be regarded as the efficient cause of collapse, since in many cases profound collapse occurs with comparatively scanty discharges.

So too we must regard Dr. Johnson's hypothesis (*Medico-Chir. Trans.*, vol. li, 1867, p. 103, *et seq.*), that the symptoms of collapse are due to a spasm of the minute branches of the pulmonary artery, caused by the specific alteration of the blood in cholera, as based upon insufficient arguments. Thus, in the first place, we have cited instances above where symptoms altogether similar to those of cholera collapse, are produced under circumstances in which it is impossible even to suspect the existence of a poisoned state of the blood. Again, there is neither any clinical nor anatomical evidence to show that the contraction of the pulmonary artery is relatively greater than that of the rest of the arterial system; or again, that such contraction precedes the other signs of collapse.

In an earlier edition of this work, we quoted the opinion of Rilliet and Barthez in regard to the implication of the sympathetic nervous system in cholera infantum, and since that time we have been led to regard this more and more strongly as the essential cause of the collapse which characterizes this and other choleraic conditions.

The passage extracted from the admirable work of Rilliet and Barthez was as follows: "The disease we have just described is, in our opinion, a catarrh which has localized itself upon the digestive tube and the great sympathetic nerve. It is, of all forms of the catarrhal affection, that which most clearly justifies the idea of a poisoning. It proves also that anatomical differences alone will not suffice to establish a separation between the various species of the disease.

"Its catarrhal nature is demonstrated by the causes, which are those of all catarrhs (improper alimentation, epidemic influence, etc.); by the analogy of the symptoms; by the gradual passage of the mild into the grave

forms, through intermediate cases; and lastly, by the fact that simple intestinal catarrh is often but the prodrome of choleriform enteritis.

"Reasoning from the simple fact that the disease is catarrhal, we admit the existence of a modification of the whole economy, and of some alteration of the blood.

"A study of the anatomico-pathological descriptions of the disease, and especially the observation of cases, demonstrates that the gastro-intestinal tube of children dying of this affection may be found in four different conditions:

"*a*. Either the stomach is softened without any lesion of the digestive tube.

"*b*. Or the stomach is softened, at the same time that the mucous membrane of the intestines, and especially its follicular apparatus, is diseased.

"*c*. Or the stomach is healthy, whilst the follicular apparatus or the mucous membrane are diseased.

"*d*. Or, lastly, the gastro-intestinal tube fails to exhibit any lesions appreciable by our senses in the present state of our knowledge, or it presents alterations too insignificant to explain the gravity of the symptoms."

. . . . "Up to this point the disease resembles all other catarrhs, but what gives to it a special type is the abundance of the serous secretions and the disturbance of the great sympathetic nerve.

"The serous secretion, which seems to be produced by perspiration (analogous to that of the respiratory passages and of the skin), rather than by a follicular secretion, shows, perhaps, that the elimination of morbid matter is accomplished by other organs than the follicles; and we ought perhaps, to see in this a proof that the matters to be eliminated are not the same as in simple catarrh. On all these points we are compelled to remain in doubt; we content ourselves with stating the fact.

"The functional derangements of the trisplanchic nerve play an important part in the disease; under this point of view it differs from the mild form, in which the innervation is normal, and from the cerebral form, in which it is especially the cerebro-spinal apparatus that is sympathetically affected. The proof of a disturbance of the ganglionic nervous system, rests upon the following physiological and nosological considerations:

"The disease exists at the age and in the physiological condition (dentition), in which functional derangements of the nervous system without lesions of organs are most frequent; it is often complicated with those very disorders of the general innervation, as is proved by certain profound changes in the functions of nutrition, circulation, and calorification, which the amount of material waste will not always account for. We occasionally observe the same symptoms of nervous sideration, and particularly the extreme smallness of the pulse, and the algid phenomena, to arise in certain of the most violent attacks of spontaneous peritonitis. Now these phenomena, which cannot always be referred to the intensity of the pain, and which do not exist in inflammations of the other serous membranes, no matter what the rapidity of their course, are only to be explained by the fact that

the disease, seated in the abdomen, envelops the ganglia of the great sympathetic nerve."

Since the date at which this was written, our knowledge of the functions of the sympathetic nerve, especially with regard to its power of regulating the calibre of the arteries, by inducing contraction or allowing relaxation of their muscular coat, has been much advanced; and we are fully prepared to understand how the symptoms of cholera collapse might be explained upon the supposition of a widespread powerful irritation of the fibres of the sympathetic nerve, so richly distributed to the coats of the vessels throughout the alimentary canal, and which have such intimate relations with the nervous supply of the whole arterial system, as well as of the heart and lungs.

Thus we can most readily explain in this way, the small, thready pulse; the cold, pale, and shrunken skin; the asphyxia and coldness of the breath; the diminution in the formation of urea and in the secretion of urine.

The above views of the pathology of choleraic collapse, have been of late ably supported by Sedgwick (*loc. cit.*), and Dr. Horace Jeaffreson (*Edin. Med. Jour.*, December, 1866, p. 520).

At the same time, the probability is that the vaso-motor nerves of the intestinal walls themselves are paralyzed, from exhaustion of their excitability, so that dilatation of the vessels occurs with profuse discharge of serum.

So far as experimental research can be made available in deciding questions involving such deepseated and delicate parts, the results entirely confirm the explanation given above. Thus Moreau[1] has found that, after section of the branches of the sympathetic nerve supplying the intestines, a copious secretion of alkaline serous fluid takes place into the bowel.

Symptoms.—Restricting, as we now do, the term cholera infantum to cases which have a truly choleraic character, we shall have a smaller ground to go over than we had in our early editions.

The *invasion* of the choleraic symptoms is sudden. The child may have been quite well previously, or may have been the subject for an indefinite length of time—days or weeks—of simple or inflammatory diarrhœa, when, from exposure to high summer heats (85° to 95° Fahr.) in a city, or more rarely, in the country; from being allowed to take some unwholesome article of food; from the effort of cutting teeth; or perhaps from having been chilled by night-air, or by a sudden change of the weather from hot to cool; the choleraic disorder breaks out, with almost simultaneous vomiting and purging. The diarrhœa is, from the beginning, violent. The stools are usually frequent, consisting almost entirely of a thin fluid, which runs through the napkins and wets the clothes of the child. Sometimes the discharges are not very frequent, but each one may be so large as to wet not only the napkins and clothes of the child, but to run

[1] Comp. Rend. de l'Acad. des Sciences, t. lxvi, p. 554, 1868, in Medical Times and Gaz., April 11th, 1868, p. 397.

through to the lap or bed on which the patient lies. The chief and important characters of the stools in true cholera infantum, as in cholera of the adult, are their fluidity and quantity. These two characters, more than the vomiting or the nature of the discharges in any other respect, are the special signs of the disease, and by the degree in which they are present do we recognize the disease, and usually determine its severity. The fluid thus rendered by stool may be of different characters. It may be an almost colorless liquid, merely wetting the napkins and clothing, as though they had been dipped into a bucket of water, or saturated with the pale urine of a healthy infant: or they may consist of the same watery fluid, holding in suspension small and soft flocculi of fecal matter of a yellowish or greenish color, or small detached portions of mucus, which are left upon the napkins as the watery fluid drains through them. When the stools are of this kind, they are usually almost inodorous. In other cases, they are still very watery, but the fluid is yellowish or brownish in color, contains rather a larger amount of thin feculent matter, and has a most offensive odor,—an odor which is peculiar for its extreme fetidity, a fetidity so great that we have known it to cause vomiting in those exposed to it, and so adhesive as to render it necessary to change at once all the clothing and bed-linen of the child, and even then the fetor may cling to the body of the patient, after repeated washings. This odor we have seldom met with except in the choleraic form of summer diarrhœa. The number of the stools varies greatly. We have known as many as twelve to be passed in as many hours. In other cases they are not so frequent, but the quantity at each time may be so great as to drain the body of its fluids at a more rapid rate than many more evacuations of an ordinary size. Eight, twelve, fifteen, or more than twenty stools in twenty-four hours are not rare. In one fatal case, in a child between one and two years old, there were between twenty-five and thirty stools during the second night of the attack, in a space of twelve hours.

Simultaneously with, or soon after the diarrhœa sets in, there is vomiting. The matters vomited consist at first of the ordinary contents of the stomach, food, and water. Soon these matters consist of the water or medicines that may be taken, and of a serous or sero-mucous fluid mixed with small portions of bilious matter. Sometimes they are tinted green as so often happens in the gastro-intestinal affections of children. The vomiting may or may not be very frequent. Sometimes it is one of the severest elements of the disease, causing everything taken to be rejected almost as soon as swallowed, or assuming the form of repeated and exhausting retching, even when the stomach is quite empty. In connection with these symptoms there is rapid loss of strength. The child is listless and still between the evacuations and vomiting, or tosses and moans with the jactitation of severe illness. The appetite is lost, but thirst is extreme, and constitutes one of the marked phenomena of the disease. Water and ice are seized upon with the greatest avidity, and taken almost incessantly, if allowed, though rejected only a few moments afterwards.

The abdomen is flaccid or retracted, not tender to the touch usually, and the walls inelastic, so that they can be readily pinched up into folds.

The tongue, moist at first, with a thin white fur upon it, becomes pasty or dryish after a time, and is sometimes protruded from time to time between the lips.

The pulse runs up from the first, rising soon to 130, 140, and 150, and being usually small in volume, whilst the temperature remains for a time normal, rises slightly above the natural point, or, in some few cases, the skin becomes hot. The urine diminishes in all these cases, and in very severe ones, ceases to flow, or flows only in the smallest quantities. As in true cholera, the degree of suppression of this function is in proportion to the severity of the choleraic discharges. The respiration, natural at first, soon becomes, if the case goes on unfavorably, irregular, unequal, and anxious. The temper is irritable at the beginning, the child being restless, peevish, disposed to fret and cry at the least contradiction or disturbance. The sleep is restless and disturbed, especially at night. The child wakes frequently, and almost always with crying. When asleep, the eyes are often but half closed, and the brow contracted and frowning. The countenance soon becomes anxious and distressed. In sudden and severe attacks, it is languid and subdued, pale and contracted.

If the disease is not soon checked, signs of collapse make their appearance, and become more and more marked features. The body becomes cool and then cold, the pulse grows smaller, thready, and very rapid; the features are drawn; the nose is sharp and thin; the eyes shrink within the orbits; the cheeks become sunken; the patient passes into a still, quiet, and drowsy state; the vomiting may cease, but the diarrhœa usually persists; the child falls into a comatose or semi-comatose state, and death occurs quietly in this condition, or may be preceded by slight convulsive movements. According to the researches of Roger (*op. cit.*, p. 399), the reduction in the temperature of the axilla never approaches, in these cases of sporadic cholera, that which is found in cases of the true epidemic form occurring in children. Some very violent cases run their course in a day, a day and a half, or two or three days. We, ourselves, do not recollect to have seen any case terminate sooner than in three days and a half.

In favorable cases, after one, two, or three days, the diarrhœa ceases to be so violent; the stools grow less frequent, smaller in quantity, thicker in consistence, containing a better-concocted fecal matter, and regaining a more natural odor. The vomiting and thirst gradually subside; food is again taken and retained; the circulation falls, and the child, though weak and thin, and the subject for some days of a simple diarrhœa, may regain its health in great measure, at the end of a week or ten days. More frequently, however, the disease assumes the form of a more obstinate simple, or inflammatory diarrhœa, which may last for several weeks, to take on again, perhaps, from a recurrence of the exciting causes, the choleraic form, or to persist in one of the former shapes until the return of cool weather.

Such is a picture of the disorder to which we think the name of cholera infantum ought to be restricted. If physicians could agree to limit the title to this true choleraic disease, our mortality returns would soon show the comparative frequency of death from this disorder, and from those

more tedious and chronic diseases which have already been treated of under the designation of simple and inflammatory diarrhœa or entero-colitis.

The *duration* of cholera infantum, as we restrict the term, is seldom more than two, three, or four days. It may prove fatal in a much shorter time. Dr. Eberle (*Dis. of Children*, p. 285) says it sometimes runs on to a fatal termination in five or six hours. Dr. J. Lewis Smith (*op. cit.*, p. 392) reports a case in a child sixteen months old, which ended fatally in less than one day; a second, at seven months, after a sickness of about one day; and a third, at twenty months, in thirty-six hours. We do not recollect, in our own experience, which has been chiefly in private practice, a shorter case than one of three days and a half. In favorable cases the diarrhœa usually persists, as already stated, for several days after the disappearance of the choleraic phenomena, and very frequently runs on into a simple or inflammatory diarrhœa, which follows the law of these disorders.

Diagnosis.—The diagnosis of cholera infantum requires no particular elucidation. The season at which it is most prevalent; the profuse, serous, or at least fluid evacuations; the frequent and severe vomiting; the early exhaustion of muscular strength; the rapid pulse, with absence of, or a very moderate febrile heat; the threatening or the actual supervention of collapse, marked by cool or cold surface, pinched and anxious countenance, shrivelled skin, sighing or irregular respiration, rapid and feeble or extinguished pulse, diminished or suppressed urinary secretion; with, finally, the still and limp body, and drowsy or comatose brain, all mark a disorder which is readily recognized after being once seen, or which may be distinguished by any intelligent person who has never yet met with such a case, if only the progression of the symptoms be carefully inquired into, and correlated with the present condition.

Prognosis.—Cholera infantum, as we restrict the use of the term, is, of course, always a dangerous disease. Collapse, which either threatens all who are attacked by it, or actually supervenes to a greater or less degree, is well known by all physicians to be one of the most formidable morbid conditions to which the body is liable. The degree of danger in any individual case must depend chiefly upon the ability of the physician to arrest, and of the patient to resist, this state. The probability of the supervention of collapse depends very much upon the hygienic condition in which the child is placed, upon the age of the patient, the stage of the process of dentition, the present state of health, the innate vigor of the constitutional force, and also, we may say, upon the period of the disease and the degree of wisdom with which medical means are applied. Children placed in favorable hygienic conditions in the country, or in the healthier parts of cities, in large and well-ventilated rooms, and who have been fed upon proper diet, and who have therefore been attacked by the disease whilst in previous fair health, are much more apt to escape collapse, or to recover from it after it has made its appearance in a more or less marked degree, than those who are placed in conditions the opposite of those we have enumerated. Early age, recent weaning, improper artificial diet, and feeble vital powers from any cause, either inherent or acquired, are amongst the most

unfavorable prognostics. Still, we should never despair until the last moment, since we have seen some most surprising recoveries from apparently desperate conditions in this disease.

The prognosis may be stated in general terms to be unfavorable in proportion to the frequency and violence of the vomiting, the number of the stools, the severity of the fever, and the more or less marked character of the collapse. When the discharges consist merely of serous fluid, and are copious and frequent; when they consist of small quantities of deep-green matter, mixed with much mucus or with blood; when accompanied by straining; when they number from fifteen to twenty-five in the day; when they are very fetid; and when, with these symptoms, the abdomen is tense and tympanitic, the countenance pinched, the expression languid, the extremities cool, the pulse rapid and small, and the child irritable and restless, or, on the other hand, very still and subdued, the prognosis is exceedingly bad. If, after the symptoms just enumerated, drowsiness or stupor, and then coma, convulsions, rigidity, or paralysis make their appearance, there is scarcely a hope left.

The favorable symptoms in any case are, diminution of the fever; equal temperature of the whole surface; cessation of vomiting; decrease in the number of the stools, and a return to their natural color, consistence and odor; quiet, tranquil sleep; return of appetite; and lastly, a restoration of the natural temper and gayety of the child.

Prophylactic Treatment.—The danger to which teething children are exposed from residence in this city during the hot months of the year, is now so well understood that most families who can afford it remove to the country during the warm season, and by this course very generally avoid the disease. It is undoubtedly the best plan that can be adopted, and very commonly succeeds. When this cannot be done, however, the prophylactic treatment consists in a most careful attention to diet, dress, and exposure to the open air. If possible, the child should be kept at the breast until it has passed through its second summer, as there is but little danger from the disease after that period. If the weaning must take place prior to that age, it ought to be accomplished before the hot weather begins, as a change from the breast to artificial food during the warm season is very apt to bring on the disease. If the child is weaned, the diet must be strictly attended to. Up to the age of ten months or a year, the food should consist almost wholly of milk containing arrowroot, rice, oatmeal, or some farinaceous substance in small quantity. A little plain chicken or mutton water, with rice boiled in it, or a piece of beef or chicken to suck, may be given occasionally, but all vegetables and fruits should be strictly forbidden. After the age of ten months, some light soup and small portions of mutton, chicken, or very tender beef, minced very fine, may be given every day in addition to the milk food, which must still form the major part of the child's nutriment. Fruit of all kinds, all vegetables except rice and potatoes, and the latter are doubtful, ought to be carefully avoided until after the hot season has passed entirely away, or until the child has its full set of teeth. We have found the food prepared with

gelatin, in the manner described, to answer better than anything else for a large number of children to whom we have prescribed it.

The dress ought to be arranged according to the heat of the day. We have not rarely known young children to be kept clothed all summer in this city in thick flannel jackets, and petticoats, and woollen socks. This is certainly too much for the hot days which so frequently occur in July, August, and early in September, and is often, we believe, very injurious. A light gauze flannel shirt is the only woollen garment that need be worn during the warm season. On hot days a child should have only this, a muslin petticoat and frock, and the lightest possible socks, or none at all. If, as constantly happens in our climate, a cool day comes, there should be added to these a light flannel petticoat.

It is of the utmost importance that children should pass as large a portion of the day as possible in the open air. In the country this is easily managed, and parents almost always contrive to accomplish it; but in a city, many people seem to think it of less importance, or their servants are occupied with other things, and it is neglected. It is nevertheless a matter of the greatest consequence; the child ought to be kept in the air by the nurse for several hours in the morning and evening, either in the garden attached to the house, if there be one, at the front door, walking in shady streets or public squares, or, better still, making short excursions into the neighboring country, taking care, however, to avoid the intense heat of the sun during the middle of the day.

We believe that with constant and wise attention to these points, viz., diet, dress, exposure to the air, and exercise, much may be done towards preventing the disease even in families obliged to remain in the city during the summer.

As stated in the account of the symptoms, the choleraic disease often supervenes in children who have already been the subjects of simple or inflammatory diarrhœa. When, therefore, a child in the city has diarrhœa, if it do not yield readily to treatment, and especially if the stools begin to be thin and watery, with any marked tendency to exhaustion, it ought to be regarded as being threatened with cholera. In such an event, the best prophylaxis in the world is instant removal to some high country locality or the seaside.

Treatment of the Attack.—Regarding this disease as a truly choleraic one, we shall follow, in the consideration of its treatment, the plan adopted by some of the more recent writers on Asiatic cholera; and shall accordingly divide our discussion of this subject into the treatment appropriate for the three stages of *evacuation*, *collapse*, and *reaction*.

Every young child who is attacked with diarrhœa, whether simple or inflammatory, in the summer season, ought to be regarded as liable to cholera, and should be carefully watched to prevent the development of this disease. For the proper treatment of such conditions, the reader is referred to the article on those affections.

Should a child, either previously well, or the subject of diarrhœa of the ordinary form, be attacked with sudden, profuse, frequent, and watery discharges, and especially, should these be associated with vomiting, with

spasmodic intestinal pain, and with any appearance of general exhaustion, it ought to be presumed to be in the early or *evacuation stage* of cholera infantum, or in what is the analogue of the evacuation stage of epidemic cholera. Under these circumstances, it has been a prevalent practice here to give a cathartic, castor oil, calomel, or rhubarb. We think the practice wrong, unless there be positive evidence that the attack has followed directly upon the use of some unwholesome article of diet. If it be found that the child has certainly eaten some such food, green apples, currants, gooseberries, or articles of this kind, and that these have not come away in the discharges, it is right to give first a moderate purgative. We prefer castor oil or syrup of rhubarb, half a teaspoonful of the former, or a teaspoonful of the latter, with two drops of laudanum at the age of one year, or a teaspoonful of castor oil, or two of the syrup of rhubarb, with four drops of laudanum, or two drops of chlorodyne,[1] at two or three years of age. Two hours after this dose, if the stools continue frequent and watery, we use the chalk mixture, with tincture of krameria and laudanum or paregoric (a teaspoonful of the chalk mixture with ten to fifteen drops of the krameria, and one drop of laudanum, or five of paregoric) every two hours at the age of one year. Thirty drops of the syrup of nutgalls (see article on entero-colitis), with an opiate every two hours, is often very useful. We believe that the great object is to arrest the watery discharges by stool. If the above means fail, laudanum may be given by injection, and two drops at one year, and double the dose at two years, every two or three hours, may be tried in addition to the above treatment. The quantity of opium must depend on its effects. Children, like adults, bear very different amounts. As soon as positive drowsiness appears, or the pupils become contracted much below their natural size, the doses must be suspended or diminished, or the intervals between them lengthened. Of course, if the stools lessen in frequency, quantity, or fluidity, the same reduction in the amount of the opium ought to be made.

When vomiting is severe and frequent, and the above remedies are rejected, we may use the one proposed in the article on inflammatory diarrhœa, consisting of solution of morphia, dilute sulphuric acid, and curaçoa cordial. This, or some similar remedy, is at times very successful. It is nineteen years since one of us saw a child nine months old, in deep collapse from a most violent attack of cholera infantum, who rejected its mother's milk as though it had been tartar emetic, whose stomach was only made worse by calomel, but who began to improve very soon upon doses consisting of two drops of aromatic sulphuric acid, and five drops of solution of morphia, in a teaspoonful of iced water, every hour. Since then we have frequently used the mixture above recommended in such cases, and we think, on the whole, with more control over the vomiting than anything else we have tried.

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[1] The preparation which we prescribe under the name of chlorodyne is not Dr. J. Collis Browne's, but is made by Messrs. Bullock & Crenshaw of this city. It contains one grain of morphia to the fluid drachm; but, as it does not drop less than 120 to the fluid drachm, the dose for an adult is 10 to 15 drops. It is a very elegant preparation, and has proved most efficient in our hands.

The experience gained by careful and lengthened observation in the treatment of the evacuation stage of Asiatic cholera, may well be applied to the affection under consideration, so much alike are they. Dr. Goodeve (*loc. cit.*, p. 177) gives first a full dose of opium (he says that calomel was generally combined with it in India, and though he does not "know that the calomel does good, it does no harm"), to an adult two grains, and half an hour afterwards he begins with an astringent, in his own practice, usually the following mixture:

℞.—Plumbi Acetat., . . . gr. xxx.
Acid. Acet., ... ♏x.
Aq. Destillat., ... ʒvj.—M. et ft. sol.
One ounce or half an ounce every half hour or hour.

At the end of an hour from the administration of the first dose of opium, if the purging persisted, he gave one grain of opium and continued the astringent. A small teaspoonful, or two-thirds of an ordinary teaspoonful of this solution would contain about half a grain of the acetate of lead, and this might safely be given to a child a year old for several doses. We have not used this remedy ourselves, but it comes from a source which commends itself to us, and we shall not hesitate to use it when the occasion presents itself. As soon as the frequency of the discharges is arrested, the doses should be given at longer intervals, and when the peculiar serous character of the stools has disappeared, this remedy ought to be suspended, and some more simple one substituted, in order to avoid the possibility of producing the toxic action of lead.

If, in spite of the treatment, the stage of *collapse* should set in, other methods of treatment must be adopted. Here the stools are usually in great measure arrested, or they are few in number and small in amount. The object to be sought after is to produce reaction, or rather to favor the efforts of nature to bring about this change. It is now generally acknowledged by men of large experience, that the old plan of pouring in large doses of opium and alcohol is a great mistake. But little is absorbed by the stomach whilst the body is in this condition, and not unfrequently the patient is injured, perhaps fatally, by the sudden absorption of these substances, when the stomach begins to act after reaction has taken place. The opium may cause dangerous or fatal stupor, or may increase or keep up the tendency to suspension of the urinary function, and thus promote one of the great dangers of the disease, uræmic intoxication. The alcohol, if it has been used in large quantities, would also tend to clog the nervous centres, to cause gastric or gastro-intestinal catarrh, and to heighten beyond a safe point the febrile movement which is so apt to accompany the reaction stage. Opium, therefore, should be avoided during collapse, or given only in the smallest doses. Alcohol, though it should never be given in large doses, and recklessly, as has so often been done, may be used in small quantities, especially if it be found by close watching, that it promotes the force and volume of the pulse. Ten or fifteen drop doses of old and delicate brandy, in a teaspoonful or tablespoonful of ice-water, may be given

every hour or two hours, at one year of age. During collapse the stomach is still often very irritable, and yet the thirst continues intense. We are glad to find that such men as Drs. Maclean and Goodeve recommend the free use of ice and water under these circumstances. Our own practice, for years past, has been to allow ice and cold water, almost without limit, to children in this condition, and we are much pleased to know that such, too, is the practice of these gentlemen. We never could understand the wisdom of refusing water to patients who were suffering the horrid thirst produced by the immense losses of the water of the body by serous purging. The degree of thirst for water (a natural and not a secondary diseased instinct, like that of the drunkard for alcohol) must be the safest guide we can have as to the need of the body for water, and as such, it ought always, it seems to us, to be gratified, unless under very rare and most peculiar conditions. We give water and ice, even though the child vomits from time to time, believing and hoping that some will be absorbed to take the place in the tissues of that which has been drained off through the intestines. This point in the treatment we regard as so important, and one, we think, so much misunderstood by the public and by some medical men, that we make the following quotation from a note of Professor Maclean's to Dr. Aitken (*Aitken's Practice*, vol. i, footnote, page 663): "Urgent thirst is one of the most distressing symptoms in cholera; there is incessant craving for cold water, doubtless instinctive, to correct the inspissated condition of the blood, due to the so rapid escape of the *liquor sanguinis*. It was formerly the practice to withhold water—a practice as cruel as it is mischievous. Water in abundance, pure and cold, should be given to the patient, and he should be encouraged to drink it, even should a large portion of it be rejected by the stomach; and when the purging has ceased, some may with advantage be thrown into the bowel from time to time." The use of water by enema, when the diarrhœa is checked, is a point which ought not to be neglected, especially if the stomach continues weak and irritable. A gill of tepid water may be used at a time, thrown slowly and gently into the bowel, in the case of a child one or two years old. If this is retained well, the same quantity may be repeated in one or two hours.

Whilst the collapse lasts, but little food can be taken. It is seldom retained if used in any quantity, and the stomach has lost, in great measure, its digestive power. The only food we have found at all available has been thin chicken tea, Liebig's cold extract of beef, or weak wine-whey, given in two or three teaspoonful doses, every half hour or hour. It is worse than useless to attempt more than this, as not only is it not retained, but it evidently tends to keep up the nausea and vomiting, and thus retard the natural effort at reaction. As to remedies in this condition, we doubt whether anything better can be done than to use water, as just advised, and small doses of brandy, and, if they can be borne, small quantities of the liquor ammoniæ acetatis, ten to twenty drops, in cold water, every hour, at one year of age. There is, however, a remedy which has obtained a great reputation amongst the English army surgeons in India, for the promotion of reaction in the collapse stage of epidemic cholera, which we

have used ourselves with advantage in adults, but not in children, though we propose trying it when we next have a good opportunity. It is spoken highly of by Dr. Maclean. The formula is as follows:

℞.—Ol. Anisi, Ol. Cajeput., Ol. Juniper., āā, . .	f℥ss.
Æther., ...	f℥ss.
Liq. Acid. Halleri, ...	f℥ss.
Tinct. Cinnamom., ...	f℥ij.—M.

The dose for an adult is ten drops every quarter of an hour, in a tablespoonful of water.

An opiate may be given with the first and second doses, but should not be continued, for the reasons already given. The liq. acid. Halleri consists of one part of concentrated sulphuric acid to three parts of rectified spirit. The dose of this mixture for a child a year old, ought, we think, to be about one or two drops in a teaspoonful of water, given, as above stated, every quarter of an hour. So much is this valued in India, according to Dr. Maclean, that it is always ordered to be kept in store in the "medical field companion" of armies on the march.

It must not be supposed that all children seized with choleraic diarrhœa are necessarily to pass through the collapse stage in all its terrors. On the contrary, many, when judiciously treated early in the disorder, escape collapse altogether, and yet they have had none the less the true choleraic disease. Others suffer more profuse and exhausting losses of water by the discharges, or their vital power of resisting disease is less, and they pass into more or less deep collapse; or hang, as we have seen them, on the very edge of that condition, for one or two days, and then emerge from the danger, without having done more than cause the experienced physician the grave anxiety which such suspense must and ought to create. During these doubtful moments of the attack, the child should be kept as quiet and still as possible. He should be made to lie in a constantly horizontal position, on a smooth and easy mattress, in the crib, or on a large and roomy bed, and as little as may be on the lap, which is uneven and unsteady, and which must give his weak and exhausted muscles more work to do than they would have on the more solid and even bed. If, however, the nature of the child be such that he clings to the mother's or nurse's lap as his only safety, or if he have been taught (a most ill-judged lesson) to prefer the lap to any other position, we must yield to him, rather than cause fretting or unhappiness, when his very life may hang upon the avoidance of all disturbing influences. In this case, it is well to place him upon as firm a pillow as can be found, and let him be held on this in the lap. It is important to move him, when this becomes necessary, as slowly and gently as possible, always keeping the body on a horizontal plane, to avoid the tendency to the syncopal state, which sudden movements, and especially the sitting or erect position, are apt to produce. When the tendency to cooling of the body shows itself, and this is usually first noticeable in the hands and feet, ears and nose, he should be kept wrapped in warm, dry, and soft flannels or blankets. Flannels heated at the fire, thus sup-

plying dry artificial heat, are of great use here. Bottles or tins filled with hot water, ought to be placed at the feet, under the blanket. A warm, soft, and light poultice of Indian meal or flaxseed, with a little mustard incorporated with it, may be placed over the abdomen, or three or four thicknesses of flannel, wrung out of hot water and whisky, may be laid over the lowest part of the thorax and over the abdomen, and covered with oiled silk, to retain their heat and prevent the wetting of the clothes. Whilst artificial heat is thus made use of, fresh air must not be excluded. On the contrary, as these cases almost always occur in the hottest summer weather, the largest supply of fresh air that can be obtained must be admitted. Warm baths, which were proper and useful during the early stage, especially when fever was present, we have not found useful in these cases. The fatigue and irritation caused by the disturbance of undressing and dressing the child, have seemed to us to do more harm than any good derived from the heat of the water compensated for.

When the case takes a favorable turn, and the *reaction stage* begins, it is usually best to do nothing more than supply food and water carefully, and keep the body quiet and tranquil. The food may be cautiously and slowly increased in quantity, if the stomach has become settled. Tablespoonfuls of thin chicken tea, just flavored with salt, or of Liebig's cold extract of beef, or of light beef tea, or of a mixture of wine-whey with two or three parts of thin arrowroot decoction (a teaspoonful to a pint), may be given every half hour or hour. If these are retained several times, and the child shows some little anxiety for food, the same materials may be given in wineglassful quantities. At the same time, water and ice ought to be allowed from time to time, as the thirst may call for them. On the second or third day of the reaction, we may give, if the child shows a desire for it, a little milk and water and lime-water, one part of milk to one or two of water, with one of lime-water, commencing with not more than two or three ounces of the mixture at each feeding. The milk ought certainly to be very much diluted for the first three or four days after it is allowed. When the child has been carried thus far safely, we may gradually return to its former habits of feeding, allowing meat to suck, a little bread, and so on, if it is old enough for such habits.

As to drugs during the reaction stage, they are not necessary if everything goes on well. If, however, the fever run high, we may use small doses of the spirit of nitrous ether, as ten drops, in iced water, every two hours at one year, or twenty drops of the solution of acetate of ammonia, in the same manner, at the same age. If, as often happens, the urinary secretion remains scanty, water, in such quantities as the stomach takes willingly, makes probably the best diuretic; or we may use the spirit of nitrous ether, as just recommended, with a grain of acetate of potash and half a drop to a drop of tincture of digitalis, every two hours, for a day or two.

When reaction is thus successfully brought about, the child may either improve rapidly and regain its previous health, or simple or inflammatory diarrhœa may set in, and pursue the usual course of those disorders. In the latter event, the child, if the attack of cholera have occurred in the

city, ought certainly to be removed to the country if possible, since it is only too apt to have a recurrence of the choleraic disease if kept in town, or to suffer, at least, a tedious and more or less dangerous attack of the simpler form of diarrhœa. For the proper treatment of either of these sequences to cholera, the reader is referred to the articles on those diseases, with the warning, however, that all such patients ought to be treated with every minute care as to hygienic and therapeutic measures that experience and art have taught us, since the health has been so rudely shaken by the sickness already endured.

We have now laid before the reader, to the best of our ability, what we think is the best method of treating cholera in children; but, before quitting the subject entirely, we wish to make a few remarks upon points not referred to in the above account.

Attention to the *state of the gums* should never be neglected in teething children. Our experience leads us to believe most implicitly that the process of dentition, or at least that and other concomitant constitutional conditions, are constant predisposing causes of gastro-intestinal disorders in early life, and that the active hyperæmic state, or positive acute inflammatory condition, which often attends upon the near approach of teeth to the surface of the gum, may become an exciting cause of acute digestive diseases, such as cholera. We think it is always well, therefore, to examine into the state of the mouth in a choleraic child as in other infantile disorders; and if the teeth are felt distinctly through the gums, and the gums be found swollen, tense, hot, and highly vascular, to cut them freely once. If, on the contrary, the gums are firm, not hot, not redder than usual, and the edges of the teeth cannot be felt, it is foolish meddlesomeness to cut them.

Baths.—In the early stage of cholera, before collapse has begun, and whilst the child is still reasonably strong, and particularly when there is marked febrile heat and dryness of the body, we think that the use of the warm or hot bath, or of sponging with hot water and spirit, are excellent measures. The bath may be used twice, or even three times a day if the child does not resist and scream. The temperature should be 95° to 98°, and the child may be kept in the water from five to ten minutes. It is an excellent plan to wrap the child, directly on lifting it from the bath, in a heated muslin sheet, and to apply over this a blanket, and keep it thus enveloped on the lap for half an hour or more if it is comfortable and disposed to rest. If the child be somewhat weak, whisky, added to the water, renders the bath more useful and safe. When the use of a bath alarms or annoys so as to cause violent agitation, it is best to substitute sponging with hot water and whisky or vinegar, under a light blanket, two or three times a day.

Antiphlogistics.—It may appear to many, in these modern times, a mere waste of words for us to state that we are opposed to bloodletting, in any form or at any stage of cholera infantum. But if any such will take the trouble to look over the works of writers of ten and twenty years back, he will find reason to think that if this be our opinion, it ought to be expressed. When one of ourselves began to practice, in 1841, it was quite

the custom to take blood for the nervous symptoms which are present in the early stage, and still more for the comatose phenomena at the close. This was done on the theory that these symptoms were the result of congestion or inflammation of the brain, whereas now they are looked upon as the results of exhaustion, of the altered conditions of the blood, or of uræmia.

Calomel.—The opinion was expressed in a former edition of this work, that the doses of calomel usually recommended were too large for young children, and were apt to aggravate the existing irritation of the digestive mucous membrane; and that such doses of a remedy acknowledged to be a powerful sedative, could not be proper in a disease which constantly tended towards exhaustion and collapse. It was also stated that the small doses which we did recommend had been declared by some critics to be entirely too small, and that to this we could only reply that the larger and more careful, and, we hoped, the wiser our observation had been in the last few years, the more thoroughly convinced were we that the larger doses, such as were formerly recommended and used by nearly all writers and practitioners, were not only unnecessarily large, but most seriously objectionable. We went on to say that the indiscriminate use of this remedy, in nearly all cases of the gastro-intestinal diseases of childhood became with some, we believed, a mere routine habit—that they never tried what might be accomplished without it, but went on pushing the drug in constant doses, when the case, if trusted to simpler means, or even left to the efforts of nature, would often do much better, we had learned to believe, than when these delicate organs were made the receptacle of doses that could not but tend to keep up the nausea, and vomiting, and diarrhœa, which form so important a part of the morbid phenomena. The experience we have had since that time has but confirmed us in these opinions. Indeed we have so often been disappointed in obtaining any good effects from this drug, and have so often had reason to think that, instead of allaying nausea and vomiting, it increased them, and added to the exhaustion which is one of the dangers always to be contended against, that we have virtually abandoned its use in this affection.

ARTICLE IV.

DYSENTERY.

It seems to us unnecessary to make more than a few remarks on dysentery, since we have already spoken of the morbid conditions of the large intestine, in our article on entero-colitis. Dysentery, however, differs from this latter affection by the fact that it frequently occurs in an epidemic form, and that there is a tendency to more rapid and extensive ulceration of the mucous membrane of the rectum and colon. It is an acute febrile

disease, characterized by frequent evacuations, attended with more or less severe pain and straining, and consisting of muco-sanguinolent or sanguineous substances, which are due to ulcerative inflammation of the rectum and colon.

The *causes* of dysentery are but little understood, beyond the mere facts that it occurs as an endemic in some regions of country, and as an epidemic over large districts. It is frequent, also, as a sporadic disease, and in this form seems to depend upon the same causes as those already cited as productive of entero-colitis. Like cholera infantum, it appears to be more common in boys than girls, since of 39 cases of which we have kept notes, in which the sex is mentioned, 27 occurred in boys, and only 12 in girls. It is most frequent in the second and third years of life. Of 38 cases in which the age was noted, 1 occurred in the first year of life, 15 in the second, 7 in the third, 3 in the fourth, 3 in the fifth, 1 in the sixth, 3 in the seventh, 3 in the eighth, and only 2 from the eighth to the end of the eleventh year. It may be either idiopathic or secondary. As a secondary affection it is most apt to follow measles and variola. We have often known dysenteric stools to occur in the course of cholera infantum, and in a considerable number of cases such as we have described under the title of entero-colitis.

The *anatomical lesions* are confined chiefly to the large intestine, and are the same as those described under the head of entero-colitis, except that they are of a graver character. The mucous membrane is commonly found thickened, swelled, red, and softened; the submucous tissue sometimes presents ecchymosed points; the follicles are often diseased, their orifices being enlarged and ulcerated, as described under entero-colitis. In grave cases, particularly those occurring under an epidemic influence, there are usually more or less extensive ulcerations, which may implicate only the mucous, or extend to the muscular or even the peritoneal coat. In such instances, pseudo-membranous exudations are often formed, sometimes in large quantity, and often covering the ulcerations. The intestine contains sanguinolent mucus, or at times a brownish or greenish material which is evidently the result of a gangrenous condition of the mucous membrane, pus, and lastly false membranes. In some rare cases, perforation has been known to take place.

Symptoms.—The symptoms are much the same as those already described as existing in entero-colitis, excepting that the local symptoms are more severe, and the presence of blood in the stools constant. The disease often begins as a *diarrhœa*. The *stools* at first contain feculent materials, but after a time become very thin, small in quantity, and consist chiefly of mucus mixed with blood. The blood may be black and in considerable quantity, or of a dark rosy red color, or like the washings of flesh; it is mixed with greenish or yellowish substances, whitish mucus, fragments of false membrane, or purulent fluid. In young children there is evidently *pain*, from the restlessness, moving of the limbs, and crying about the time of the evacuations, while in those who are older, there is true *tenesmus*, like that observed in adults, and severe pain in the anus. The number of stools varies according to the severity of the case. There may be only four, eight,

or ten in the day, or many more. We have quite frequently known as many as 30 and 40 to be voided in the twenty-four hours, and in fatal cases, the dejections sometimes number three or four in an hour, while between the discharges the child often suffers from most violent and painful tenesmus.

The *abdomen* is generally distended, tympanitic, warmer than natural, and painful.

In mild cases there is usually no *fever*, or very little, while in severe attacks, there is high fever during the first few days, marked by frequent pulse, hot dry skin, followed after a time, unless a favorable change takes place, by coolness of the surface, contraction of the countenance, hollow, sunken expression of the eye, rapid emaciation, and death.

It is useless to give a longer detail of the symptoms, as they are the same as those already described in the article on entero-colitis.

The *diagnosis* presents no difficulties. The frequency of the discharges, the pain in the course of the colon and in the anus, the tenesmus, the character of the evacuations, and the febrile reaction, all make the disease easy of recognition.

The *prognosis* is favorable in mild cases, unattended with much fever, or very frequent discharges. When, on the contrary, there is violent fever in the beginning, followed by disposition to coolness and collapse; when the stools are exceedingly frequent, and attended with severe pain and almost constant straining; and when they consist of nothing but mucus, mixed with considerable quantities of blood, or with pus or false membranes, the prognosis is very unfavorable. Of 36 cases, the termination of which we have recorded, 4 proved fatal.

Treatment.—The treatment of dysentery in children is often very unsatisfactory. The mere variety of the remedies recommended by different writers and practitioners marks the uncertainty of the effects obtained from drugs. Mild cases so generally get well under any treatment that all methods have had their supporters and advocates, while grave cases, and especially those occurring under the influence of severe epidemic visitations, are so difficult of treatment, and often so little under the evident control of medical means, as to leave the careful observer in great doubt as to what he ought to set down as the evident result of his own interference in the case, and what as the results of the efforts of nature to cure the disease.

Mild cases of the disease, in which the fever is not very high, the number of stools not great, and the pain and distress moderate, require little else than *rest* in bed, a light and unirritating *diet*, and the use of *opium* in small quantities either internally or by injection. When there is reason to suspect the presence of unwholesome food in the stomach, or of unhealthy secretions in the intestines, it is necessary to give in the beginning small doses of some mild *cathartic*. The one generally preferred is castor oil, which may be given either simple, in the dose of a small teaspoonful containing one to four drops of laudanum according to the age, or in the form of emulsion. The latter is the mode of employing it usually chosen. A drachm of oil should be rubbed up with a scruple of gum, a little sugar, from two to eight drops of laudanum, according to the age of the child,

and seven drachms of some aromatic water. The dose is a teaspoonful every three or four hours. If the case continue to improve under the emulsion, it may be continued for a couple of days, but should the stools become more and more frequent, and the pain and tenesmus increase, it must be suspended after one or two days, and laudanum enemata, with or without the internal use of absorbents and astringents, substituted. The injections ought to consist of four or five drops of laudanum at two years of age, and of ten drops at five or six years, suspended in from half an ounce to an ounce of some mucilage, or thin farinaceous fluid, or simply mixed in a tablespoonful of tepid water, which is perhaps the best plan of all. The injections may be given every four or six hours if necessary, or they may be made use of only at night, while small doses of Dover's powder are administered every three or four hours through the day.

The *diet* in these cases should consist of arrowroot, sago, tapioca, or some such food, made into thin pap with milk and water; and the quantity allowed ought to be very moderate. Rest in bed, in the cradle, or in the lap, is very important. The child ought not to be allowed to run about, or use exertion of any kind.

Where the pain is severe and the fever high, and where there is a good deal of soreness in the abdomen, *depletion* may with propriety be resorted to, but always with moderation and prudence. A few leeches applied around the margin of the anus, or to the surface of the abdomen, often prove of great service in relieving pain and tenesmus. An occasional *warm bath* is very soothing and useful.

In very severe cases of dysentery the treatment is, as above stated, difficult and uncertain, owing to the dangerous character of the disease, and to the fact that so many different methods have been recommended by different writers.

In the early stage of a severe case, whilst the febrile reaction is high and the strength of the patient still unsubdued, depletion by leeches in young children and by venesection in older ones, is strongly approved of by many able practitioners. For our own part we have not resorted to it as a general rule, from the fact that we have so often found the strength of the child to fail rapidly under the disease itself. In a few of our cases, however, leeching around the anus has been followed by manifest benefit. The remedies most commonly depended upon are castor oil in emulsion with laudanum, mercury, sugar of lead, opium, nitrate of silver, spirit of turpentine, and astringents. The castor-oil emulsion, prepared as mentioned above, is useful in the early part of the attack, but ceases to be so, according to our experience, after the first twenty-four or forty-eight hours. From mercury we have not ourselves obtained any very positive benefit, though, in combination with opium and ipecacuanha in small doses, it is much thought of by many excellent authorities. The only remedy which is used by all, though it is rarely given alone, is opium, and the very fact that it is so universally employed points it out as one of the most reliable and valuable means we have at our command. It is certainly the one upon which we most depend ourselves. It may be given either alone or in connection with other substances. Where injections can be retained it

is best given in that way. About five drops of laudanum at two years of age, or ten drops at four or five years, may be given in a tablespoonful of any bland vehicle every four hours. When the rectum rejects the enema as soon as administered, the opium should be given either by the mouth, in the form of laudanum or solution of morphia, or in that of Dover's powder; or in the form of suppository. We should indeed strongly recommend the administration of opium in this latter form in such cases, since we unquestionably obtain a certain beneficial local action, in addition to its constitutional effect through its absorption. The amount of opium should be about the one-eighth of a grain at two years of age, which, together with any other remedy, such as acetate of lead, if it be desired, should be incorporated with butter of cocoa, a most bland and soothing substance, which dissolves readily at the temperature of the body. When made of this substance, and of proper shape and sufficiently small, the suppository can be introduced without pain, and will usually be retained. They should of course be repeated at intervals, depending upon the effect produced. Opium is almost always employed in connection with some other remedy, and particularly with calomel or acetate of lead. The dose of calomel is from a sixth to half a grain, or, as used by some practitioners, a grain with a twelfth of a grain of opium, or half a grain or a grain of Dover's powder, every three or four hours, for children two or three years of age. The acetate of lead is more relied upon, and has probably higher testimony in its favor than calomel. We have ourselves obtained excellent effects from it in some instances. The dose is from half a grain to a grain every two or three hours at two and three years of age.

There are two other remedies not yet mentioned, which have been of more positive efficacy in our own practice than any others, with the exception of opium. These are the nitrate of silver and the solution of the nitrate of iron. The former we have used both internally and by injection, the latter only by injection. For an account of the mode in which these remedies are employed by different authorities, the reader is referred to the remarks on chronic entero-colitis. We have employed nitrate of silver in 14 cases of dysentery. These were all severe attacks, and some of them most violent. Of the 14 cases, three died. The remedy was given by the mouth alone in 7 cases, by injection alone in 5, and by the mouth and by injection both in 2. It has proved most beneficial in its effects, in our hands, when given by the mouth, though its influence over the disease has always been less immediate than when used by injection, but it has been more permanent. The dose in which we have used it has varied with the age of the child, and with the severity of the symptoms. For children two years old we have usually employed from one grain to one and a half grains, and for those of five or six years or upwards, two grains dissolved in two ounces of a vehicle, consisting of an ounce each of syrup of gum arabic and distilled water. The dose is a teaspoonful every two or three hours. It is well, as a general rule, to add from four to sixteen drops of laudanum, according to the age of the subject, to the mixture. For use by injection we have commonly employed for each enema two grains for young children, and four grains for older ones, dissolved in four ounces of distilled water.

The injections are to be repeated twice or three times a day. After the nitrate of silver enema has come away, it is a good plan to throw into the bowel a laudanum and starch injection.

We have made use of the solution of nitrate of iron, to which allusion was made above, only as an injection in acute dysentery. We have employed it in eight cases, and are quite sure that it was of essential service in six, while in two it appeared to irritate, probably because the quantity given was too large. Our mode of applying it is to mix from ten to twelve drops in four ounces of tepid water for each injection. The injections were given twice or three times a day, and they were followed, as soon as they had returned, by a laudanum injection. On two occasions, the nitrate of iron injection remained in the bowel for several hours before being rejected, and thus restrained for that time the stools, which had previously been very frequent, and attended with much tenesmus.

When the stools continue very frequent in spite of the use of opium in some of its many shapes, when sugar of lead and nitrate of silver have been employed without controlling the frequency of the discharges, we have sometimes found the mixture of aromatic sulphuric acid, laudanum, and syrup of rhatany, before recommended, very beneficial. When the stools, in addition to their dysenteric characters, have been watery, and greenish in color, the chalk mixture, with laudanum and tincture of rhatany, kino, or catechu, repeated every two hours, with occasional laudanum enemata, has been very useful.

The *hygienic management* of dysentery should be precisely the same as that which was suggested as proper for entero-colitis.

ARTICLE V.

DISEASES OF THE CŒCUM AND APPENDIX CŒCI—TYPHLITIS AND PERITYPHLITIS.

Synonyms; Definition.—The diseases of the cœcum and of its vermiform appendix are so important and frequent, and present so many peculiarities, as to demand a separate and detailed consideration. In approaching their discussion, it is necessary to bear in mind several important points in which the cœcum differs from the rest of the large intestine. Thus its peritoneal investment is deficient over the posterior part, which is generally quite firmly attached to the right iliac fossa by connective tissue, containing a small proportion of fat. Its anatomical relations moreover indicate that the semi-feculent materials passing from the ileum are destined to be retained in the cœcum to undergo some important action. The ileum at its lower portion rarely has a calibre greater than one-third that of the cœcum, a circumstance which must materially retard the progress of the contents of the latter, and a further detention is caused by the

ileo-cœcal valve, which prevents all reflux, and by the position of the cœcum, which compels it to force onwards its contents in opposition to gravity. The view that the cœcum is the seat of an important part of the digestive process, either in the appropriation of any remaining nutritious elements of the semi-feculent chyme, the absorption of its watery parts, or the elimination of some excrementitious matter from the system, receives confirmation from the very rich vascular and glandular supply of the walls of this part of the intestine.

In addition to this, the cœcum has opening into it, usually at its lower and back part, the appendix vermiformis, a narrow, elongated, glandular process, varying from three to six inches in length, and having an average diameter about equal to that of a goose-quill, although its calibre is quite small. It is usually directed upwards and inwards behind the cœcum, and lies coiled upon itself. Its function appears to be the secretion of a viscid ropy mucus.

We thus see in the anatomical and physiological relations of the cœcum strong predisposing causes of many morbid conditions. Among these the most frequent are distension and impaction of its calibre by hardened fæces; the lodgment of a foreign body or intestinal concretion in one of its pouches or in the appendix, an accident which often excites violent and destructive inflammatory action; and finally localized inflammation of one or all of the coats of the cœcum or the vermiform appendix.

This last condition has received the names of typhlo-enteritis, from τυφλος, blind, and εντερον, intestine; typhlitis; and cœcitis, from the Latin word *cœcum*, also signifying blind.

The pericœcal connective tissue is also occasionally the seat of inflammatory action, constituting a condition known as perityphlitis.

Seat and Character.—Clinical experience and the researches of pathological anatomy fully justify us in recognizing the above-mentioned morbid conditions, but the question as to their relative frequency and importance is still far from being settled.

By some authorities the diseases of the cœcum are regarded as secondary to morbid affections of the appendix, the latter consisting generally in the presence of foreign bodies, or of hardened, inspissated mucus, which act as the focus and exciting cause of the inflammation of the cœcum.

It is probable, however, in regard to the simple form of typhlitis, that both the cœcum and its appendix are subject to a peculiar localized inflammation, involving all their coats, and due to the temporary arrest of some foreign substance or intestinal concretion in their cavity, or to the action of the causes to be hereafter considered. It is indeed possible that the inflammation excited by the presence of a foreign body may subside, whilst the cause still remains arrested in the appendix or one of the pouches of the cœcum; but experience would lead us to infer, that, when once inflammatory action has been excited, so long as the foreign substance which has caused it remains in contact with the mucous membrane, the tendency is usually to produce ulceration and perforation of the coats of the bowel.

We find this same discrepancy of opinion in regard to those cases at-

tended with perforation of some portion of the cœcum, and the formation of an abscess in the iliac region. Dupuytren, who was the first to call attention to the pathology of these *iliac abscesses*, attributed them to suppurative inflammation of the pericœcal connective tissue, produced in many cases by extension of inflammation from the coats of the cœcum, and held that the perforation of the bowel often found in connection, was a secondary phenomenon, and was in fact the *mode* by which the abscess was discharged. Inflammation and suppuration of the pericœcal tissue does indeed occur as an idiopathic affection, or from extension of inflammation from the cœcum, but it is of extremely rare occurrence; and there can be no doubt that nearly all cases of iliac abscess are due to perforative ulceration of either the cœcum or appendix. As Bouchut suggests, one proof that most cases of non-puerperal iliac abscess are thus due to perforation of the cœcum or appendix, is afforded by their almost constant occurrence upon the right side. Thus of 57 non-puerperal iliac abscesses collected by Grissolle, 9 only were on the left side; while of 26 puerperal ones, 15 were on that side.

It is necessary, however, to carry this question one step further, and to determine, if possible, the relative frequency of perforation of the cœcum and of the appendix. It has been supposed, as by Ferrall, that ulceration of the cœcum is in most cases the starting-point in the development of the lesions. But, while we are in possession of a sufficient number of recorded cases, 12 of which we have collected, where post-mortem examination has proved the abscess to have originated in perforation of the cœcum, there is good reason to believe that perforation of the intestine is much more frequently found associated with disease of the appendix than with ulceration of the cœcum itself.

Causes.—In addition to the anatomical peculiarities of the cœcum and appendix, which must be regarded as predisposing causes of these affections, there are other conditions which exert an unquestionable influence.

The *strumous diathesis* has been regarded as a predisposing cause of diseases of the cœcum and appendix. It does not appear, however, that inflammation of these parts is more frequent in strumous subjects, but merely that it has a greater tendency in such patients to run on to ulceration and perforation of the bowel.

Age.—The greater irritability and proneness to inflammation which the intestinal canal presents in early life, appears to have its effect upon the development of typhlitis, since a considerable majority of reported cases have occurred under the age of 25 years. This is particularly true of the milder attacks, which are not attended with ulceration. Thus, of 38 cases of typhlitis at all ages, which recovered without perforation of the bowel, 29 occurred at or under the age of 25; 9 only were in older persons. Of these 38, 13 occurred in our own practice, and were aged as follows: 2 under six years; 6 between 6 and 12 years; 5 between 12 and 15 years. Finally, 19 of the 38 cases occurred at or under the age of 15 years. This does not appear to hold true, however, with regard to perforative ulceration of the cœcum and appendix.

We have not met with any case of perforation of the cœcum occurring

during childhood, but of 25 cases collected from different sources, 13 occurred after the age of 25; 12 at or under that age. Of these 25 cases, 12 only were verified by post-mortem examination, of which 3 were under 15 years of age, 2 between 15 and 25 years, and 5 above 25 years.

Of perforation of the appendix vermiformis, we have met with 3 cases in children, aged respectively 4½, 8, and 11 years. Of 25 other cases, collected from various sources, in which the age is stated, 9 were above, 16 below 30 years of age. Of these 16, 3 only were under 15 years of age, so that, including our own 3 cases, we find 6 cases occurring under 15 years, 13 between 15 and 30, and 9 above 30 years of age.

Sex.—The influence of sex has been very variously stated by different observers. It appears, however, that males are somewhat more prone to all these forms of disease than females. Thus of 39 cases of typhlitis, which recovered without perforation of the bowel, 23 were in males; 16 only in females. Of 13 of these 39 cases, which we observed in children, 8 were males and 5 females.

Of 25 cases of perforation of the cœcum, 13 occurred in males; 12 in females.

The sex is stated in 27 of 32 cases of perforation of the appendix. Of these, 21 were males; 6 only were females. Of 6 cases occurring under 15 years of age, the sex is stated in 5, 4 of which were males.

Occupation.—Various occupations, especially those involving sedentary habits, have been supposed to predispose to these affections, as also the practice among females of wearing tight corsets. Experience, however, has not verified these suppositions.

Constipation.—A constipated state of the bowels undoubtedly predisposes to these affections by favoring the production of a distended and impacted condition of the cœcum, even if the presence of the hardened fecal matter does not prove the exciting cause of some cases of typhlitis. Rokitansky considers this cause so important that he has given the name typhlitis stercoralis to one form of inflammation of the cœcum.

Exciting Causes.—*Cold and Exposure.*—The action of these ordinary exciting causes has been denied by some observers on account of the frequent absence of a chill or rigor at the inception of the attack, and the development of the local before the general symptoms. It cannot, however, be doubted that typhlitis may be idiopathic, and arise from the ordinary exciting causes, though the cases are comparatively rare.

Food.—In several instances the attack appears to have been brought on by the use of indigestible or irritating articles of diet, among which may be especially mentioned unripe acescent fruits. It has been said that the use of oatmeal, which favors the formation of intestinal concretions, is also liable to be followed by this disease. It does not, however, appear that typhlitis is any less frequent in countries where wheaten bread is used, than in those where oatmeal forms a chief part of the food.

Blows or Exertion.—There are a few cases recorded in which a blow upon the abdomen, or a sudden violent strain, appears to have been the immediate cause of an attack of typhlitis.

Foreign Bodies and Intestinal Concretions.—This class, comprising very

various substances, certainly forms the most important and frequent cause of diseases of the cœcum and appendix.

We cannot be positive as to the amount of influence they exert in the milder and more tractable cases of simple typhlitis, though it is quite probable that many of these are caused by the temporary arrest of some foreign substance in the appendix, or one of the pouches of the cœcum. Thus, in a case reported by Dr. Wynn Williams (*Lancet*, January 25th, 1862), in a male adult, three months after a well-marked acute attack of typhlitis, which yielded to judicious treatment, a large intestinal concretion, having a plum-stone for a nucleus, was passed by the rectum. They are, however, the efficient cause of a large majority of all the cases of perforative ulceration of the cœcum and its appendix.

The diseases of this latter part, however, are far more uniformly dependent upon the presence of foreign bodies even than in cases of the cœcum; almost three-fourths of all recorded cases of perforation of the appendix having been due to this cause. In 6 cases occurring in children, some extraneous substance was found in the appendix in each one; in 2 a foreign body was present; and in each of the other 4, an intestinal concretion.

Many of these bodies are true intestinal concretions, having for their nucleus merely a nodule of hardened fæces or inspissated mucus. They vary considerably in size, the majority of them being about the size of a cherry-stone or date-stone, though Habershon mentions having seen one as large as a hen's-egg. They are also of very varying consistence, according to Volz, as quoted by Hanbury Smith, constituting three varieties: the soft, resembling excrement in appearance and odor, and having a nucleus of hardened fecal matter; the semi-hard, of a grayish-brown color, consisting of shining concrete layers, with a nucleus which is not a foreign body; and the stony, which are of a grayish-white or earthy color, and have a surface from which may be detached delicate scales, or which is smooth, shining, yellowish-white, or brown and studded with calcareous projections.

Many of these concretions consist of carbonate and phosphate of lime united with inspissated mucus. Copland also mentions one which consisted of cholesterin.

In addition to these, however, numerous foreign bodies have been found in connection with the cœcum or appendix, either free or forming the nucleus of an intestinal concretion. Among these may be mentioned grape-seeds, cherry-stones, date-stones, pins, bristles, fragments of glass, biliary calculi, and balls of worms, either ascarides or lumbricoids.

It may not be amiss to remark here, that some intestinal concretions resemble, to a marked degree, the seeds or stones of different fruits, particularly of the cherry, date, and plum; and there is no doubt that many of the bodies found in the cœcum or the appendix, and reported as cherry-stones or date-stones, have been in reality intestinal concretions.

Whatever be the nature and origin of these bodies, it is probable that in many cases some morbid condition of the mucous membrane of the cœcum

or appendix precedes their formation or lodgment, and the development of the grave symptoms which often follow.

As Habershon justly remarks, the ordinary calibre of the appendix is so extremely small and so thoroughly lubricated, that it must be very rare for any extraneous substance to become impacted in it so long as it remains healthy. A further argument in favor of this view is the fact that the presence of these concretions is attended by the most varying results, since very large and irritating bodies have been occasionally found occupying the cavity of the appendix without having produced any symptoms during life, or any inflammation of its surface; while, on the other hand, minute concretions of semi-solid consistence, and apparently unirritating in character, have frequently been observed to act as the foci of the most serious and destructive inflammatory action.

Anatomical Appearances.—In the simple forms of typhlitis, the mucous membrane of the cœcum presents the usual appearances of inflammation; the peritoneal investment is also involved, and besides injection and opacity of this membrane, there are adhesions formed between folds of the intestines.

When, however, ulceration is present, as often results from the presence of foreign bodies, or in strumous subjects, it is a matter of the utmost importance which portion of the cœcum is involved, since, as such ulcers have a strong tendency to perforate the coats of the bowel, if they occur on the anterior part of the cœcum, which has a peritoneal investment, there is the greatest danger of an escape of the contents of the bowel into the peritoneal sac, and the development of rapidly fatal peritonitis. Thus, of 10 fatal cases of perforation of the cœcum, in which the seat of the perforation was determined by post-mortem examination, the anterior wall was involved in 6 instances. If, on the other hand, the ulcer be seated on the posterior part of the cœcum, where it is attached to the iliac fossa by connective tissue, and devoid of a peritoneal covering, perforation is not directly followed by any such unfortunate results. Inflammation is excited in the pericœcal connective tissue, suppuration ensues, and the resulting abscess follows one of several courses, precisely as in idiopathic suppuration of the pericœcal tissue. Thus it may reopen into the bowel; may burrow along the sheath of the psoas muscle, and point below Poupart's ligament; or it may discharge in the lumbar region, or at any point along the crest of the ilium.

In one case the iliac artery was opened, leading to speedy death from hæmorrhage.

Occasionally these abscesses discharge themselves by more than one avenue, as for instance through the bowel, and in the groin or iliac region simultaneously. When, as occasionally happens, the inflammation of the cœcum passes into a chronic form and the ulcerative process ceases, the adhesions of the cœcum to the iliac fossa become preternaturally dense, the cœcum itself is contracted, its coats thickened, and the mucous membrane almost entirely destroyed, or converted into a retiform and trabecular fibroid tissue. Rokitansky has found in such cases the cœcum converted

into a slate-colored capsule, with dense parietes, of the size of a walnut or a pigeon's egg.

The *appendix vermiformis* may be the seat of catarrhal inflammation, associated with inflammation of its peritoneal covering. Death does not result from this condition, but the pathological appearances are probably analogous to those found in all cases of localized sero-enteritis.

When, however, the appendix has been the seat of ulceration, and death has resulted before perforation has occurred, its cavity is found distended with pus, its mucous membrane deeply ulcerated, and in nearly every instance, a foreign body or an intestinal concretion is present.

The ulceration of the appendix varies in its position and extent, at times being seated at the free extremity, at others occupying the lower third of the appendix, which is perhaps the more frequent seat. In regard to its size, the ulcer and the subsequent perforation may be either very small, or else may involve almost the entire circumference of the appendix.

Under favorable circumstances, especially if the foreign body is discharged, the ulceration ceases, and the appendix becomes converted into a ligamentous cord, its calibre being entirely obliterated.

When perforation of the appendix occurs, the results vary according to the degree of local peritonitis which has been excited. If the appendix has become strongly adherent at the point where perforation is about to take place, this accident may not be followed by the development of general peritonitis. The points to which the appendix generally becomes adherent, are the cœcum, the anterior abdominal wall, and the right iliac fossa. In the first case, the circumscribed abscess which follows the perforation of the appendix will discharge itself though the cœcum by effecting a perforation of its wall from without inwards, and this is the most favorable termination possible. When, however, the appendix has become adherent to the abdominal wall or iliac fossa, the resulting abscess will follow the course, already described, of abscess from perforation of the cœcum.

It is in this connection that the various abnormal positions which the appendix may assume, are of importance, as determining the position in which the abscess will point.

Unfortunately, however, the adhesions are rarely strong enough to circumscribe the purulent matters escaping from the appendix, so that these generally find their way into the peritoneal cavity, and excite general peritonitis.

We subjoin the histories of 3 fatal cases of perforation of the appendix from intestinal concretions, occurring in children, in all of which some local peritonitis with adhesions had occurred, but had not sufficed to prevent the above unfortunate termination.

Case 1. *Intestinal concretion in the appendix cœci, causing perforation and fatal peritonitis.*—T. D. S., a healthy, well-grown boy, 11 years of age, rose on the morning of December 25th, 1860, apparently quite well. Soon afterwards, however, he complained of pain in the right iliac and lumbar regions, was chilly, and returned to bed. A dose of castor oil was given him. In the course of the day fever came on.

Next day he was feverish, with a pulse of 132, a hot and dry skin, and a moderately furred tongue. The pain still continued, with tenderness and slight distension of the abdomen on the right side; there was no vomiting. His bowels had been acted upon three times by the oil. Leeches and a poultice locally, and a mixture of blue pill with rhubarb syrup internally, were ordered.

On the 27th and 28th, the symptoms were much the same, except that the tenderness and distension increased. The pain was aggravated by coughing, by a full inspiration, and by motion, especially of the right leg. The bowels were slightly moved by the mixture; no vomiting as yet. His fever continued, but the pulse fell to 108, and his skin was somewhat cooler.

On the 29th he was worse. All his symptoms were aggravated, and vomiting set in; his bowels became confined. Small doses of calomel and opium were given, enemata of various kinds were tried, and rhubarb syrup with a little fluid extract of rhubarb was perseveringly employed, but without effect. The abdomen now became greatly distended, exceedingly sonorous, and painful; the stomach grew more and more irritable, rejecting from time to time, towards the last, with a sudden spasmodic effort, everything that was taken by the mouth. The bowels were completely obstructed, so that repeated injections of various kinds elicited no discharges, even of flatus. The urine continued to be secreted to the last; and there was at times, in spite of the nausea and vomiting, quite a strong desire for milk and bread.

During the last few days wine-whey and beef tea were given in small quantities; and opium by enema and by the mouth was used to allay pain. On the third day of the treatment a blister four inches square was applied over the seat of tenderness; but neither this nor any of the other remedies employed seemed to exert the least effect upon the course of the disease.

Death took place on the eighth day, January 1st, 1861.

The autopsy was made by Dr. Packard, twenty-four hours after death. Body large, muscular, and well formed; rigor mortis well pronounced. Abdomen only examined.

On making the usual section, several coils of small intestine, very greatly distended with gas, and markedly injected, with flakes of lymph here and there over the surface, at some points gluing the adjacent coils together, were seen concealing the rest of the abdominal viscera. After some search, the colon was found, very much contracted, except at the cœcum. The ileum was in like manner contracted, the narrowing beginning at about the end of the jejunum, which formed the distended coils above mentioned. No cause was assignable for the constriction at this point; but a little lymph was thrown out here, and it may have been that the bowel had been twisted.

The appendix vermiformis was bound down by peritoneal adhesions. Within it near its origin, was a mass as large as a small bean, but perfectly oval. Just beyond this mass, at what seemed to have been its position, was an ulcer extending all round the tube, and of a gangrenous aspect. At the distal end of this ulcer was a perforation, by which matter had found an exit into the peritoneal cavity. The rest of the tube looked as if it had been distended by the pus before the opening was formed. After its escape from the appendix, the matter seemed to have caused a circumscribed peritonitis, in addition to the general one already indicated. The adhesions bounding this peritonitis had extended up to the liver, the convex surface of which was hollowed to a slight depth in an oval shape, the depression being lined by false membrane. The whole quantity of the pus was perhaps f℥iv.

The liver was pale in patches, but was not degenerated. Rather too large a number of oil-drops existed in a dark, inflamed portion of its substance, just beneath the depression above mentioned; but even here the quantity was not great. The mesenteric glands were swollen and injected over the surface. No other lesions were observed.

Case 2. *Intestinal concretion in the appendix cœci, causing perforation and fatal*

peritonitis.—C. B., æt. 4½ years, was taken sick with slight fever, pain in the abdomen, some vomiting, constipation, and inflation of the abdomen. With these symptoms there was marked tenderness in the right iliac fossa. After three days the bowels were well opened, and the fever subsided; the abdomen, however, continued inflated, and a small but distinct tumor had appeared just inside of the right anterior superior spinous process of the ilium.

He continued to improve, and was apparently much better, but was strictly confined to bed, when on the ninth day, at 3½ P.M., he was seized with severe abdominal pain; symptoms of collapse rapidly appeared, and he died at 2 A.M. the following morning.

At the autopsy an intestinal concretion of the shape and size of a date-stone was found in the appendix. The end of the appendix was perforated, and had become attached to the anterior wall of the abdomen, where a small abscess had formed in the cellular tissue between the peritoneum and the abdominal muscles, evidently seeking an outlet through the abdominal parietes. The wall of this had unfortunately ruptured into the peritoneal sac, and death had resulted in a few hours from general peritonitis.

CASE 3. R. P., a healthy girl, aged 7½ years, died at the end of the second week of a well-marked attack of perforative disease of the appendix vermiformis.

At the autopsy a large, rounded intestinal concretion was found in the appendix cœci, which was perforated, allowing an escape of matter into the peritoneal cavity. There was marked general peritonitis, with the formation of a large quantity of pus.

SYMPTOMS.—Mere *distension* of the cœcum by hardened fæces, without actual inflammation of its coats, may be attended with constipation, some vomiting, and the presence of a somewhat sensitive tumor in the cœcal region. According to Copland, when the distension by accumulated matters is great, it may, from rising high in the abdomen and pressing upon the nerves, vessels, and ducts in its vicinity, occasion numbness and œdema of the right lower extremity, retraction of the right testicle, and derangement of the urinary secretion, so as to be mistaken for disease of the kidney.

Inflammation of the mucous membrane only of the cœcum, is generally attended with a moderate degree of fever, slight pain and tenderness in the right iliac fossa, and some diarrhœa, with mucous, offensive stools. This condition is not unfrequently chronic, and evinces its presence by no very positive symptoms, unless adjacent parts have become involved in the inflammation, or an acute attack of typhlitis supervene.

TYPHLITIS, or inflammation of all the coats of the cœcum or appendix, usually appears suddenly during full health, or it may be preceded by slight intestinal derangement, such as diarrhœa or constipation.

Pain.—The earliest and most marked symptom is generally pain in the region of the cœcum, which appears suddenly, becomes fixed and constant, rarely remitting, and is greatly increased by a deep inspiration or by coughing.

This pain is attended from the very first with such exquisite tenderness on pressure in the right iliac region, that the weight of the bed-clothes cannot be borne, and the patient shrinks from the lightest touch. To relieve this pain the patient lies toward the right side, with the thighs flexed upon the pelvis, and any attempt to draw the right leg down causes ago-

nizing suffering. These local symptoms are usually confined to the right iliac fossa, though the entire peritoneum may become somewhat involved, and the symptoms of general peritonitis develop themselves.

Fulness or Tumor.—Owing to the distended state of the bowel itself, and to the adhesions formed between folds of the intestines, or in some rare cases to an inflammatory effusion behind the cœcum in the iliac fossa, there is marked fulness or even a well-defined tumor in the right iliac region. Frequently there will be merely fulness during the first few days of an attack, and then a distinct tumor will be developed. In 11 of 39 cases of acute typhlitis, recovering without perforation of the bowel, a distinct tumor was present. In most of the other cases the condition of the cœcal region is described as one of fulness or distension. Of these 39 cases, 19 occurred in children under 15 years of age, in only 3 of which a distinct tumor is recorded to have been observed.

Constipation.—The bowels are almost invariably constipated; in many cases very obstinately so. This constipation is frequently associated with quite severe tormina and tenesmus, and if the cœcum be much distended, there may be pain shooting down the right thigh, or numbness and even œdema of this part, together with retraction of the right testicle.

It is important to observe here, that in most cases, when once the constipation is relieved, and free feculent stools procured, the most threatening symptoms of the attack rapidly subside.

Vomiting nearly always attends in children; it was present in all of our 13 cases. It is never stercoraceous, and indeed is rarely troublesome unless the constipation is marked, or perturbating treatment has been adopted in the beginning of the attack.

Fever.—The attack is not usually ushered in by any chill or rigor; but marked febrile symptoms soon appear, the pulse becomes accelerated, the skin hot, the tongue furred, and the thirst extreme. These symptoms usually subside under appropriate treatment after a variable time, generally from four to twelve days; the bowels are opened freely, the pain and tenderness diminish, and the fulness in the right iliac region gradually disappears.

This description of symptoms applies to acute inflammation both of the cœcum and appendix, as there are no well-recognized differences in the symptoms of these two conditions. The only probable points of difference are, that in inflammation of the appendix the pain is more acute, and the thorough evacuation of the bowels is not followed by the same prompt and complete relief.

Perforation of the Cœcum.—When, however, perforative ulceration is progressing, the symptoms follow a different course. The constipation may be relieved and the vomiting cease, but the local symptoms persist, until the rupture of the bowel leads either to speedily fatal peritonitis, or to the effusion of fecal matter mixed with the products of inflammation into the pericœcal tissue. When this latter event occurs, the constitutional symptoms soon indicate the occurrence of suppuration, and hectic irritation, with rigors or marked chills succeeded by drenching sweats, colliquative diarrhœa, rapid prostration and emaciation, with a dry brownish tongue

and feeble running pulse, soon appear. Despite the desperate character of these symptoms, however, recovery may take place if the abscess points externally in the way already described, and does not open into the peritoneal cavity. It is necessary to be aware that the approach of a fecal abscess to the surface is not attended with the appearances which usually accompany the pointing of an abscess. Thus, instead of the skin becoming tense, prominent, and reddish, with a distinct sense of fluctuation present, the surface becomes doughy and dark-colored, and upon palpation a distinct sense of emphysematous crepitation is often obtained. Upon incising such a point, a discharge of fetid gas and grumous matter follows the puncture, and this peculiarity has more than once led surgeons to believe that they had opened a knuckle of intestine.

Perforative Ulceration of the Appendix.—The symptoms of this disastrous condition closely resemble those of perforation of the anterior part of the cœcum. They are, however, often even more acute, the pain is sudden and violent, and a distinct tumor is more uniformly present; while, on the other hand, the symptoms of obstruction of the intestine are not so well developed. Constipation and vomiting are not constant in the early stage, and at a later period spontaneous diarrhœa may appear, but without any favorable result. The perforation of this part is, as already said, far more apt to be followed by general peritonitis; and, indeed, so far as we know, there is but one well-authenticated case on record of recovery after this accident, which was published by one of ourselves in the *Proceedings of the Pathological Society of Philadelphia.* (See *Amer. Jour. Med. Sciences*, vol. liv, July, 1867, p. 145.)

Perityphlitis, or inflammation of the pericœcal tissue, when it does occur independently of typhlitis, is ushered in by pain, with deepseated tenderness in the right iliac region. There is also some fulness of this part, but not the formation of a distinct tumor, as may frequently be detected in typhlitis. There are usually colicky pains in the abdomen, with either constipation or diarrhœa, and with a moderate degree of febrile excitement. This disease, when judiciously treated, frequently seems to terminate in resolution; when, however, suppuration occurs, the symptoms will approximate those given above, and the abscess which forms may discharge itself externally, into the bowel, or into the peritoneal cavity.

Duration.—Many attacks of acute typhlitis, when promptly and judiciously treated, yield on the second or third day; though the case is often prolonged to the ninth or twelfth day, and, in violent attacks, it may be many weeks before all local tenderness in the cœcal region passes away, and the function of the bowel is again completely restored.

When perforation of the cœcum occurs, the after-duration of the case depends entirely upon the point of perforation. If the ulcer have penetrated the anterior wall, general peritonitis is usually excited, and death results in less than forty-eight hours. But if, on the other hand, the posterior wall be perforated, a fecal fistula may be formed, and continue open for very many years. The duration of perforative ulceration of the appendix varies considerably. In 3 cases in children, observed by our-

selves, the duration was respectively seven, nine, and fourteen days, with a mean of ten days.

In 11 cases, at all ages, in which the duration is distinctly stated, the mean duration was nine days, the extremes being two and a half and twenty-nine days.

Bamberger, however, gives the duration of seven cases, occurring at various ages, at from twenty to fifty days, with a mean of thirty-one days. It is probable, however, that this last mean is rarely attained in cases occurring in children.

Prognosis.—Nearly all cases of simple acute typhlitis, without perforation of the bowel, recover under proper treatment. Indeed, there are no cases on record of acute typhlitis proving fatal, in which post-mortem examination did not show the existence of perforation of the cœcum or appendix.

When the cœcum has become the seat of chronic inflammation, however, death may result, either from the sudden development of acute peritonitis, without perforation of the bowel, or from such contraction of the cœcum as finally to lead to obstruction of the intestine.

When perforation of the cœcum does not prove speedily fatal from peritonitis, but leads to the formation of an abscess in the iliac fossa, the prognosis of the case depends, in a considerable degree, upon the course taken by this abscess. Dupuytren regarded the reopening into the bowel as the safest termination of an iliac abscess, and the opening upon the surface of the body as almost universally fatal. Further experience has confirmed the truth of the first portion of this opinion, but has also established the fact, that almost one-half of the abscesses opening externally recover.

Perforation of the appendix vermiformis is invariably fatal, so far as our experience goes, if we except the case before referred to, where, in an old man about whose past history nothing could be learned, we found the appendix converted into a solid fibrous cord, with a small opening, near the free extremity, leading to its centre.

Diagnosis.—The general diagnosis of most of these conditions is not attended with much difficulty. We have already mentioned that simple excessive distension and impaction of the cœcum is sometimes attended with severe pain, some tenderness, constipation, and even vomiting, and that these symptoms are relieved upon free action of the bowels being secured. We do not have here, however, the sudden attack occurring in a state of perfect health, as in typhlitis, nor the marked febrile symptoms, nor are the local signs in the right iliac fossa, and especially the peculiar, exquisite sensitiveness, nearly so well developed.

Inflammatory disease, in connection with the right ovary, with local peritonitis, is unquestionably sometimes mistaken for typhlitis. The local symptoms in the former affection are, however, lower down in the abdomen than is usual in typhlitis; there is not the well-defined tumor nor the obstinate constipation; and, in addition, there is generally the history of some menstrual trouble, or the attack occurs in immediate connection with the period of menstruation.

Pain in the course of the last dorsal nerve may arise from spine disease, or, in the course of the genito-crural nerve, from the passage of a renal calculus, and, according to Habershon, be confounded with cœcal disease. It is evident, however, that most of the characteristic symptoms of typhlitis would be absent, whilst a careful investigation of the case would probably educe more symptoms of the existing trouble.

The diagnosis of typhlitis from intussusception, an affection which presents many features of resemblance, will be fully considered in the article devoted to this latter disease.

Ulceration of the cœcum or appendix may be suspected, if the violent pain and the exquisite tenderness persist in the right iliac region, after the other symptoms of an acute attack of cœcal disease, especially the vomiting and constipation, have been overcome. Ulceration of the cœcum is much more apt to have been preceded by bowel complaint for some time; it is also much more rare than ulceration of the appendix.

In cases where we are consulted only after perforation has taken place, with the production of a fecal abscess, we must endeavor, by obtaining a most accurate history of the case, to establish the presence or absence of symptoms of inflammation of the cœcum at the beginning. And further, care must be taken to exclude the following conditions, all of which may at times simulate iliac abscess, namely: psoas abscess, or abscess connected with caries of the pelvic bones; abscesses in the walls of the abdomen, with local peritonitis, resulting from blows; suppuration originating in connection with the right kidney or its envelope; and finally, some cases of disease of the right hip-joint.

The differential diagnosis of these affections of the cœcum and appendix from one another is as yet scarcely possible. The following general remarks contain, perhaps, all that can be surely advanced:

Simple inflammation of the appendix presents symptoms of even greater acuteness and severity than those of simple cœcitis, and which do not subside so promptly after the bowels have been freely acted upon.

In ulcerative disease, both of the cœcum and appendix, the symptoms also persist after the constipation and vomiting have yielded.

Ulceration of the cœcum, however, is rare, and is apt to be preceded by symptoms of bowel complaint. Whilst ulceration of the appendix, on the other hand, is often terribly acute, advancing from a state of apparent perfect health to perforation and death in forty-eight hours; it is also much more frequently attended with a distinct tumor in the right iliac region.

Treatment.—The indications for treatment in the acute stage of typhlitis are clearly to reduce the local inflammation of the peritoneum and intestine, to relieve the pain and tenderness, and to secure free and natural action of the bowels. At the same time, all perturbating and strongly reducing treatment is forbidden, by the knowledge that the attack is frequently caused by an irritating foreign body: and that, in a certain number of cases, perforation will occur, in which event the only hope of recovery often rests upon the adhesions which have been formed during the early

stage, and upon the vigor of the constitution to resist a prolonged and exhausting process of suppuration.

Depletion.—The local abstraction of a few ounces of blood by the application of leeches to the cœcal region, should be practiced in acute cases. This measure, while it does not seriously reduce the strength of the patient, relieves the pain and tenderness, and probably facilitates the action of the internal remedies employed. Beyond this degree, however, depletion is injurious, or, at least, unnecessary.

Purgatives.—The experience of all observers agrees in condemning the use of powerful, irritating purgatives at any stage of typhlitis. In the early stage, they aggravate the pain and inflammation, increase or establish vomiting, and frequently fail entirely in their object; while, on the contrary, the constipation which will resist the strongest, most drastic purgatives, will quickly yield to mild, saline, or vegetable laxatives.

It is a good plan to combine a small amount of opium with the laxative; since, so far from counteracting its operation, it appears, by allaying the intense sensitiveness of the bowel, to promote its painless and thorough action.

Burne recommends highly the following laxative draught, the dose of which is arranged for an adult:

R.—Sodæ Sulphatis, ... ℥j.
Tr. Opii, ... gtt. v.
Inf. Sennæ, ... f℥j.
Ft. sol. S.—Repeat every four hours until the bowels are freely moved.

We have ourselves been led by experience to rely upon the combination of comp. ext. colocynth with opium, given in small and frequently repeated doses. Thus, for a child of from five to eight years, the following pill may be prescribed:

R.—Pulv. Opii, ... gr. ij or iij.
Ext. Colocynth. Comp., ... gr. xij to xviij.
Ft. mas. et div. in pil. No. xxiv.
S.—One every three or four hours until free action of the bowels is secured.

Enemata.—The action of these laxatives may be furthered by the administration of large enemata, which may consist either entirely of tepid water, or of water containing a small proportion of some stimulating or laxative substance, such as soap, molasses, or castor oil. In cases where the irritability of the stomach precludes the administration of laxatives by the mouth, enemata become especially important, and at times their use will be followed by the most happy results, the irritating contents of the cœcum being brought away, with almost immediate relief to the most threatening symptoms.

Mercury.—It is difficult to support the practice of giving this drug in typhlitis. In the early stage, indeed, when it may be supposed that the intestinal canal contains irritating ingesta and secretions, a small dose of calomel or blue pill may be administered; and, in a large number of the

successful cases on record, this was done. It is not, however, at all necessary. Beyond this, the further use of mercury appears to us injurious, since, if it be given until any constitutional effects are produced, it must have a tendency to prevent the formation of those strong adhesions which constitute the sole chance of recovery in case of perforation of the appendix or the anterior wall of the cœcum.

Opium.—We have already mentioned the way in which opium is most advantageously given in this affection, in combination with the laxative employed. Its use is absolutely called for, and the violence of the local symptoms, the pain and exquisite tenderness, form the best guide as to the amount required.

Poultices and Counter-irritants.—In case even the local abstraction of blood appears undesirable, resort should be had to the frequent application of mustard plasters or turpentine stupes to the cœcal region. Hot fomentations or light poultices, to which some sedative substance may be added, should be kept constantly applied to the abdomen.

Vomiting when present, should be allayed by counter-irritation, by swallowing small fragments of ice, by carbonated drinks, hydrocyanic acid, or any other suitable remedy.

The diet during the early stage should be fluid, and unirritating in character.

When the persistence of the symptoms leads us to apprehend the presence of ulceration, either of the cœcum or appendix, all depletory and perturbating treatment should be abandoned, and we should limit our efforts to the relief of pain, by the use of opium and the continued application of poultices; to regulating the functions of the intestinal canal, and to the sustentation of our patient's strength.

If perforation has occurred, without the speedy development of general peritonitis, our attention should be mainly directed to supporting the system during the long and exhausting process of suppuration which must ensue. For this purpose a generous, though digestible diet, with as much stimulus as appears necessary, should be enjoined; and resort may also be had to the various tonics, as quinia or the preparations of bark. If a tumor forms, and it becomes evident that the abscess is tending to discharge externally, its approach to the surface should be encouraged by poulticing; and the moment an emphysematous condition of the skin is detected at any point, a free incision should be made, and the discharge of matter furthered by the introduction of a sponge-tent or a pledget of lint, and the application of a poultice.

In those unfortunate cases where the perforation of the bowel has been followed by general peritonitis, all treatment is unavailing. Our main reliance must, however, be placed upon the exhibition of opium, and the use of counter-irritation.

ARTICLE VI.

INTUSSUSCEPTION.

Definition; Synonyms; Forms; Frequency.—Obstruction of the intestinal canal, from one or another of the numerous causes capable of producing it, is an accident liable to occur at all periods of life. But the variety of it which forms the subject of this article is of rare occurrence excepting in early childhood. It has been called ileus, volvulus, miserere mei; but is best known under the descriptive names of intussusception or invagination of the intestines. It consists in the passage or introduction of one portion of intestine within another, as a small tube might slide into a large one, or, to borrow a familiar illustration, as the end of a glove-finger may be pushed back upon itself into the glove. This simple invagination, however, is not the only element present, for in order that the symptoms of intussusception should be produced, it is necessary that the included portion of bowel should be so incarcerated and constricted as to give rise to more or less complete intestinal obstruction. This has led to a very just division of intussusceptions into such as are slight, unattended by inflammation, or spasmodic; and such as are grave, or attended by inflammation and incarceration. The slight form of invagination is found very frequently at autopsies of children who have died of other diseases, and in whom during life there was no symptom of disturbed function of the alimentary canal: it is in all probability produced in the death agony.

M. Louis states that the greater part of 300 children dying during the period of dentition at the Salpétrière, had 2, 3 or even 4 volvuli without inflammation.

Baillie, Cheyne, and Billard speak of such intussusceptions as being frequently found at the autopsies of children; and Burns, as quoted by Gorham,[1] gives the results of the autopsies of 50 children who had died from diarrhœa, in every one of which they were found. This species of invagination in children occurs almost exclusively in the small intestine; the invaginated part is usually of no considerable length; and the very slightest traction suffices to restore it.

The grave form, on the other hand, differs from this alike in the very positive symptoms by which its presence is announced, in the condition of the parts involved, and in the part of the bowel affected; and as the form first mentioned scarcely deserves to be called a disease, it is to the latter alone that the following remarks are addressed.

Frequency.—Although numerous well-authenticated cases of intussusception occurring in adults are on record, statistics prove that it is relatively much more frequent during the first four years of life. Thus of 100 cases

[1] Guy's Hosp. Reports, 1st series, vol. iii, 1838, p. 330.

given by Duchaussoy[1] in which the age is mentioned, there were 31 under 4 years of age, 6 between 4 and 10 years, and 63 adults. Smith's[2] tables go to show that "this complaint is rare under the age of 3 months, and that the period of greatest frequency is from the third to the sixth month of life, the maximum number being at the fourth month." Thus there were 11, of the 50 cases collected by him, at the age of 4 months, or 21 in all between 3 and 6 months inclusive; 8 from 6 months to 1 year; and only 18 between the ages of 1 and 12 years.

We must, however, call attention to the rarity of this disease at any age among us; for although, in the course of a very extensive practice among children in this city, we have met with several well-marked illustrations of the various forms and terminations of intussusception, it has been one of the rarest occurrences in our experience.

Anatomical Appearances.—Intussusceptions, anatomically considered, may be divided into descending or progressive, and ascending or retrograde, according to the direction which the invaginated portion takes; and into central or lateral, according as the entire intestine, or but one wall, is invaginated. Lateral invaginations, however, are exceedingly rare, occurring but twice in 137 cases collected by Duchaussoy.

Excepting when invagination occurs as a complication of some other affection, it is almost invariably of the descending form. Thus, of Duchaussoy's 137 cases, only 16 were retrograde, all of them being complicated; and Haven gives but 3 instances of ascending intussusception out of 59 cases.

It is a matter of considerable importance to determine what is the most frequent seat of intussusception in children. Rilliet and Barthez[3] declare that in infants the small intestine is almost never the seat of intussusception, but that ordinarily it is the lower end of the ileum which is invaginated into the large intestine. The reasons for this are found in the anatomical conditions of the intestines in infancy: the adhesions of the cœcum to the right iliac fossa being much more limited and less powerful than in later life; and the muscular coat of the cœcum being but slightly developed in childhood, a circumstance which must also tend to favor the passage of the lower end of the ileum through the valve.

The statistics of Duchaussoy and Smith confirm this opinion; as of 31 cases of simple descending intussusception in children under 4 years of age, collected by the former, the large intestine alone, or both the large and small, formed the intussusception in all but 4 cases; and Smith states that he has found no exception to Rilliet's remark, as regards early infancy. In children above the age of 2 years, fatal invagination in the small intestines may occur in rare cases. In a few cases also, the ileum has preserved its normal relations to the ileo-cœcal valve, the cœcum being the first part inverted, and drawing after it the lower end of the ileum.

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[1] Duchaussoy, Mém. de l'Acad. de Méd., vol. xxiv, p. 97 (New Syd. Soc. Year-Book, 1863, p. 294).

[2] Smith, Statistics of Intussusception in Children (Am. Jour. Med. Sci., vol. xliii, 1862, p. 17).

[3] Mal. des Enfants, 2ème ed., tom. i, p. 806.

An intussusception, then, is made up of three folds of intestine: 1st, The inner, or contained part, which in descending intussusceptions is always in the natural direction; 2d, The middle, which is a reflection of the inner, and passes in a direction contrary to the intussusception; and 3d, The outer, containing part or sheath, which is in its natural position, and in the direction of the intussusception. We find, therefore, the mucous membrane of the middle and outer parts in apposition; and the peritoneal investment of the middle and inner parts in contact.

The amount of intestine invaginated and the condition of the parts depend, in great measure, upon the duration of the case. If death takes place early, only a small portion of the ileum may have passed the valve; but as the case progresses, the tenesmus or the active peristaltic action of the outer part, brings down more and more of the ileum with its accompanying mesentery, until finally, the constriction of the ileo-cœcal valve preventing the descent of any more of the ileum, the cœcum is inverted and forced into the ascending colon. This in turn may be invaginated in the descending colon and rectum, until not unfrequently a portion of the invaginated intestine protrudes from the anus. In rare cases, the whole invaginated mass descends into the intestine below, thus forming a double intussusception of great thickness. It has occurred, in a few rare cases, that the amount of constriction was so slight that the intestine remains pervious to a certain extent; so that life has been protracted for many weeks, and death has finally ensued only from exhaustion. But ordinarily the parts are in the following condition: the intestine above the point of constriction is distended with gaseous and fecal contents, and more or less discolored from congestion of its walls. It is rare, however, to find any evidences of enteritis either here or in the intestine below the intussusception, which is generally pale and contracted. The invaginated portion itself, at the upper part, where it seems to plunge into the containing portion of the intestine, presents a series of concentric circular folds. The walls of the bowel thus incarcerated are thickened and infiltrated; their serous investment either deeply injected or discolored by congestion and ecchymosis, so as to be of a deep blackish-red color; and frequently evidences of local peritonitis are present. The mucous membrane in cases of short duration may be merely thickened and injected, but more frequently it is turgid from congestion, ecchymosed in points, and shows the effects of violent inflammation by its unequal roughened surface, presenting either ulcerations or grayish false membranes. The capillaries of the constricted portion become greatly distended, so that, especially in young children, in whom the vascular rete of the intestines is remarkably rich, whilst the tissues are delicate and yielding, they frequently rupture, filling the invaginated intestine with blood, and producing bloody discharges.

If the case is protracted and the powers of life sufficient, when treatment has not sufficed to reduce the intussusception, nature endeavors to effect a cure by eliminating the invaginated portion. The incarcerated bowel becomes gangrenous, a line of separation forms, union and cicatrization take place between the part of the bowel above the intussusception and the upper

part of the containing intestine, and the invaginated portion is discharged per anum. This process of elimination is extremely rare in infants; but it is stated by Rilliet to be the ordinary method of cure in children in their second infancy. In 59 cases reported by Haven,[1] of all ages, discharge of the intestine per anum took place 12 times, with recovery in all but two cases. The average length of intestine passed in these cases was 23½ inches; in the two fatal cases, the portions passed were respectively 39 and 44 inches long. The earliest age at which we have met with this process of cure, is at 13 months in a case reported by M. Marage:

In the report of the *Proceedings of the Pathological Society of London*, vol. xiii, a specimen is described by Dr. Hare, where this process had taken place. The patient was a female, 41 years of age, and her death resulted from tubercular disease three months subsequently to the passage of the sphacelated bowel, "which was 6½ inches in length, of a very dark purplish-gray color: it formed a perfect cylinder, but the intestine was turned inside out, the exterior of the specimen, as voided, being the mucous membrane, and the interior of the cylinder being the peritoneal covering of the intestine."

At the autopsy, at the point where the invaginated portion had been separated, about fifteen inches above the cœcum, the line of union was found running obliquely across the intestine, "but the union was so perfect that it could scarcely be detected except by holding up the intestine between the eye and the light, when the thinness of the intestine clearly pointed out the line or seam where the union had taken place. Exactly at the point of union the intestine was notably narrower than natural; but the intestine above this point was a little dilated."

We have recently had an opportunity, through the courtesy of Prof. A. Stillé, of studying a specimen in which a similar process of cure had been effected. The patient was an adult, who died of some chronic disease, and no history could be obtained of the occurrence of the attack of intestinal obstruction, or of the discharge of the sphacelated portion of bowel from the anus. The specimen, however, presented appearances which left no doubt that invagination of a portion of the ileum had occurred, that the invaginated portion had sloughed away, and that union had taken place between the intestine, just above the intussusception, and the upper part of the sheath, so as to preserve the continuity of the bowel. The external surface presented a marked constriction encircling the intestine due to the entrance of the upper part of the bowel into the sheath. There was a layer of organized lymph investing the peritoneum at the line of junction, and firmly uniting the two serous surfaces. Upon laying open this part of the ileum, a narrow rim of indurated tissue, evidently the altered intestinal wall, projected downwards into the intestine from the line of constriction, and formed, as it were, a perforated diaphragm across the calibre of the bowel.

We thus see that even when the slough is cast off, and the patient recovers from the intussusception, the cure is not always permanent, since in

[1] Haven on Intestinal Obstruction, Amer. Med. Sci., vol. xxx, 1855, p. 351.

a small proportion of cases there may be serious contraction of the bowel, caused by the ensuing cicatrization.

In addition to the modes of recovery already adverted to, namely, the reduction of the intussusception either by the movements of the bowel itself or by the remedial measures adopted, and the elimination of the invaginated portion, there is still a third mode possible, in which the intestine remains invaginated, but by agglutination of the outer folds, becomes pervious, and undergoes such atrophy and contraction as not to interfere materially with the functions of the bowel. Rilliet and Barthez, as well as other Continental authors, speak of this as of occasional occurrence, but we have not found any well-authenticated cases recorded.

There are few morbid changes found in intussusception excepting those pertaining to the intestines. It is, however, worthy of mention, that in some cases the invaginated mass appears to produce serious compression of the large vessels of the abdomen.

Causes; *Age.*—We have already given the statistics which prove that intussusception is relatively very much more frequent during the first four years of life, the period of maximum frequency being between the third and sixth months. It is very rare before the age of three months. All forms of invagination, however, do not occur with equal frequency at these various ages. During early infancy, for the anatomical reasons already assigned, the almost invariable seat of the invagination is the lower end of the ileum and the upper part of the large intestine; while, after the age of two years, invagination of the small intestine alone, though still very rare, may occur.

Sex.—All statistics agree in giving a majority of males over females, at least in the proportion of 2 to 1; while in some tables the proportion is as high as 7 to 1; thus Rilliet and Barthez collected 25 cases, of which 22 were boys.

Previous Condition.—In by far the majority of cases, intussusception in the infant occurs as an idiopathic affection, appearing during perfect health. In children over one or two years of age, however, it is much more apt to be preceded by some disturbance of the alimentary canal, as constipation, diarrhœa, dysentery, or even by symptoms of imperfect obstruction of the intestines.

Intussusception may also occur during the course of other diseases, as in a case quoted by Rilliet from Legoupil, where the invagination appeared during the progress of variola; the child, 4½ years old, recovered.

Exciting Causes.—*External violence*, as blows upon the abdomen, or sudden jerking of the child's body, as in tossing it in the arms, are assigned as the probable exciting cause of a certain number of cases. It has been supposed, also, that violent fits of coughing or screaming, or strong straining at stool, have produced invaginations, especially in very young children.

Improper alimentation and sudden changes of diet appear to act quite frequently as efficient causes; thus in a case reported by Gorham, occurring in a healthy infant of four months old, the only assignable cause was the administration of panada for three days preceding the attack. It is,

however, frequently impossible to assign any plausible reason for the sudden production of severe intussusceptions.

Granting, however, the presence of any of these causes, the question still remains as to the exact mechanism of the invagination. According to Gorham, "it is necessary to the production of an intussusception that there should be either: 1st, A contraction of the part to be intussuscepted; or 2d, A dilatation of that part which is to be the outer fold; or 3d, A natural and sudden inequality of calibre of some portion of the intestinal tube. The first of these conditions may be produced by spasm; the second by flatus; whilst the third is always present at the termination of the ileum in the cœcum." It is at this point, accordingly, that intussusception most frequently occurs, and, from the anatomical arrangement of the parts making it very difficult for restitution to occur, puts on its most dangerous and fatal characters.

The invagination having once begun, its increase and persistence are probably due to the active peristaltic action of the outer fold, aided by the spasmodic contractions of the diaphragm and abdominal muscles, causing the powerful tenesmus so frequently observed.

There is one more question in regard to the etiology of this affection, about which various opinions have been expressed; whether, namely, enteritis holds the relation of cause or effect to intussusception. Rilliet and Barthez appear to us to have given it its true importance in stating that it sometimes plays one part and sometimes the other. We have already seen that, though in many cases intussusception occurs suddenly in full health, there are a sufficient number of instances where the attack has been preceded by symptoms of intestinal irritation or inflammation, to make it clear that at times enteritis acts as a predisposing or determining cause. And, on the other hand, the pathological anatomy of the disease, showing the inflammation of the bowel to be limited to the immediate vicinity of the invagination, and to be the more intense as the constriction is tighter, proves that enteritis frequently appears as a result of intussusception. This becomes especially evident in those cases where the disease has been caused by external violence, and where after death the above conditions have been noticed.

Symptoms; Duration; Terminations.—The principal symptoms of intussusception are furnished by the gastro-intestinal apparatus; and, towards the termination of unfavorable cases, by the nervous system. We have seen that a considerable difference exists in the seat of the invagination at different periods of childhood, and in examining the symptoms we find a corresponding disparity, according as the intussusception occurs in the first infancy, under the age of two years, or in the second infancy, between the second and sixth year. These points of difference will be mentioned as each symptom is discussed.

The most important and characteristic symptoms are: vomiting, constipation, and bloody discharge from the anus; abdominal pain, tenesmus, and protrusion of the intestine, the presence of a tumor in the abdomen, and tympany.

Vomiting is an almost constant symptom, being present in about 95 per

cent. of the cases. Very rarely the gastric disturbance amounts only to nausea, but nearly always vomiting sets in early in the attack and persists, despite all treatment, until either the invagination is relieved, when it promptly ceases; or until the approach of death. Quite frequently it ceases a day or two before the fatal event occurs. The matters vomited at first consist of the ingesta, the stomach rejecting everything taken into it; soon, however, they become mixed with mucus and bile. In very young children it is rare for stercoraceous vomiting to occur, but in those who are above two years of age it may occasionally be present. In Smith's 50 cases, it occurred in three at the respective ages of 3, 6, and 11 years.

The condition of the bowels is generally one of obstinate *constipation*, so far as the passage of fecal matters is concerned. It is not unusual for one natural abundant stool to occur after the intussusception begins, but this is succeeded by constipation. It is only in those very rare cases where the invaginated portion remains pervious, that a small amount of fecal matter finds its way into the stools.

The discharges which, however, do take place almost invariably in intussusception in children are due to the rupture of the capillaries of the constricted bowel, and consist of blood mixed in varying proportions with mucus and serum. It is rare for the blood to be so deficient that the discharges resemble the gelatinoid mucous discharges of dysentery, merely streaked and tinged with blood, whilst, at times, the blood is in such excess as to appear pure, and to constitute a true intestinal hæmorrhage. This symptom, the true value of which was first recognized by Gorham and Clarke,[1] is of more uniform occurrence in children under two years, on account of the greater ease with which the intestinal capillaries give way in infancy. Thus of 26 children under one year of age, bloody evacuations occurred in 23, usually several times in the twenty-four hours; in 2 of the 26 there is no record of this symptom, and in 1 only is it recorded as absent. In case No. 2, of Mr. Gorham's table, a child of 3½ months passed within a few hours more than a teacupful of fluid blood. In older children, on the other hand, bloody discharges occur less frequently; thus Smith records 18 cases of invagination between one and two years, in only 6 of which it is stated that there were bloody motions.

We have already mentioned the various ways in which recovery takes place, and when elimination of the invaginated portion is about to occur, which is almost exclusively limited to cases occurring in the second infancy, the stools become highly fetid, contain more or less blood, are blackish or brownish in color, and are soon accompanied by the discharge of the slough. The interval elapsing between the inception of the attack and the discharge of the portion of bowel, varies considerably in different cases, but seems to be less in childhood than in adult age. Thomson states that in adults the elimination takes place in the majority of cases within thirty days; and in one of his cases it occurred as early as the sixth day. In children the interval rarely exceeds twelve days; and the average of

[1] London Lancet, January, 1838.

all recorded observations would seem to fix about nine days as the usual time.

Abdominal pain is among the earliest and most constant symptoms at all ages. During the early part of the attack, it appears in paroxysms; and may be detected even in the youngest children, by the violent paroxysmal screaming, and contortions of the limbs and trunk. At the commencement, the abdomen is generally relaxed, supple, and indolent; and this condition may remain until death, perhaps because the constriction in some cases is not complete and allows the passage of gas. But, after a few days, there is apt to be more or less continuous pain and soreness on pressure in the part of the abdomen corresponding to the invagination, due to the local enteritis and peritonitis. This may or may not be accompanied by tympany and diffuse tenderness of the abdomen; but, as a general rule, intussusception in very young children is not attended by the great distension and marked symptoms of general peritonitis which frequently appear in intestinal obstruction in adults. In children over two years of age, the abdominal symptoms are more apt to indicate peritonitis. In a considerable proportion of cases, tenesmus occurs and adds much to the suffering. It does not appear so early as the abdominal pain, and generally ceases a few days before death.

Tumor.—It would appear natural that when a considerable intussusception has taken place, the knot formed at the point of obstruction should be readily detected through the abdominal walls. And yet the cases on record show that this tumor is recognizable in not more than two or three out of every ten cases. When it can be detected, it is generally found in the left iliac region, varying in size from a walnut to a large goose-egg, and giving the sensation of a solid, but doughy and compressible mass. It is ordinarily quite movable, and percussion elicits a dull note over its position.

Another symptom depending upon the displacement of the intestine, to which considerable importance has been attached in the diagnosis of invagination in the adult, is a depression of the abdomen at a point corresponding to the displaced intestine, and a fulness at the corresponding point on the opposite side. Experience has shown, however, that but little value can be attached to this sign in young children, on account of its great rarity.

We have seen that the presence of a tumor in the abdomen is far from an invariable sign of intussusception, and the same remark applies to the *protrusion of the invaginated bowel from the anus*, a symptom to which very different diagnostic value has been attached by different authors. It is stated by some to be almost never present, but we have found it recorded particularly in six of Smith's cases, the same number in which an abdominal tumor was present in the same series; and in three other cases, although no tumor protruded from the anus, the invaginated mass was readily felt by examination per rectum.

When the bowel protrudes, it forms an oblong tumor, at times even two inches in length, much congested from the constriction, and smeared with blood and mucus.

When we pass from these positively diagnostic symptoms, we find little

elsewhere characteristic of the disease. The tongue is normal until inflammatory action sets in, when it often becomes dry and brown; the appetite is impaired or absent, and the thirst is generally but moderate. Rilliet and Barthez call attention to the importance of this last symptom in a diagnostic point of view, as well as to the fact that the emaciation is usually not so marked as in other acute diseases of equal duration and severity.

The amount of febrile action is generally slight in infancy; the surface, cool at first, may at times become hot, or is alternately hot and cold, and as death approaches remains continuously cold. The pulse soon becomes frequent, though small and feeble. There is no marked disturbance of respiration.

In older children there is apt to be more febrile action, the skin being hot until late in the attack, and the pulse frequent and more full. The physiognomy of the little patient is greatly altered from the commencement of the attack. The eyes are dull and languid, sunken in their orbits, and surrounded by discolored areolæ; the countenance is expressive of the most profound prostration, so as to have elicited a comparison to the physiognomy of cholera patients.

Almost all cases, at whatever age, present symptoms of marked disturbance of the nervous system, as great restlessness, indescribable malaise, sharp cries, and, toward the close of the case, profound prostration. But in infancy, in addition to these symptoms, the case is more apt to present an attack of convulsions, either as one of the earliest symptoms, or toward death, alternating with coma.

Duration.—It is necessary to distinguish here between cases occurring during extreme infancy, when we cannot hope for elimination to take place, and those in more advanced childhood. In early infancy, when the attack is about to take a favorable turn, the symptoms usually yield in from two to four days, owing to reduction of the invagination. In fatal cases, death occurs within five days, as the rule. In some cases, however, where the constriction was not complete, life has been prolonged even for six weeks.

In second infancy, where the constriction is complete, and the result fatal, death occurs within seven or eight days in the vast majority of cases. But when elimination is to result, the case is more protracted, and complete recovery is postponed to the third week. Thus, in 7 cases out of Smith's statistics, which resulted favorably by sloughing, the ages were 5, 6, 6, 9, 11, 12, and 12 years respectively; and the separation of the invaginated portion took place between the ninth and twelfth days, with an average of nine and a half days. After the discharge of this, which is soon followed by the fetid, brownish-black stools already described, the symptoms rapidly disappear, and in one or two weeks the cure is complete; so that, if we can carry a patient, advanced beyond the first infancy, through the first week of the attack without too much exhaustion, we may each day look for the discharge of the invaginated bowel, the restoration of the function of the intestines, and ultimate recovery.

Terminations.—We have already described the favorable modes of termination, namely, by the subsidence of the intussusception, either spon-

taneously or as the result of treatment; by restoration of the calibre of the bowel by sloughing of the invaginated bowel, and union and cicatrization of the divided edges; and finally, by agglutination of the outer layers of the invaginated portion with subsequent thinning and atrophy, thus rendering the intestine pervious, although the intussusception remains.

In those cases in which death takes place very early, as on the first or second day, it is frequently produced by cerebral congestion or an attack of convulsions. In the majority of cases, however, it occurs somewhat later, and is preceded by a state of collapse. Even in those cases where the constriction is not at first complete, and where there are daily feculent evacuations for a time, death is apt to occur from exhaustion, or from the invagination becoming more extensive and symptoms of complete obstruction arising.

Prognosis.—A single glance at the character of the lesion and the accompanying phenomena, suffices to assure us of the grave nature of intussusception, and of the impotence of all ordinary methods of treatment against it. In young infants, indeed, where the strength of the system cannot be expected to hold out until elimination occurs, intussusception is almost invariably fatal. In a single instance only has recovery by elimination been noticed so early as the end of the first year. In a few cases, where the symptoms were well developed and threatening, they have subsided and the infant has recovered, apparently from spontaneous reduction of the invagination.

We must not, however, forget that during the early stage of this affection the diagnosis is somewhat doubtful, since young children frequently present symptoms of obstructed and loaded intestine, such as a distended, hard abdomen, constant unnatural straining, with evident suffering, and yet are entirely relieved after the administration and operation of laxatives.

Not to refer now to the recent cases of successful abdominal section, a considerable number of cases of cure of undoubted intussusception, by means of inflation, have also been reported even at this early age; so that, when treatment is instituted soon after the appearance of the symptoms, the case is not absolutely hopeless. In older children, that is to say, above three years of age, the prognosis is much less unfavorable, since treatment offers a certain amount of hope, and there is always the prospect of the occurrence of elimination of the invaginated bowel, if the strength of the patient has been sustained during the first week.

Even after elimination has taken place, however, the prognosis should still be somewhat guarded, as the slightest indiscretion in diet may, either by the development of flatulence or by the escape of irritating, undigested particles into the intestine, cause a rupture of the recently formed cicatrix and speedy death.

Diagnosis.—Intussusception has been, until recently, regarded by all authors as an affection of obscure and doubtful diagnosis. With the light, however, which has been thrown upon this subject by the labors of Clarke, Gorham, Smith, and especially Rilliet, the diagnosis in the great majority of cases can be made with precision. It is true, however, as conceded by

Rilliet, that "very rarely in early infancy, more frequently than later, there are certain cases of invagination impossible to distinguish from other forms of intestinal obstruction; and that at all periods of childhood the diagnosis presents many difficulties."

With what diseases, then, could we confound this affection, occurring, as we have seen, suddenly in perfect health; attended by obstinate, though rarely fecal vomiting; by marked constipation, but with frequent bloody discharges; by paroxysmal abdominal pain and tenesmus; by the presence of a tumor, generally in the left iliac region; by the protrusion of the invaginated bowel from the anus; and by profound prostration and disturbance of the nervous system. It is to be remembered, indeed, that this group of symptoms, so characteristic when viewed together, are rarely all present; and that with the exception of the vomiting, constipation, and bloody discharges, there is no single symptom which is not more frequently absent than present. There are, nevertheless, a sufficient number present in nearly every case to enable us to form a diagnosis.

The diseases which may most readily be confounded with intussusception are, 1st, impaction of the intestine with hardened fæces; 2d, typhlitis or perityphlitis; 3d, cholera infantum; 4th, dysentery; 5th, intestinal hæmorrhage; 6th, the various forms of internal strangulation; 7th, peritonitis.

1st. When an accumulation of fecal matter takes place in either the cœcum or sigmoid flexure, the case may present many symptoms similar to those of intussusception. There is frequently such gastric and intestinal irritation, as to lead to occasional vomiting and paroxysmal abdominal pain; the bowels are constipated, and there is frequent and strong tenesmus, so as often to cause protrusion of the bowel. In addition to these symptoms, a well-defined tumor is present in one or the other iliac fossa.

These cases, however, often have presented symptoms of intestinal disturbance for some time previous to the attack; the vomiting is rarely so constant as in intussusception; the tumor is quite painless and has a peculiar doughy consistence; bloody discharges from the bowels are very rare; and we do not notice the profound prostration which exists in well-established invagination. During the early stage of the case, however, the diagnosis is doubtful; and when we have reason to suspect the presence of fecal accumulations, we must await the result of the administration of laxatives and laxative enemata, before deciding upon the nature of the case.

2d. Inflammation of the cœcum, appendix vermiformis, or of the pericœcal connective tissue, is attended with fulness or a well-defined tumor in the right iliac fossa, with vomiting, constipation, and occasionally tenesmus, with distension of the abdomen and pain radiating from the right iliac region.

There is, however, a marked degree of fever, and the symptoms of local peritonitis appear early in the case; the patient assumes a characteristic position, with the thighs flexed upon the pelvis, and the right iliac fossa is the seat of exquisite tenderness, so that the slightest pressure cannot be tolerated. The vomiting and constipation are not so marked and obsti-

nate, and excepting in those cases which have been preceded by dysenteric symptoms, there are no bloody discharges, and as we have remarked above, the tumor or fulness is in the right iliac fossa; whereas when this sign is present in intussusception, it usually occupies the left iliac region.

3d. In cholera infantum, the vomiting is often incessant; the stools are frequent, with painful tenesmus; the abdominal pain paroxysmal, and occasionally the intestine protrudes from the anus. It is almost impossible, however, to mistake this affection for intussusception, if we remember that it is almost always accompanied by fever, with insatiate thirst, and prompt and extreme emaciation; that the abdomen is without tumor, and rarely distended until towards the close of the case, and that the stools, instead of being bloody, are large and fluid.

4th. Dysentery frequently offers a close resemblance to intussusception so far as the characters of the stools are concerned, as they are often small and bloody, or muco-sanguinolent. But we do not see in dysentery the sudden inception, the rapid progress, the obstinate vomiting, the moist tongue and moderate thirst, which characterize intussusception.

5th. We have seen that occasionally the amount of blood passed by stool in intussusception is very great, and constitutes a true intestinal hæmorrhage; thus in the case reported by Marwick,[1] it amounted to a large teacupful of pure blood.

Intestinal hæmorrhage is a very rare occurrence during childhood, but has been noticed in children in connection with polypus of the rectum, especially by Mr. Bryant; in typhoid fever, or the hæmorrhagic form of some others of the exanthemata, and in the course of purpura. The absence of the other symptoms of intussusception, however, and the presence of the local or general symptoms peculiar to these various conditions, will serve to render the diagnosis easy.

6th. Other forms of internal strangulation, such as those produced by a diverticulum from the intestine compressing it, by the adhesion of the vermiform appendix so as to constrict the bowel, or by a contraction of the calibre of the bowel, produce symptoms so identical with those of intussusception in second infancy, when the affection more nearly resembles intestinal obstruction in the adult, as to render diagnosis impossible. The presence of an abdominal tumor, the occurrence of bloody stools, or the protrusion of the constricted bowel from the anus, would be the only diagnostic signs.

7th. Peritonitis, when diffuse, presents a few symptoms in common with intussusception; as the vomiting, constipation, abdominal pain and tenderness; and when the inflammation of the peritoneum is localized, there is in addition a well-defined sensitive tumor, which soon appears as the result of the inflammatory action. The diagnosis here rests upon the greater frequency of the vomiting in intussusception, the more obstinate constipation with bloody discharges from the bowels; the paroxysmal nature of the abdominal pain, with less tenderness; the less degree of fever, the

[1] London Lancet, July, 1846.

moist tongue, slight thirst, quiet respiration, and only moderately accelerated pulse.

Treatment.—There is no special plan of treatment for intussusception deserving the name of *preventive*, owing to our ignorance of any symptoms which can be definitely regarded as the precursors of the invagination. The fact, however, that various derangements of digestion, such as pain upon going to stool, diarrhœa, or constipation alternating with diarrhœa, have been occasionally noticed to precede the attack, should be an additional motive to urge us to meet these symptoms by the most assiduous attention to the hygiene of the child, and to the regulation of its alimentary functions.

The *curative* treatment may be divided into three classes: the medical, mechanical, and surgical treatment.

Medical.—Depletion is strongly contraindicated by the tender age of the patients, and by the necessity of preserving the vital powers; since elimination, which affords the principal chance of recovery, does not occur until after the eighth day. In order, however, to relieve the engorgement at the point of constriction, without reducing the strength of the patient, it is advisable to apply a few leeches or cups to the abdomen, and preferably to the right iliac region, unless a tumor can be detected, when, of course, they should be applied over its seat.

Purgatives were formerly strongly advocated by most authors; the one most generally advised being quicksilver, which was given with a view of overcoming the obstruction by its great weight and fluidity. The use of this agent is now, however, universally reprobated.

In regard to other and less mechanical purgatives, there is still some difference of opinion.

During the early stage of the attack, before the symptoms of intussusception are very positively developed, we should advise the administration of a mild but thorough laxative, such as castor oil, in conjunction with large laxative enemata. If, however, at the end of twenty-four or forty-eight hours, the administration of these remedies, aided by the local depletion, has failed to produce an evacuation from the upper bowel, these measures should be abandoned, and recourse be had to means of calming pain and nervous disturbance, and to the sustentation of our patient. Among the remedies best calculated to allay the pain, the tenesmus and the nervous irritability are: opium, in doses proportionate to the intensity of the pain; warm anodyne poultices applied to the abdomen, and warm baths carefully given. These latter are especially serviceable when the symptoms of nervous disturbance are marked, even amounting, as they occasionally do, to general convulsions.

In endeavoring to sustain the child's strength, attention must be paid to the vomiting, which is generally so severe as to prevent any nourishment being retained. The remedies of most service against this are counter-irritants to the epigastrium, opium, hydrocyanic acid, carbonated water, small pieces of ice kept constantly in the mouth or swallowed whole.

Nutritious enemata may also be tried, but are rarely retained.

The *mechanical* treatment consists in the injection of fluids or air into the

bowel in such quantities as to distend it; and in the introduction of a large sound, with the view of pushing up the invaginated portion of intestine. The fluids generally used have been either tepid water or warm gruel, injected forcibly into the bowel, until the sudden cessation of resistance informs us of the reduction of the intestine. We have already seen that the seat of intussusception in the child is almost invariably the lower end of the ileum, which passes into the cœcum and is there constricted; and, when we reflect that it has been frequently demonstrated that if fluid be forcibly injected into the large bowel, the ileo-cœcal valve will rupture before any fluid is allowed to pass into the ileum, it is evident that we can in this way exert a most powerful pressure upon the invaginated intestine. Experience shows that this procedure is frequently successful, even in cases where all medicinal treatment has proved unavailing; and there are now a sufficient number of such cases on record to render a resort to it proper. The fluid may be introduced by an ordinary syringe, or better by a Bowditch's syringe, the limbs being held together so as to prevent as far as possible any reflux. It has been recently suggested by Simon that hydrostatic pressure might be employed to force fluid into the bowel. For this purpose a glass funnel attached to a long india-rubber tube terminating in an olive-shaped plug is used. The plug is inserted in the anus, and the funnel is held on a level with the body, and water poured in until it is filled. The funnel is then gradually elevated, and more and more water poured in to replace that which is forced by the hydrostatic pressure into the bowel. Owing to the gradual and uniform increase in pressure thus brought about, extreme distension of the entire colon can thus be produced. We have recently employed this mode of treatment with most gratifying success in a very severe case of an infant of 6 months of age.

Air, also, both on account of its great elasticity and mobility, as well as the great facility of its introduction in sufficient quantity, is to be highly recommended. Indeed, inflation was advised by Hippocrates as a remedy in intussusception, but until within the past forty years does not seem to have been much practiced. Two cases of obstruction of the bowels, occurring in adults, successfully treated by inflation, are reported in the *American Journal of Medical Sciences*, for 1833: one by Dr. Janeway, of New York; the other, which, however, was transcribed from the *Glasgow Medical Journal*, for 1831, by Dr. King. The following year, in the *Boston Medical and Surgical Journal*, December 15th, 1834, Dr. J. Wood published a case, also in an adult, where death seemed imminent, but where the obstruction was readily overcome by inflation, and the patient recovered. Since then, this remedy has been frequently employed in intussusception in children, and with such good results, that it may fairly be said that the prognosis of this affection is less grave since the introduction of this remedial measure. To obtain the best results, inflation should be employed early in the case, before any considerable amount of adhesive inflammation has taken place between the sheath and the contained intestine. The air is readily introduced by a pair of ordinary bellows; the nozzle being inserted well into the rectum, and inflation continued until the obstruction yields. The return of the invaginated intestine is some-

times attended by a clearly audible sound, a species of crack, but it never gives any pain, and has generally seemed to afford relief. The complete restoration of the calibre of the intestine is proved by the copious feculent stools which frequently come away soon after the inflation.

A third mechanical means for restoring the displaced intestine has been recommended by Dr. Nissen, and consists in pushing up the invaginated portion by means of an œsophageal sound protected by a sponge. This proceeding would probably be readily accomplished, if the intussusception occurred far down in the large intestine; but it would appear very difficult to replace in this way an invagination as high up as the ileo-cœcal valve. Dr. Nissen, however (in the *Journal de Canstatt*, quoted by Rilliet and Barthez), gives two cases in which he succeeded in pushing up the intestine into the ascending colon, with complete relief of the symptoms of obstruction. There are also a few other cases of cure, by this means, upon record in medical literature.

The *surgical* treatment consists in the performance of the operation of gastrotomy, finding the invaginated portion of bowel and reducing it by gentle traction. When, in our last edition, we expressed ourselves in favor of this operation under certain circumstances, there existed much diversity of opinion on the subject and many authors condemned it. Their disapproval was based upon the grounds of the great difficulty of ascertaining the exact position of the intussusception; the difficulty of restoring the invaginated intestine even if found; and finally upon the dangers of the operation.

We have seen, however, that in the majority of cases the invaginated mass will be found in the neighborhood of the left iliac fossa; the lower end of the ileum having traversed the cœcum, ascending and transverse colon, and these parts being successively inverted; that in a certain proportion of cases a tumor is readily detectable; and further, that some idea as to the seat of obstruction may be obtained from the distance to which enemata appear to penetrate. So that in a considerable proportion of the cases, we have the means of localizing the point of constriction, with a certain amount of definiteness.

In regard to the difficulty of reducing the invaginated parts, authors differ greatly. It has been remarked, that even if the equivocal and uncertain nature of the symptoms of volvulus were not sufficient to deter us from undertaking the operation, the state of the invaginated parts would entirely banish all thoughts of such an imprudent attempt; since the different folds of intestine become so agglutinated to each other that they can hardly be withdrawn, even after death.

Rilliet and Barthez (*loc. cit.*), however, conclude from their anatomical researches, that in the majority of cases the disengagement of the intestines is very easily accomplished; and accordingly they declare that, "after employing medical treatment during three or four days, and after having made several attempts at inflation, we should not hesitate to perform gastrotomy."

The great danger of the operation is, of course, apparent, but should hardly be considered an objection, when we consider the fatal nature of

this affection. Nor have the results of operation been such as to destroy hope. In addition to several successful operations previously recorded, the only 3 cases out of the 57 collected by Haven, in which gastrotomy was performed, terminated favorably. More recently, also, the operation has been performed several times by different operators (J. Hutchinson, Howard Marsh, Legge, and others), and with such encouraging results as to fully justify us in repeating our former advice in regard to its performance.

To sum up our remarks upon this subject: after having tried for two or three days the medical and mechanical means recommended, without success, we must forbear and decide whether to trust the case to nature, with the hope of elimination of the invaginated bowel occurring, or to resort to gastrotomy. And in this decision, the circumstances of each case must be taken into account; for if the case has not yet progressed so far that adhesive inflammation has certainly taken place, and if we are able to detect the exact seat of constriction by the presence of a tumor, the operation certainly has strong arguments in its favor, and should not be hastily rejected.

In those cases which have been trusted to nature, and when elimination has fortunately occurred, we must treat the child, during this crisis, with the utmost care. The diet must be rigidly regulated, and the child kept in absolute repose. Nor must we relax these precautions for several weeks, and allow either indigestible food, or too large a meal of even the most digestible articles; since death has been several times known to follow this imprudence, from a rupture of the imperfectly formed cicatrix.

CLASS IV.

DISEASES OF THE NERVOUS SYSTEM.

GENERAL REMARKS.

It is a very common opinion, both in and out of the medical profession, that this class of diseases occasions a much larger number of deaths in childhood than any other. Indeed, many persons suppose that, be the primary disease what it may, nearly all children who die, die, as it is said, by the brain. It appears, however, from an examination of the bills of mortality for this city, that this opinion is not well founded. During the five years from 1844 to 1848 inclusive, the number of deaths from diseases of the nervous system was less than from diseases of the digestive system, and though larger than those from diseases of the respiratory organs, not so much so as the popular notion would seem to warrant. The number of deaths from diseases of the nervous system was 3970; from diseases of the digestive system, 4204; and from affections of the respiratory system, 3376. M. Barrier, whose observations were made at the Children's Hospital in Paris, says (*loc. cit.*, t. i, p. 35) that, setting aside cases in which the nervous symptoms were probably only sympathetic of some other coincident disease, the cerebro-spinal affections were few in number in comparison with those of the thorax, abdomen, and senses, including amongst the latter the eruptive fevers. He states (*loc. cit.*, p. 34) that affections of the thorax constituted two-fifths of all the cases of disease, those of the abdomen and senses each one-fifth, and of the nervous centres only a tenth. M. Barrier, after combating the opinion so generally entertained, that disorders of the nervous system cause the death of the greater part of the subjects who die before puberty, says (*loc. cit.*, t. ii, p. 233) that there is only one circumstance that in part justifies this opinion, which he opposes "not as false, but as exaggerated," and this is, that the affections alluded to are almost always of a dangerous character, that they are beyond the resources of art, and that they furnish a very considerable relative mortality. He says that, according to his experience, the mortality in diseases of the cerebro-spinal system has been as sixty-eight in a hundred, while in those of the thorax, senses (including the skin), and abdomen, it was respectively as forty-eight, forty, and thirty-two in a hundred.

Before beginning the consideration of the particular diseases of this class, we are desirous of stating that we shall be compelled, on account of our limited space, to devote attention chiefly to those which are most important from their frequency or severity, avoiding or merely alluding to

hose which are of less consequence, or which occur in childhood merely n common with adult life.

In our earlier editions we divided this subject into two classes, one containing all the diseases attended with and dependent upon, some appreciable lteration of the nervous centres, the second containing those in which no uch alteration exists. We have since discarded that arrangement, principally on account of the minute researches of histologists during the past few ears, which have all gone to prove the existence of positive and definite issue-changes in many diseases previously regarded as purely functional.

ARTICLE I.

TUBERCULAR MENINGITIS.

Definition; Synonyms; Frequency.—This disease is characterized y violent cerebral symptoms, dependent upon the existence of tubercular ranulations in the pia mater, as the essential anatomical lesion; accompanied, in the great majority of cases, by coincident inflammation of that nembrane, by softening of the central parts of the brain, by effusions of erum into the ventricles, and in many instances by tubercular deposits in ther organs. Formerly tubercular meningitis, simple acute meningitis ndependent of tuberculization, and simple dropsical effusion within the avity of the cranium independent of inflammation, were confounded together under the single term of acute hydrocephalus or water on the brain. t has been shown, however, that a large majority of the cases of acute ydrocephalus of authors are, in fact, cases of tubercular meningitis, and nore recent researches have further shown that most of the remaining ases are in reality due to the altered condition of the blood, called ræmia, and are independent either of any material lesion of the brain or f the presence of an excess of serous fluid in its cavities.

The term acute hydrocephalus ought to be therefore restricted to the ingle condition of sudden serous effusion in or around the brain, independent of any inflammation; a condition which only occurs in connection ith the causes of general dropsy, and especially with renal disease, and , indeed, merely the most rare form of internal dropsy, and, as such, not o be regarded as a separate disease. A description of the symptoms of his condition will be found in our remarks upon the renal complication f scarlatina.

There can be no doubt that tubercular meningitis is of rather frequent ccurrence, though it is difficult to obtain statistics which will enable us to orm anything like an accurate idea upon this point. M. Barrier (*loc. it.*, t. i, pp. 34, 36) states that during the period in which his observations ere carried on at the Children's Hospital in Paris, there occurred 576 edical cases of all kinds. In this number there were only 10 cases of ubercular meningitis, whilst there were 83 of pneumonia, 48 of pleurisy,

24 of typhoid fever, 48 of measles, etc., etc., showing the first-named disease to be much less frequent than many other affections. We may also form some idea of its frequency in proportion to other diseases, by a reference to the work of MM. Rilliet and Barthez (1ère édit.), who report 33 cases of tubercular meningitis, against somewhat over 245 of pneumonia, 174 of bronchitis, 111 of typhoid fever, 167 of measles, and 87 of scarlet fever. We are of opinion that it is not of frequent occurrence amongst the easier classes of this city, since we have met with less than 60 cases in private practice in the course of thirty-five years. We observe it more frequently, however, in our large children's hospitals, and from what we have been told by other practitioners, it seems probable that it is much more common among the destitute classes, and particularly the blacks, who crowd the southern parts of the city, and who suffer to a great extent from tubercular and scrofulous diseases. It is, however, impossible to obtain accurate information in regard to the frequency of the disease in this city, in comparison with other affections of the brain, from a reference to the bills of mortality. Thus during the year 1874, with a total mortality of 16,254, there were 8349 deaths among minors; of these, 143 are recorded as from hydrocephalus (tubercular meningitis), 382 as from cephalitis, 211 as from congestion of the brain, 83 as from brain disease undefined, and 654 from convulsions. It cannot be doubted that a considerable number of cases of tubercular meningitis are included under these latter vague headings.

Predisposing Causes.—MM. Rilliet and Barthez (2ème édit., t. iii, p. 511) state that the disease is very rare in the first year of life; that it becomes notably more frequent in the second year, but that it is between two and seven years of age that it occurs with the greatest frequency. After this, it diminishes, they say, rapidly from eight to ten, and especially from eleven to fifteen years of age. The influence of *sex* has not been determined, but it appears probable that boys are somewhat more subject to it than girls. It has been clearly shown by the observation of various writers that the disease usually attacks delicate children, and especially those born of parents who are either themselves laboring under tuberculosis, or in whose families that diathesis has existed to a greater or less extent. Of the 31 cases that have come under our own observation in which we have preserved notes of the disease, in 20, one of the parents either had phthisis at the time, or died of it subsequently; in 3, one or the other parent came of a tuberculous family, though in these both parents were living at the time in seeming good health; in 4, no trace of tuberculosis could be found in the parents or in their families, and in 4 the history of the parents or of their families could not be traced out. It is not uncommon for several children in a family to die of tubercular meningitis. Under these circumstances, it has nearly always been ascertained that the parents, or some of the immediate relations, have either died of tuberculous or scrofulous disease, or shown unequivocal signs of one of those diatheses. Thus, 4 of the above-mentioned 20 cases occurred in two families, in one of which the father is since dead of phthisis, and in the other the mother has long been ailing with inactive tubercle of the lungs, and slow caries of a bone, in all

probability of tuberculous origin. It may follow other diseases, and has been observed particularly after measles and other fevers, and after the suppression of eruptions.

M. Barrier (*op. cit.*, t. ii, p. 379) explains, and we think with good show of reason, the causes of the disposition on the part of the tubercular diathesis in children to localize itself in the brain, as well as the disproportionate violence and extent of the inflammatory action in comparison with the degree of the tubercular lesion, by the physiological conditions of the nervous system in early life, which are those of great functional energy and nutritive activity. The affection, though much more frequent in childhood, is by no means peculiar to that period of life, and we have met with, in addition to the cases above referred to, a number of cases occurring in the adult, and presenting the same general clinical symptoms and anatomical lesions.

As to the *exciting causes*, nothing positive is known. The disease has been supposed to be brought into action by falls and blows upon the head, by violent moral emotions, and by exposure to the sun. These causes, however, are all of doubtful influence.

Recent pathological investigations have established the fact that, in many case, the development of true miliary tuberculosis of the cerebral membranes, or of other tissues, is connected with the previous existence of foci of cheesy degeneration, as in an enlarged lymphatic gland, a patch of unabsorbed pneumonia exudation, or otherwise. Undoubtedly such a condition exerts its power of infesting the general system, and leading to the development of tuberculosis, especially when there exists a hereditary predisposition to that disease. In a number of instances, we have been able to trace the origin of tubercular meningitis to this cause.

Anatomical Lesions.—The tubercles which constitute the essential anatomical element of the disease are very rarely found upon the free surface of the arachnoid, but almost invariably beneath that tissue, or in the meshes of the pia mater. They usually appear as more or less opaque gray granulations, the so-called *miliary tubercles*, and may generally be seen through the arachnoid, scattered about in the shape of small, rounded, or flattened bodies, of grayish or yellowish-gray color, and varying in size from two-fifths to four-fifths of a line. When the finger is passed over the arachnoid above them, they may be usually felt as little granular bodies. Their size, however, varies very much, and they are in some cases so small and so closely resemble in color the surrounding parts, that it requires a careful search to detect them. They vary also greatly in number, being in some cases thickly scattered over a considerable extent of the pia mater, while in other cases but two or three can be discovered on each hemisphere.

Frequently they can be detected with most ease upon the processes of pia mater which dip down between the convolutions, so that if we fail to find any granulations upon the surface, we should always strip off the pia mater and carefully examine these processes. Upon a careful examination of the arrangement of the miliary tubercles, it will often be observed

that they are clustered about the small arterioles of the pia mater, and evidently follow in their distribution the branches of these vessels.

These granulations are not found upon all portions of the brain equally in cases of tubercular meningitis. On the contrary, they are rarely present upon its convexity or lateral aspects, while they are uniformly present at the base, and especially about the optic chiasm and the fissures of Sylvius.

Upon *microscopic examination* of one of these granulations, its tissue is seen to be composed of numerous oval cells, with a single nucleus, though there are also some larger cells mixed with these which contain several nuclei. In many instances, as has been observed by Cornil,[1] Hayem,[2] Bastian,[3] and ourselves,[4] the tuberculous granulation will be seen to envelop a small arteriole, whose calibre is obstructed at the point of its development. There is also marked proliferation of the cells of the perivascular sheath of the vessel for a varying distance on either side of the granulation, and it is highly probable that it is from these cells that the granulation has been developed.

We think it probable that some of the granulations may also be developed from the cells of the connective tissue which holds together the vessels of the pia mater.

These miliary tubercles precede the occurrence of the inflammatory changes in the meninges described below, and sometimes it happens, in very acute cases, that the only lesions discoverable consist of a few gray granulations scattered in the meshes of the pia mater. It is not probable, however, that they exist any great length of time without giving rise to meningitis, since they are usually found associated with more or less abundant inflammatory exudation, which surrounds and often conceals them. The chief seat of this inflammation, as of the tubercular deposition, is the pia mater; the arachnoid membrane being, as a general rule, affected only to a slight extent. That membrane sometimes, however, contains a very small quantity of clear or turbid serum in its cavity. Its surface is often dry and viscid, and in some instances its whole tissue is opaque and thickened. But it is chiefly in the pia mater that are found the evidences of severe inflammation. In order to detect these changes, it is necessary to examine the membrane not merely upon the surface of the brain, but to tear it off, so as to bring into view the portions which dip in between the convolutions, and which often exhibit the greatest amount of morbid alteration. The inflammatory lesions vary between mere vascular injection, infiltration with clear, turbid, or gelatinous liquid, and abundant formation of lymph. When the inflammation has gone beyond mere sanguine injection, it is marked by infiltration of the membrane with turbid, whitish, or sanguinolent serum, with pus, or with whitish or yellowish lymph. These products are, like the tubercular granulations which they imbed and often conceal, most abundant at the base of the brain, about

[1] Arch. de Phys. Norm. et Path., 1868, p. 98.

[2] Etudes sur les Diverses Formes d'Encephalite, Paris, 1869.

[3] Edin. Medical Journal, 1867, p. 875.

[4] Trans. of Biological and Micros. Section of Acad. of Nat. Sci. of Phila., 1869.

the peduncles of the cerebrum, the optic chiasm, and in the fissures of Sylvius; like these granulations also, the products of the inflammation are most marked along the track of the bloodvessels. In this respect the disease differs from simple meningitis, in which the results of inflammation are usually more abundant and well marked upon the convexity than at the base. The pia mater, which, in a healthy brain, can be readily detached from the surface of that organ, becomes, in cases of meningitis, particularly in those which are violent, more or less adherent, so that in tearing it off portions of the cineritious substance, which is itself softened, come with it. The proper tissue of the membrane is thickened and indurated, the degree of thickening depending on the amount of infiltration.

After the changes in the pia mater, the most important anatomical feature is effusion within the ventricles. This was formerly thought to be the essential lesion of the disease, but recent researches have shown that it is absent in some instances which have followed in all respects the ordinary course of the malady. According to M. Barrier, effusion cannot be supposed to exist unless the ventricles contain from one and a half to two ounces of fluid, whilst Rilliet and Barthez assert that the normal quantity is a few grammes (about a drachm). The quantity in this disease is very variable; sometimes there are only a few drops or a teaspoonful, while in other instances it amounts to three ounces and a half, or much more. It may be so large as greatly to distend the ventricles, rupture the soft commissure of the thalami, and even the septum lucidum, diminish considerably the thickness of the hemispheres, and flatten the convolutions against each other. In such cases the effused fluid passes through the membrane of the ventricle and infiltrates into and softens the substance of the brain, so that the latter becomes almost of the consistence of thick cream. The characters of the fluid vary in different cases. It is white, perfectly limpid and transparent, or may be turbid, either from being secreted in that condition or from holding in suspension albuminous or purulent flocculi, or portions of the broken-down walls of the cavity. In some rare instances it is sero-sanguinolent. Rilliet and Barthez remark that the effusion which coincides with tubercular meningitis is different from that which accompanies tubercles of the substance of the brain. In the former it takes place rapidly, is turbid, exists in smaller quantity, and constitutes the condition formerly called acute hydrocephalus. In the latter it is secreted slowly and in considerable quantity, dilates the walls of the cranium, and constitutes one form of chronic hydrocephalus.

The brain itself presents various morbid alterations. The whole organ often seems enlarged, so that the dura mater appears distended, and when the latter is cut into, the cerebral substance protrudes in the form of a hernia. At the same time the convolutions are observed to be pressed against each other, and the anfractuosities seem to have disappeared. The compression of the brain depends either upon the distending action of the ventricular effusion, or upon sanguine turgescence of the organ. In most cases, but not in all, there is evident congestion of the cerebral substance, shown by a more or less abundant dotted redness, and sometimes by a general rosy tint of the medullary, and vivid redness of the cortical

portion. Softening of the substance of the brain is of common occurrence in connection with the other lesions. We have already spoken of the softening of the walls of the ventricles where there is much effusion, and which in some cases appears to result from the macerating influence of the fluid. In many other cases, however, microscopic examination of the softened brain-tissues shows the effects of inflammation in the presence of numerous granule-cells, free granular matter, and a disintegrated condition of the nerve-fibrils. In addition to this, as figured by Rindfleisch (*Syd. Soc. edit.*, vol. ii, p. 312), the proper vessels of the cortical substance of the brain frequently present tubercular degeneration of their walls. The lining membrane of the ventricles also presents abnormal appearances in a majority of cases. In some these consist merely in injection with loss of polish and transparency; in others, however, by viewing the surface sideways, we can detect a very finely granular condition, as though the membrane had been sprinkled with fine sand. Löschner (*Aus dem Franz Joseph Kinderspitale*, 1860, Prague), has found this appearance to be due to a proliferation of the cells of the ependyma, the minute granulations consisting of rounded nucleated cells. In Dr. West's minute analysis of 61 autopsies of tubercular meningitis, also, the lining membrane of the ventricles presented evidences of inflammation in a large proportion of the cases. We have also referred, very cursorily, to the softening which exists under the inflamed portions of the membranes, and which occasions adhesion of the pia mater to the brain beneath. In the latter cases the softening may be either red or white, and does not penetrate more than a line, and often less, in depth.

In addition to the changes already described tubercles of the brain itself may be occasionally met with, having no connection with the meninges. These are found in various parts of the organ, and differ greatly in size, varying generally between that of a millet-seed and hazel-nut, but reaching sometimes the volume of a pigeon's or hen's egg, or even that of half the fist.

We have but few words to say in regard to the lesions of other organs. It is undoubtedly true that in the vast majority of cases tubercles are found in other parts of the body. Of all the cases of tubercular disease observed by Rilliet and Barthez, amounting to 312, in only one was the deposit confined to the meninges (*op. cit.*, 1ère édit., t. iii, note, p. 49). M. Valleix (*op. cit.*, t. ix, pp. 196, 197), states, that in all the cases, without exception, of tuberculosis of the meninges in adults, tubercles exist also in the lungs, and that the same is true, in the vast majority of cases, in regard to children. The organs in which the deposit is most apt to exist are the bronchial glands, lungs, mesenteric glands, pleura, and peritoneum.

Another very frequent lesion is softening of the stomach. This may affect only the mucous or all the coats, so that a slight degree of force will suffice to tear the organ. Dr. Gerhard (*Am. Jour. Med. Sci.*, vol. xiv, 1834) states, that lesions of the stomach existed in six of the ten cases detailed by him, and in four-fifths of others not detailed.

Before quitting this subject, we would call the attention of the reader to the fact mentioned by M. Valleix (*op. cit.*, t. ix, p. 214) that all the

ymptoms about to be described as constituting the disease under consider-
tion, with the exception of paralysis, may depend on simple tuberculosis
f the meninges. Several cases have been cited, in fact, in which the only
sion found after death consisted of granulations in the pia mater. No
races of inflammation were observed. It is clear, therefore, that the evi-
ences of the disease, or symptoms, depend not merely on inflammation
aused by the tubercular deposits, but on the presence of that morbid pro-
uction. The paralysis, which is one of the important symptoms, depends
artly upon the inflammatory changes in the brain-tissue itself, and partly
pon the pressure exerted on the structures at the base of the brain by the
xudation which forms there.

SYMPTOMS; COURSE; DURATION.—The disease has been divided by
uthors into different stages, founded on the predominance of certain
ymptoms at particular periods of its course.

These divisions are all imperfect and unsatisfactory, because the disease
in fact a continuous one, and for this reason some writers have avoided
ttempting any classification of the symptoms. We can, however, obtain
more faithful picture of the disorder by adopting the division made by
M. Valleix, which, though arbitrary and imperfect, because of the want of
natural line of demarcation, seems warranted by the very great differ-
nces in the character of the symptoms at an early and late period of the
ffection. We shall therefore describe first the invasion of the malady,
nd then two stages or periods of the symptoms after the disease is con-
rmed.

The *invasion* of the disease may be either insidious or sudden. In a
rge majority of the cases, the onset is preceded by a well-marked pro-
romic period. The length of this period varies greatly in different sub-
cts. Its duration is stated by MM. Rilliet and Barthez to be, as a general
ule, between fifteen days and three months, scarcely ever less, and rarely
ore. During this period, the symptoms presented by the child are those
hich are usually held to be indicative of a failure in the general health.
he nutritive functions especially show disorder. The appetite diminishes,
becomes capricious, there are alternations of constipation and diarrhœa,
e body grows thin, the color pales, the gayety of childhood disappears,
nd the patient becomes listless, apathetic, and complains of being tired and
eak; or he is irritable and peevish, or too mild and gentle; study and
xercise both become distasteful, and there is a degree of weakness and
bility, which, though slight at first, becomes at length so evident as to
ouse the attention of the parents, or those who have charge of the child.
, as not rarely happens, there is a development of miliary tubercles in
e lungs also, there may be troublesome, dry, spasmodic cough before the
ppearance of cerebral symptoms. Besides these symptoms, there is often
ry great restlessness at night. The only pain complained of is headache,
nd sometimes abdominal pain. The headache is, in subjects old enough
notice and describe their sensations, often a prominent symptom. It is
t constant, but occurs at intervals, and is sometimes severe, and its re-
rns frequent. Fever is not generally present until after the more positive
mptoms have fairly begun, and when present is generally slight and

fugacious. The emaciation and loss of strength are seldom present to such a degree, in the prodromic stage, as to confine the child to the house. On the contrary, he continues to amuse himself at times, and to walk as usual.

The following is a rapid and summary account of the mode of invasion in some of the cases that have come under our own observation:

In one case, in a girl six years of age, the invasion was preceded during three months by occasional cough, and irregular attacks of fever, by progressive emaciation, paleness, languor alternating with extreme irritability, disinclination to take exercise, and during the latter part of the time by partial lameness, and in fact by all the signs of general tubercular disease. In another, which occurred in a boy eight years of age, it was preceded for several months by frequent complaints of intense headache, especially after taking active exercise, and by unusual languor, but no other symptoms. The boy was sent to a boarding-school apparently well, and was suddenly attacked there. In five cases the meningeal symptoms were developed in connection with those of phthisis, whilst in an eighth they followed a state of general weak health, with dyspeptic symptoms, which had lasted for several months. In a ninth case, a violent convulsion, seemingly dependent on a fit of indigestion, was followed during four months by irregular and diminished appetite, by some loss of strength and flesh, and by frequent attacks of severe headache, and at the end of that time, by the symptoms which denote inflammation of the membranes. In a tenth, after some months of gradual thinning and general debility, a convulsion occurred, also from indigestion apparently. This was recovered from, but a few days afterwards the symptoms of meningitis showed themselves, and followed their usual course. In an eleventh case, occurring in a girl ten years of age, there was a mild, almost continuous fever, lasting four weeks, and resembling most closely typhoid fever, except that there was no diarrhœa and only a very few doubtful rose spots, when severe frontal headache, vomiting, slow and intermittent pulse, with drowsiness, declared the invasion of tubercular meningitis. In a twelfth, a girl three years old, born of healthy living parents, presented for four days the signs of gastric catarrh, with, however, unusual irritability of temper alternating with a suspicious quiet. On the fifth day, there was just perceptible strabismus, after which the case went on in the usual way to a fatal result. In a thirteenth, in a girl five years old, of healthy living parents, but with tuberculous grandparents on the father's side, the general health failed slowly, with loss of appetite and flesh for one month. Then there set in lassitude, desire to lie about, with the most petulant irritability on the slightest disturbance, occasional vomiting, constipation, loathing of food, and gradual conversion of drowsiness into coma, and so on to the end. In a fourteenth, a case of general miliary tuberculosis, to which allusion has already been made in the article on Hooping-cough, there was a hard, spasmodic cough for some weeks, succeeded by an irregular febrile state simulating typhoid fever, and lasting some days before the appearance of cerebral symptoms. In the remaining cases that we have seen, the invasion was preceded by much less decided prodromic symptoms.

After the different phenomena above described as characteristic of the

prodromic stage have continued during a variable length of time, the disease enters into activity, a change which is ushered into by three important symptoms: *headache*, *vomiting*, and *constipation*, to which is added, in a large majority of the cases, slight *acceleration* of the circulation. At the same time the *intelligence* remains perfect, the *strength* is not greatly diminished, the *appetite* is not entirely lost, and the *thirst* is moderate.

First stage.—The headache, vomiting, and constipation persist and become more marked. *Headache* is a nearly invariable symptom in children old enough to describe their sensations, and is therefore very important. In infants its presence is to be inferred when the child carries its hands frequently to various parts of the head, and presses strongly against it, and when the head is constantly rolled from side to side. It is generally frontal, and is usually referred to a point just over one or both brows. In other cases it extends over the whole head. It is commonly severe, so that the child when old enough complains of it spontaneously. In the case of a girl seven years old, whom we saw, it was so severe that she cried frequently and bitterly, begged to have the doctor sent for, and submitted willingly to any remedy suggested with a view to its relief. It is thought that the acute, shrill cry of the disease, to which the term hydrencephalic has been applied, depends on the acuteness of this pain. It usually lasts throughout the first stage, and ceases only as the delirium and coma of the second stage come on. *Vomiting* is also a nearly constant symptom. Of 90 cases collected from different sources by M. Barrier, it was absent only in 15, or less than a fifth. This symptom generally makes its appearance on the first day, rarely later than the second or third, and lasts two or three days, and sometimes longer. In one case that we saw, it lasted seven days, though it was but slight on the tenth and eleventh. The matters ejected from the stomach consist of the ingesta, and of mucus and bile in various proportions. It is commonly repeated two or three times a day. *Constipation* is even more important as a symptom than the one last named. Of 87 cases it was absent only in 7, according to Barrier. MM. Guillet and Barthez state, however, that it exists at the beginning only in about three-fourths of the cases. Where there is diarrhœa instead of constipation, at the invasion, as sometimes happens, the former symptom almost always depends on tubercular disease of the intestine. Even under these circumstances, however, the diarrhœa is sometimes arrested, and constipation substituted under the influence of the cerebral disease. The constipation generally persists obstinately for several days, and then gives way under the influence of purgative medication, or is replaced spontaneously by diarrhœa with involuntary stools towards the termination of the case.

In connection with the three important symptoms just described, there are others, which, though less characteristic, are of much assistance in forming the diagnosis. The child is *dull* and *sad*, or *excited* and *irritable* by turns; he shuns the *light*, or closes the eyelids and contracts the brows when it is thrown upon the face; his hearing becomes painfully acute, so that sudden and jarring sounds distress and irritate him; the *sleep* is restless and disturbed, and accompanied by grinding of the teeth; and he

utters from time to time, both sleeping and waking, the peculiar shrill, sharp, and sudden scream, which seems to depend upon internal pain, probably headache, and which has been called by Coindet the *hydrencephalic cry*. In young children, those who have not yet learned to put their sensations into words, a peculiar, apparently causeless, obstinate peevishness and positive ill-temper, shown by sudden, sharp crying at any disturbance, as even the kindness of a father or mother, especially when this alternates with sluggishness or drowsiness, and when there is no evident disease of a painful or exhausting kind to explain such a state, ought to arouse the fears of the physician as to the possible inception of this disease, even when there is as yet no vomiting or distinct signs of headache to call attention to the brain. The general as well as the special sensibility is sometimes but not by any means always, exaggerated at this time. Rilliet and Barthez met with exaltation of this function only in four of their patients. The *intellectual faculties* remain undisturbed in the majority of the cases during the first few days, and this fact, which is so contrary to what might be expected, is one of the utmost importance in the judgment of the case. We remember being asked by a little girl seven years old, to whom we have already referred, "why it was that she saw double; why she saw two mothers and two doctors?" At the time when she first asked the question there was no perceptible strabismus, but on the following day we thought we could detect a deviation of one of the eyes from its proper axis, and on the third day the deviation was very marked, though the poor child still wondered why she saw two objects instead of one. In another case in a boy five years old, there was no disorder of the intelligence until the eleventh day, when there was slight delirium alternating with somnolence; yet it was clear from the first that the attack would prove one of tubercular meningitis, from the coexistence of violent frontal headache, obstinate vomiting, constipation, slow and irregular pulse, and the absence of other local or general symptoms. In only a fifth of the cases observed by MM. Rilliet and Barthez was there perversion of the intellectual faculties at the invasion. Let us observe, moreover, that even when children present some of these disorders early in the attack, they generally consist only of slight delirium, dulness of the intelligence, slowness and hesitation in answering questions, disposition to somnolence, excessive irritability and peevishness of temper, and what is more important and characteristic than any of these, perhaps, of a certain expression of the countenance, and particularly of the look, which is expressive of astonishment or of the utmost indifference. The look is, in fact, fixed or staring, like that of one in a mild ecstasy. Even when these symptoms exist, however, at an early period, they not unfrequently alternate with the most perfect clearness of the faculties, so that the physician in private practice, who sees his patient only at long intervals, and for a few moments at a time, should never venture to disbelieve, without due consideration, the account of the mother or nurse as to their occasional presence during his absence, even though never observable during his visit. We knew this to happen in regard to two boys of eight and ten years of age respectively, whose mothers constantly insisted to the physician in attendance that during his absence the chil-

ren occasionally presented slight delirium, and a wild uncertain expres-
on of the countenance, which made them fear that the brain might be
ffected. As the children's intelligence was perfect, however, whenever
ıe doctor saw them, he determined that the mothers were fanciful through
ver-anxiety, and ascribed the sickness to a bilious disorder of the stomach.
fter a few days the cases developed themselves, and the boys died with
very symptom of tubercular disease of the brain.

When disorders of intelligence do not occur in the early days of the
ttack, they usually make their appearance about or soon after the fifth
ay.

In this disease, as in acute simple meningitis, the obstruction to the re-
ırn of venous blood through the sinuses produces in both eyes, but especi-
ly in the one corresponding to the hemisphere where the inflammation is
ost intense, congestion and œdema of the optic papilla and surrounding
ssue (Bouchut's peripapillary congestion); tortuosities and varicosities of
e retinal veins; and occasionally thrombosis or rupture of these vessels,
using minute hæmorrhages in the retina. In some cases the size of the
obe is increased, owing to hydrophthalmia. In addition to this, the char-
teristic appearances of optic neuritis often become visible. These lesions
e indeed more frequent in this disease than in simple meningitis, since
e inflammation and resulting exudation are more apt here to involve the
se of the brain, and cause a greater degree of obstruction to the circula-
on.

Enlarged experience has convinced us of the high value of these retinal
ions in establishing the differential diagnosis of tubercular meningitis.
is true that they cannot be regarded as pathognomonic of the existence
this disease, and are therefore only valuable as confirmatory of the gen-
l symptoms, still in certain cases the development of the ocular lesions
fore the appearance of the more characteristic symptoms enable the diag-
sis to be made at an earlier date than would be possible without oph-
lmoscopic examination; while in others where the general symptoms
ve it for the time doubtful whether the case is one of typhoid fever or
tubercular meningitis, the use of the ophthalmoscope renders invalua-
aid.

During the first stage the *coloration* of the face ought to be noticed. It
enerally paler than natural, though from time to time a sudden flush
redness may be seen to pass over it. The condition of the *senses* is
ural, except that the acuteness of the eye, ear, and sometimes that of
ch, are exalted, so that the child avoids the light, starts at sudden or
d sounds, and cries when it is touched or moved. The *respiration*
omes unequal and irregular, and is interrupted by sighing or yawning.
Convulsions rarely occur in the first stage. MM. Rilliet and Barthez
clude that meningitis without complication of tuberculous disease of
cerebral substance, never begins with convulsions. In one of the cases
t came under our charge, a severe and prolonged convulsive seizure did
ır, however, on the very first day of the attack of the disease. The
ject of the case was a boy between four and five years old. The death
place on the eighteenth day, and the autopsy showed no tubercular

disease of the cerebral substance. It is proper to state, however, that the child had eaten on the morning of the day that he was attacked, a most unwholesome meal, and it is very possible, as we in fact supposed at the time, that the convulsions were caused by the presence in the stomach of undigested food. When they do occur in tubercular meningitis, they may be limited to the extremities, upper lip, eyeballs, or they may be general. Sometimes the child dies in a convulsion. They are generally much less important as a symptom, according to M. Valleix, than in simple acute meningitis.

The *tongue* remains moist; the *appetite* is not entirely lost; *thirst* is moderate; the *constipation* continues, unless removed by treatment; the abdomen becomes *retracted*, so that its walls approach closely to the spinal column, and allow us to feel the pulsations of the aorta without using more than very slight pressure. The latter symptom comes on gradually, and is generally well marked by the sixth day or a little later. MM. Rilliet and Barthez regard it as a very important sign, and state that they have observed it almost exclusively in cerebral affections. They think it depends not upon contraction of the abdominal muscles, but upon retraction of the intestines. We can corroborate by our own experience, the evidence of the above authorities as to the value of this symptom. It has been very marked in most of the cases that we have seen.

The state of the *circulation* is of the utmost importance in forming the diagnosis. So true indeed is this, that Dr. Whytt, of Edinburgh, whose description of acute hydrocephalus, published in 1768, has been most highly commended by all recent writers as a singular instance of accurate observation, makes three stages of the disease, each of which is characterized by the state of the pulse. In the early part of the attack the pulse is accelerated, rising to 110, 120, or, according to Whytt, in a few cases to 130 or even 140. At the same time it is neither full nor tense, as a general rule, but rather soft and compressible. This condition of the pulse changes, as we shall find, in the middle period of the disease, and again shortly before the fatal termination. The *heat* of the skin is usually moderate and sometimes quite natural, at this time, as might be supposed from the state of the circulation. Frequently the temperature will not during this period exceed 100° to 100.5°, though occasionally marked and rapid changes in it are observed. It is especially to be noted that the temperature does not follow the regular mode of development so characteristic of typhoid fever.

Second stage.—This stage begins about the time the more marked nervous symptoms show themselves. The headache generally subsides or ceases at the beginning of this period and gives place to *delirium*. This occurs usually somewhere between the sixth and twelfth days. The delirium which occurs has been generally supposed to be always mild and calm. MM. Rilliet and Barthez state, however, that in one-third of the cases it was intense, and accompanied with cries, agitation, and frequent changes of position. In most of the cases, however, it is mild, and is manifested in older children by their muttering unintelligible words, by inattention to what is going on around them, by an expression of wildness

and astonishment, and by their giving hesitating answers to questions. In children under two years of age there is no proper delirium. There is, however, an analogous condition, which is characterized by disorder of the two faculties of attention and perception. The delirium seldom lasts more than two or three days, and generally alternates with somnolence, so that the child is either dozing and sleeping, talking in its sleep, or frequently waking with loud cries, and restlessness. The *general sensibility*, which may have been exaggerated in the early period of the disease, is diminished in the early part of the second stage, or about the seventh day, and completely abolished towards the end. The face in the second stage is almost always pale, or pale and flushed alternately. During this stage, and especially during the latter part of it, it is very common to see sudden alterations in the color of the face. Sometimes without any apparent cause, but more frequently from disturbances of any kind, as from pain, or from external influences acting upon the child, such as moving it, or the administration of food or medicine, the face becomes suffused of a more or less deep pinkish or scarlet tint, the color beginning faintly at first and gradually deepening and expanding until it covers the whole face and forehead, and then as gradually fading away. It is during this stage also that another symptom, which we have often noticed, and to which M. Trousseau has called attention, may usually be observed. M. Trousseau refers to it as a red line or spot remaining upon the skin of the forehead or abdomen when the finger has been drawn across it, and has given to it the name of "*tache méningitique*," or "*tache cérébrale*." We had often remarked, before knowing that M. Trousseau had drawn attention to this phenomenon, that the slightest pressure with the finger on any part of the face or forehead, caused the appearance at the point of pressure, of a spot of a peculiar pink or rose color, which, like the flush above referred to, began faintly, became more or less deep in tint, remained a few moments, and then as gradually faded away. This symptom is undoubtedly due to the extreme modification of the innervation of the minute bloodvessels of the skin. There is no doubt that it is nearly always present in cases of tubercular meningitis, and thus may be said to possess a diagnostic importance. We have, however, so frequently met with the same phenomenon in cases of typhoid fever, and more rarely in cerebral pneumonia, that we must warn against its being regarded as a pathognomonic symptom of tubercular meningitis. Occasionally contractions pass over the features, giving rise to grimaces, after which the countenance resumes its expression of indifference and stupor. The eyelids are generally only partially closed, and between them the globes of the eyes can be seen to oscillate and move in various directions, as though by some automatic force.

As the case progresses, the *nervous symptoms* become more and more marked; somnolence gradually deepens into coma; the delirium becomes less and less frequent; and the child no longer observes what is going on, nor answers questions. As the somnolence and coma increase, various lesions of motility make their appearance, consisting, in order of frequency, of paralysis, which is generally partial; contraction with rigidity of the limbs; stiffness of the muscles of the back of the neck, causing retraction

of the head; stiffness of the trunk; spasmodic closure of the jaws; carphologia; subsultus tendinum, and convulsions. The paralysis is almost always partial and of very limited extent, affecting, for instance, the jaw, the orbicularis muscles of the eyelids, the levator of the upper eyelid, the tongue, or one side of the face. It is very rare to see one of the limbs paralyzed. Contraction with rigidity of the muscles is an important symptom, but is not always present. When it exists it generally appears at an advanced period of the attack, commonly between the seventh and thirteenth days, and is usually partial. It may affect either the extremities, back of the neck, trunk, or inferior maxilla. It is seldom permanent, but after lasting one or two days, disappears, to reappear at a later period. The carphologia, subsultus, and chewing motion of the under jaw generally occur only a few days before death, and lasts but a few days.

The *decubitus*, in the early part of the second stage, is generally lateral, with the thighs flexed upon the pelvis, the legs upon the thighs, the arms applied against the thorax, the elbows bent, and the hands placed in front, the decubitus called by the French "*en chien de fusil*," or *gun-hammer*. At this time the child will still occasionally move its position with facility, showing that strength is not by any means entirely lost. At a still later period the decubitus is dorsal. In the latter part of the first and early part of the second stage, the *pulse*, which we have ascertained to be accelerated at the invasion, falls to the natural standard, or becomes slow, and at the same time irregular. From 110 or 120, as it was, it now sinks to 90, 80, 60, or, as happened in one instance to M. Guersant, to 48 in the minute. Coincidently with this change it almost always becomes irregular. The irregularity affects both its force and frequency, so that a strong pulsation may be followed by a feeble one, or the rhythm may be regularly or irregularly intermittent. The irregularity varies greatly at different periods of the day, or within short spaces of time, so that the pulse is found to be very slow at one moment and much more frequent the next. On this account it is necessary to examine it on different occasions. Slowness and irregularity of the circulation are important as a means of diagnosis, since it has very rarely been met with as a permanent condition, except in the tuberculo-inflammatory affections of the brain and its appendages. Towards the termination of the disease, generally speaking two or three days before death, the pulse rises again in frequency, so that it counts at first 112 or 120, and gradually increases to 140, 160, or even 200 the day before, or that on which death takes place. Simultaneously with this change it also becomes extremely feeble and small, and often ceases to be perceptible at the wrist on the last day.

The *respiratory movements* also show marked irregularities. During the early stage of the disease they are frequent, though we think rarely so much so as to preserve the normal ratio to the pulse. But during the stage we are now considering, the breathing becomes unequal and irregular, and deep sighing respirations alternate with quick superficial ones. We have called attention lately[1] to a very peculiar modification of respira-

[1] Remarks on Cheyne-Stokes Respiration, especially in connection with tubercular meningitis, by William Pepper, Phila. Med. Times, May 27th, 1876.

tion, which has been frequently observed by ourselves and others in the exudative stage of tubercular meningitis. The following description may serve to give an idea of its general character: "The breathing is from time to time interrupted by periods of apnœa of varying length (five to thirty seconds), between which occur a series of respiratory acts, which begin by very feeble and barely perceptible movements, and gradually grow fuller and stronger until they reach a climax, when they occasionally end by a long-drawn sigh, or more commonly, pass through a descending scale of movements, each growing more and more feeble until they end with barely perceptible respirations, such as marked the beginning of the series. This period of respiration, which also occupies from five to thirty seconds, is followed by a second period of complete apnœa, which is in turn succeeded by a group of respirations similar to the first." (*loc. cit.*) This disturbance of respiration, together with the interference with the heart's action, depend upon the pressure of the exudation upon the pneumogastric nerves; and, as they are not found in the affections which may simulate tubercular meningitis, must be regarded as possessing considerable diagnostic value.

The *heat* of skin, which has fallen with the reduction in the frequency of the pulse, generally increases with its acceleration. This is not invariable, however, since in some cases the temperature remains but moderately elevated, about 101° or 102°, until death; and in others an algid condition precedes death, in which the temperature falls as low as 79.4°. (*Reynolds's Syst. of Medicine*, vol. ii, p. 379, art. Tuberc. Meningitis.) On the other hand, in some cases the temperature increases irregularly as the fatal result approaches, and may attain an extreme height. Thus Roger (op. cit., p. 323) has observed on the day of death in an attack of tubercular meningitis, a temperature of 108.5° F. During the last few days the surface is often covered with an abundant perspiration; the tongue becomes dry; the teeth and gums are fuliginous; the exhaustion increases; the respiration becomes stertorous, unequal, difficult, and anxious, and at the very last attended with great dyspnœa; and the urine and stools are discharged involuntarily. Death finally occurs in this condition, or is hastened by an attack of convulsions. In some cases it is most lingering. In one instance we expected the death of a young child in this disease every day for eight in succession.

The *duration* of tubercular meningitis is exceedingly variable in different cases. As a general rule it lasts between eleven and twenty days, though it may continue a considerably longer time. Rilliet and Barthez have never known death to occur before the seventh day.

Diagnosis.—The diseases with which tuberculosis of the meninges is most likely to be confounded are simple meningitis and typhoid fever. It might also be confounded, though this is much less probable, with the cerebral symptoms which complicate the exanthemata and some local diseases, especially pneumonia, and to which symptoms, as a group, M. Barrier has applied the term pseudo-meningitis.

The diagnosis between tubercular and simple meningitis will be best understood from the following synoptical table, based upon the one contained in the last edition of the work of MM. Rilliet and Barthez.

SIMPLE ACUTE MENINGITIS.

I. The subjects of acute simple meningitis are usually robust and well-developed, and present no trace of either internal or external tubercular disease. Born of healthy parents.

II. The disease may prevail epidemically.

III. *Condition prior to invasion.*—The disease begins in the midst of the most blooming health, or, if secondary, it occurs in the course of, or during the convalescence from, some acute non-tubercular disease, or it follows an external cause.

IV. *Mode of invasion.*—Violent convulsions attended with intense febrile movement, and with very hurried respiration in young infants; or very acute frontal headache, accompanied by fever, bilious vomiting, and towards the end of the first, or in the course of the second day, at the latest, excessive restlessness, preceded or not by somnolence; most violent delirium; formidable ataxia.

V. *Symptoms.*—*Very intense* headache, *obstinate* vomiting, *moderate* constipation, *violent* fever, *high* delirium.

VI. From the beginning, the aspect of a grave disease of ataxic form.

VII. Course rapid, aggravation progressive and continuous; convulsion after convulsion, or else violent delirium, extreme agitation, violent fever, etc.

Duration.—Disease of short duration, ending sometimes in 24 or 36 hours, but lasting generally from three to six days, and seldom more.

REGULAR TUBERCULAR MENINGITIS.

I. Subjects of tubercular meningitis delicate, puny, exhibiting often precocious intelligence and sensibility. Have sometimes had, in infancy, enlarged glands or chronic cutaneous eruptions; the parents, or brothers and sisters, often present the signs of tubercular disease.

II. Disease always sporadic.

III. *Condition prior to invasion.*—For some months or weeks the patients grow languid, lose their strength, become pale, emaciate; their temper changes, they are dull, they lose appetite, the digestion is deranged, etc. Absence of prodromic symptoms is rare.

IV. *Mode of invasion.*—Never with convulsions at the onset; the change from the prodromic to the acute stage sometimes imperceptible. It takes place by a progressive increase of the symptoms before mentioned, and by the setting in of headache; in other cases, the acute stage is better marked by headache, vomiting, and constipation; generally, the intelligence remains clear; no ataxia. In the rare cases in which there is ataxia at the onset of the acute symptoms, the prodromic stage, above described, has been observable, or the meningitis has occurred in the course of advanced phthisis. In cases in which no prodromes exist, the meningitis begins with vomiting, constipation, moderate headache, and slight febrile movement; ataxia, if it is to appear, occurs later, and a mistake is impossible.

V. *Symptoms.*—Not *very intense* headache, vomiting *less frequent*, *very obstinate* constipation, *very moderate* fever, slowness and irregularity of the pulse, delirium usually mild.

VI. Invasion insidious, with the aspect of a mild disease.

VII. Course slow, preservation of the intelligence to an advanced period, fever slight, and some slowness and irregularity of the pulse, sighing, changing color of the face, eye dull or ecstatic, etc.

Duration.—Always much longer in the regular form.

We will remark in regard to this table, which is, in most respects, admirable, that we have never met with more intense and persistent headache than we have in some cases of the disease under consideration. In some of our cases this has been a most prominent and striking symptom.

Before quitting the subject of the diagnosis of these two affections, it is desirable to state for the information of the reader, that some of the highest authorities acknowledge it to be sometimes nearly or quite impossible to distinguish between them. This is the expressed opinion of MM. Guersant, Rufz, Barrier, and Valleix.

From typhoid fever, tubercular meningitis is to be distinguished by the antecedent history of the patient, which often reveals the existence of a tubercular diathesis in the latter affection; by the symptoms of the invasion, which in meningitis consist of severe and persistent headache, frequent vomiting, and constipation, whilst in typhoid fever the headache is less severe and less persistent, the vomiting much less frequent, and the constipation replaced by diarrhœa, or at least by an unusual susceptibility to the action of laxatives; by the different characters of the febrile movement, which, in typhoid fever, is more marked, and attended with a frequent, full, and regular pulse, while in meningitis it is less marked and is accompanied after a few days by slowness and irregularity of the pulse, and by irregularity of respiration; lastly, in meningitis, the constipation is usually marked, the abdomen is retracted, and there are various important and characteristic lesions of motility, and the special senses; in typhoid fever there is diarrhœa, the abdomen is distended and meteoric, there are characteristic rose-colored spots, whilst there are no considerable lesions, either of motility, or of the special senses. Much assistance in the diagnosis can also be obtained by a careful study of the course and changes of the temperature in the two diseases. In tubercular meningitis, instead of the gradual progress in development, with moderate evening exacerbations, which is so characteristic of typhoid fever, the temperature presents great and irregular variations; it is specially marked by a period of reduction, even to 97° or 96° (Roger), corresponding to the middle stage, and then by a final rise, which may continue increasing until the last day of life, or may be replaced by an algid state, with great lowering of the heat of the surface. In doubtful cases, the use of the ophthalmoscope will often be of great value. We have already mentioned the retinal changes which are frequently seen in tubercular meningitis, whilst in typhoid fever no lesions will be detected.

Although the above general remarks apply to the majority of cases, it must not be imagined, however, that the diagnosis between the two affections is always easy or even possible in the early stages. This is largely due to the fact that the typhoid fever of children presents as many irregularities and departures from the typical course which it more frequently follows in the adult. Thus it is not very rare to have epistaxis, diarrhœa, and even the peculiar eruption absent in typhoid fever in young children, and if, when this occurs, the *tache cérébrale* be developed by drawing the nail over the skin, it is evident that it will be difficult to decide whether the irregular fever, with cerebral disturbance, be the result of the one or the

other of these affections. The symptoms of most value in such obscure cases, are irregularity and slowing of the pulse, with unequal and irregular respirations; and strabismus, diplopia, or changes in the optic nerves or retina. When these appear, as they usually do in the second stage of tubercular meningitis, the diagnosis can scarcely possess any further difficulty.

It is unnecessary to do more than allude to the possibility of confounding the disease with the exanthemata, or with local diseases accompanied by cerebral symptoms, and particularly with pneumonia in very young children. The resemblance of pneumonia of the apex of the lung in the early stage to tubercular meningitis, has been referred to in the article on pneumonia. The diagnosis must be made by careful consideration of the symptoms peculiar to each, and in the case of a local disease, by accurate physical examination of all the important organs of the body.

Occasionally, also, cases are met with where, in connection with gastro-hepatic disturbance, there is probably some cerebral congestion, and which may simulate the early stage of tubercular meningitis. For instance, we were called to see a boy eight years old who had been suffering for two weeks with violent frontal headache, frequent vomiting, constipation, slight fever, and somnolence. We feared that the case might prove to be one of tubercular meningitis. However, a large dose of calomel, followed by castor oil and free leeching to the temples, relieved him in two days perfectly, and he has remained well ever since, though this was a number of years ago.

Prognosis.—M. Barrier, in speaking of the prognosis of this affection, says: "The gravity of tubercular meningitis is not surpassed by that of any other disease. Thoracic and abdominal phthisis, though almost constantly fatal, pursue a slower course, and last a longer time. We may even allow as proved, that in a small number of cases, they are susceptible of cure, or may remain stationary for months or years. Unfortunately it is not so in regard to tubercular meningitis." MM. Rilliet and Barthez, in their second edition, do not express the same entire hopelessness as to recovery from the disease, that they did in their first. They say, amongst other conclusions (*op. cit.*, t. iii, p. 510), that there are on record incontestable examples of the complete disappearance of the symptoms, but remark, that such cures have occurred in the first stage, or in the first half of the second stage, after seven or eight days of sickness, rarely later, and after alternations of amelioration and aggravation. They state also that, in excessively rare instances, a return to health has been obtained even in the course of the third stage, after many weeks of illness. They are of opinion that the disease often returns and proves fatal in from one to five years and a half after the recovery. The cause of the relapse is to be found in the fact that the local lesion remains, and that the diathesis has not been eradicated. M. Valleix is of opinion that after having acquired the conviction that a case is really one of tuberculosis of the meninges, we should regard the patient as lost; "for the exception that I have mentioned (a case belonging to M. Rilliet, then unpublished), even did no doubt as to the exactness of the diagnosis remain, ought not, standing by

itself, to impart to us any real security." M. Guersant (*Dict. de Méd.* t. xix, p. 403), seems to think it possible that the disease may sometimes terminate favorably in the very early stage, but adds that "such cases are always more or less doubtful, and seem to us to belong rather, for the most part, to simple meningitis." During the second period (that of slowness and irregularity of the pulse), he has scarcely seen one child in a hundred survive, and even then they perished at a later period of the disease, or of phthisis pulmonalis. Of those arrived at the third stage (marked by renewed frequency of the pulse, coma, and lesions of motility and sensibility), he has never seen any recovery, even momentarily. Dr. George B. Wood (*Prac. of Med.*, vol. ii, p. 365), states that he has "never seen a well-marked case of tuberculous meningitis end favorably." Dr. Robert Whytt (*Works of Robert Whytt, published by his son*, quarto, Edinburgh, 1768, p. 745), says: "I freely own, that I have never been so lucky as to cure one patient who had those symptoms which with certainty denote this disease; and I suspect that those who imagine they have been more successful have mistaken another distemper for this."

In the quarterly abstract furnished by Dr. A. Wiltshire in the *Brit. and Foreign Med.-Chir. Rev.*, for April, 1876, at page 465, it is stated that Dr. Clifford Allbut has known of two cases of recovery from tubercular meningitis, in which the diagnosis made with the aid of the ophthalmoscope was verified some years later at the autopsies of the patients. And at the same place is quoted another case by Dr. Rinteln (*Berl. Klin. Wochnschr.*, No. 21, 1876, p. 287), where recovery occurred after all the recognized symptoms of tubercular meningitis had been present, and where this diagnosis with a consequent fatal prognosis was made by all the physicians who saw the patient.

Our own experience coincides with the mass of evidence given above as to the almost hopeless fatality of the disease. All the undoubted cases that we have seen have proved fatal. A case, however, came under our observation, in 1850, which might, perhaps, be classed as a recovery from tuberculosis of the meninges, though not from tubercular meningitis, since there were no well-marked signs of inflammation of the membranes of the brain, though there was every reason to suppose that the symptoms depended on the deposit of tubercles in those membranes. The case was as follows:

A girl between four and five years old, whose mother was then laboring under tubercular disease of the summit of one lung (which has since proved fatal), and who had lost several brothers and sisters with consumption, had had nearly constant cough during the winter of 1849-50. During the months of April, May, and June, of 1850, she had exhibited all the signs of induration over the upper two or three inches of the right lung, before and behind,—marked dulness on percussion and bronchial respiration, but no râle. For these symptoms she had been treated with cod-liver oil, iodide of iron, opium for the cough, and good diet. From the middle of June she complained frequently of headache, had occasional vomiting without any gastric derangement, and was much disposed to be constipated. She had no appetite, grew thin, and was very languid, listless, and weak. On the 27th of June the mother thought she observed some squinting. On the 29th we found that the child had lost all power over the right muscles of the right eye, so that

when she looked towards the right hand, she squinted dreadfully. She was dull and heavy, and vomited two or three times a day. The pulse was 62 to 75 or 80; there was a slight hitch in its beat, but no decided intermittence. The child said that she sometimes saw two things instead of one From this time until July 7th, she continued in much the same state. On the first July, finding that the eyes were quite yellow, and that the child was constipated, we ordered half a grain of calomel morning and evening. After three doses she was purged. This relieved her a good deal, there being less headache, more appetite, and an improvement in color afterwards. But still there was every day some vomiting, complaints of headache, and more or less listlessness and heaviness in the morning, while in the afternoon she would brighten up and seem better. The intelligence continued perfect; the temper was rather irritable, but not very much so.

The treatment after the 29th of June was calomel, given as above stated, from time to time, to keep the bowels soluble; cod-liver oil, a teaspoonful twice or three times a day, as the child would take it; mustard foot-baths every day or two; and meat, bread, and ice cream for diet. On the 5th July we ordered half a grain of iodide of potassium, three times a day, in addition to the oil.

On the 11th July, she was taken, by our direction, to the seaside, where the use of the oil and of the iodide of potassium was to be continued.

On the 7th of August she was brought back from the seaside, and we saw her on the 8th. We were astonished to see how well she looked. The strabismus had entirely disappeared. We were told that it had begun to diminish two weeks after her arrival at the sea, and had then gradually disappeared. She had grown somewhat, though not very much, fatter. Her whole appearance was very much improved. The coloration of the body, the expression of the face, were both much better; she was much stronger, running about, in fact, all day; she ate well, and with the exception of a little cough, and a rather delicate frame, looked very well. Except one day, she was well all the time at the seashore. On that day she was feverish, had much headache and vomiting, and laid abed. The cod-liver oil and iodide of potassium were ordered to be continued.

The child remained pretty well throughout the winter of 1850–51. There was no return of either the strabismus or the vomiting. She was thin, pale and delicate-looking, coughed occasionally, and the solidification of the summit of the lung continued, but she was not confined to the house. Late in the winter she went south with her mother, and there, after having become quite stout and healthy during their travels, died of dysentery in April or May. The mother died in 1852, of phthisis, with large cavities in both lungs.

Another case, in which the early symptoms of the disease were well marked, and in which recovery took place, will be detailed in the remarks on prophylactic treatment.

In the following case, also, the diagnosis was of tubercular meningitis in the early stage:

The patient was a boy eight years of age, whose father had died a few years before of phthisis, the younger brother died of tuberculous meningitis, and the sister of hooping-cough, with the lungs filled with miliary tubercles, as ascertained by a post-mortem examination. The child, after having had fair health previously, was seized, towards the end of March, 1865, with frontal headache, very slight fever, occasional vomiting, constipation, hesitating pulse, languor, willingness to lie abed, and a tendency to somnolence. He was treated with rest, milk and beef tea in alternate doses, and mustard foot-baths morning and evening; the bowels were kept moderately open, and he took tincture of the chloride of iron in combination with dilute acetic acid and solution of the acetate of ammonia every three

ours. Under this treatment he improved, and in ten days had quite recovered. is mother removed from this city to Washington, where he died on the 30th of ne of the same year, after an illness of twenty-one days, of what was called ater on the brain.

In another case to which one of us was called in consultation, a boy hose mother had died a few years before of diabetes mellitus, and whose ther's family was tuberculous, presented a series of symptoms which we uld explain only as the result of slow thickening of the membranes at e base of the brain, in all probability the result of a tubercular deposit. is child had, for several weeks, violent frontal headache, constipation, ss of flesh, lassitude, a peculiar one-sided or lateral gait in walking, rabismus, and great impairment of vision, so that he could see a small ob- t only by bringing it almost in contact with the face. There was scarcely y disturbance of the circulation, and only slight febrile heat at night. e was treated at first with rest, nutritious food, minute doses of bichloride mercury in combination with iodide of potassium, three times a day, and en when he began to improve, with tincture of the chloride of iron and d-liver oil for a long period. He finally recovered his health, grew ut and strong, but has remained ever since so blind that he reads with eat difficulty, but manages to pick his way through a room or the street, th only occasional stumbling. The illness occurred several years ago, d he is still living in good general health at this time.

Are we then to abandon all hope of deriving any good from medical ans in the disease under consideration? To this most serious question ought clearly to respond in the negative. The grounds for entertaining pe are first, the evidence of M. Guersant that he has seen cases which peared to be tubercular meningitis recover in the first stage. Let it be pposed, even, that they were cases of simple inflammation. But they re undistinguishable from the tubercular disease by one of the most ebrated of modern physicians. Surely, therefore, it may happen to men inferior skill to meet with the same difficulty, or if we may so speak, to ke the same mistake, if a mistake was made. It is said by M. Valleix t M. Rufz, after determining at the autopsy, that a case which he had nessed was one of simple meningitis, asserted that it would have been possible to distinguish it from the tubercular disease during life. Again, Rilliet has, according to M. Valleix, seen one case of recovery from at he believed to be the tubercular affection, and MM. Rilliet and rthez, in their second edition, as above quoted, assert its occasional cura- ity. To these authorities must be added the valuable evidence of Dr. fford Allbutt, already quoted; and it would be possible to cite still ther instances, if it were necessary. We know of the occurrence of a e in this city, under the charge of one of our friends, than whom we be- ve no one can be more competent to make a correct diagnosis, in which, er the child had presented in regular order all the early symptoms of disease, and had arrived at the last and most hopeless stage, perfect overy, to his utter amazement, gradually took place. This child, when friend last heard of it, three months afterwards, was in all respects ng and hearty. No doubt the probabilities are that the case was one

of simple meningitis, but who could have known this at the time; and should it not deter us from abandoning all hope, and, as a consequence, all active treatment, when we seem to have under our hands a case of this dreadful malady? Our own cases, given above, also go to prove that the disease is sometimes curable in its early stages.

It is important, in tubercular meningitis, to avoid making a positive prognosis as to the period at which death will occur, notwithstanding that the patient may present every mark of an immediately fatal termination. We have already adverted slightly to this subject. On one occasion we expected the death of a patient with this malady for three days in succession, and on another, we visited a child for a week, during every day of which it seemed as though existence could not endure until the next. It had during this time profound coma, subsultus tendinum, and enlarged pupils; the eyelids were half open, the eyes constantly oscillating, or else rigidly distorted, and both corneas dimmed and slightly eroded, from constant exposure to air and light. Convulsions occurred from time to time, the pulse was variable, and at times exceedingly frequent, and indeed everything threatened a speedy termination. MM. Rilliet and Barthez say, "Often have we inscribed upon our notes *death imminent*, and been astonished the next day to find still alive, children to whom we had allowed scarcely two hours of life."

The symptoms which most positively indicate the near approach of death are, livid color of the face, sweats occurring about the face, glassy expression of the eye, dry and incrusted nostrils, and especially a very rapid pulse, and the various nervous symptoms mentioned, as carphologia, subsultus tendinum, and general convulsions.

Treatment.—In the early editions of this work we took the ground that it was proper in the early stage of the disease to employ bloodletting. Further experience and knowledge compel us to retract this opinion. We believe now, that abstraction of blood should not be resorted to unless when the diagnosis between this disease and simple meningitis is very uncertain. Where there are no marked signs of active inflammation, where from the family history, from the absence of marked fever, and the peculiar state of the pulse, we have every reason to believe that the low-typed inflammation present is the result of the presence of tubercle, we deem it safest to avoid all lowering measures. The case is so critical, so almost hopeless from its very nature, that we prefer a treatment based on the theory of promoting a retrogression of the tuberculous deposit. The only measures which, in an experience of over thirty years, we have found to delay and, in the cases referred to in the article on prognosis, to cure the disease in part, have been the following: quiet of body and mind, obtained by means of rest in or on the bed, in a pleasant room, with attendants who know how to soothe and still the child. We always insist upon a nutritious diet: and one consisting mainly of milk and cream, or the two mixed with beef tea, bread and butter, if the patient will take it, or milk toast, in moderate quantities every three or four hours, a soft-boiled egg or the yelk of a hard-boiled egg, once or twice a day, is what we usually endeavor to get the patient to take. A mustard foot-bath two or three

mes a day, is always safe, and we think useful and tranquillizing. The owels should be moved gently once a day, or every two days, by means f an enema or some simple laxative, as simple syrup of rhubarb. Active irgation we have found of no use. As remedies, we prefer the following:

R.—Tr. Ferri Chlorid., ... fʒj.
Acid. Acet. Dil., ... fʒj.
Liq. Ammon. Acetat., ... fʒij.
Syrup. Simp., ... fʒj.
Aquæ, ... fʒijss.—M.

A teaspoonful at five years of age, every three or four hours.

In connection with this, we give half a teaspoonful of cod-liver oil in mulsion three times a day. Calomel we have abandoned of late years tirely, as it has utterly failed in our hands to do any good.

Iodine has been very much employed as a remedy in this disease, both the forms of Lugol's solution and iodide of potassium. Perhaps the ongest argument which exists in its favor is the benefit which often fol- ws its employment in other scrofulous and tuberculous diseases; though ere are several cases in which it is asserted to have been successfully ed in tubercular meningitis. Iodine itself is comparatively little used. Rilliet (*op. cit.*, t. iii, p. 308, 1847) states that it has entirely failed in hands in the tubercular form of the disease; the only influence which seemed to exert was to cause the immediate suspension of the coma. is was its effect also in a case in which we employed it, that of a girl en years old, to whom we gave two drops of Lugol's solution three nes a day, from the thirteenth to the twentieth day, when she died. e day before her death she seemed to improve somewhat, and we were hopes that it had been of some service. The amelioration did not con- ue, however, and we are now disposed to believe that the change was e of those which often take place naturally in the disease.

Iodide of potassium was recommended more than twenty years ago by eser (*Hufeland's Journal*, April, 1840), as a remedy of special power this disease. It has since then been very widely employed, and there quite a number of cases in which it is asserted that its administration been followed by successful results.

Dr. West (*op. cit.*, 4th Amer. ed., p. 97) thinks that he has seen good m its employment, "and that in one instance of what seemed to be ad- nced tubercular hydrocephalus, under the care of my friend and former league, Dr. Jenner, recovery took place under its employment."

Niemeyer (*op. cit.*, vol. ii, p. 218) speaks as follows of its use: "On the ength of two successful cases, opposed, it is true, by a large number of successful ones, I recommend large doses of iodide of potassium, con- ued for a long time."

Dr. J. Lewis Smith (*op. cit.*, p. 145) also recommends its use through- the entire disease, beginning as early as possible in the premonitory riod.

Successful cases of its administration are also reported by Drs. Bourrose

de Lafore, Coldstream (*Edin. Med. Jour.*, Dec. 1859), and Carson (*Med. Times and Gaz.*, March 5th, 1857).

We have ourselves frequently administered it, either alone or in combination with small doses of bichloride of mercury, but have not yet been fortunate enough to arrest the progress of any case when once the second stage has been fully developed. In a few cases, however, the use of the following combination:

R.—Potass. Iodidi, ... ℥j.
Hydrarg. Chloridi Corrosivi, ... gr. j.
Syr. Simp., ... f℥j.
Aquæ, ... f℥iij.
Ft. sol. Dose, a teaspoonful three times a day at five years of age,

has seemed to delay the march of the disease, in one some weeks, and in another, the one already mentioned, it seemed to have a positive effect in promoting the absorption of the exudation upon the membranes at the base of the brain. It is improbable, also, that in *all* of the reported cases, errors of diagnosis were made, and simple meningitis taken for the tubercular form; so that there is no remedy from which so much benefit may be hoped for in this almost hopeless disease, as iodide of potassium in full doses, and it should therefore be faithfully tried whenever opportunity offers. We have been in the habit of giving it in doses of one or two grains every three or four hours, to children two years of age. It has, however, been given to the extent of a drachm in the course of a single day to children of that age. It ought to be begun with early in the case, and continued in connection with counter-irritation and cold to the head. We must remark, however, that it sometimes irritates the bowels too much, causing diarrhœa; and here the dose ought to be greatly reduced, or the remedy withdrawn.

Bromide of Potassium, on account of its undoubted power in cases of active cerebral congestion with great nervous excitement, may be advantageously associated with the iodide, and we are in the habit of combining from three to five grains of the former with the dose of the latter above recommended.

The treatment which has just been described is that which we have been led by our convictions as to the nature of the disease, and by our personal experience of different plans, to adopt as the most reasonable and the best. It is proper to state, however, that we have never seen it, nor any other method, of any avail after the disease has passed into the latter part of the second stage—when coma, dilatation of the pupils, marked strabismus, paralytic or convulsive phenomena, show the presence of inflammatory exudation under the membranes, and of serous effusion into the lateral ventricles, or the peculiar lesions of the substance of the brain which exist at that period of the malady. It is also proper to add that other means have been recommended by high authorities, and to these we shall now devote some remarks.

Counter-irritation in different forms has been employed, and apparently with success, though it has failed in our hands. Blisters to the nucha, be

hind the ears, or over the whole scalp, have been used. At one time, in this city, it was a common practice to cover the scalp with a blister, but it was found to fail so constantly, and was so painful a sight to the relations of the child, that it has been very much abandoned. Surely, if it had succeeded in any considerable proportion of the cases, it would have been received as a boon, however revolting to the sight. We have, ourselves, in past years, blistered the nucha, the back of the ears, and the temples in a number of cases, but have always failed to obtain any evident good from them. Within a few years it has been claimed that pustulating the whole sinciput with croton oil has been of great service. The last case of tuberculous meningitis we saw, occurred in an adult, and here we had nearly the whole of the crown of the head shaved, and pustulated with the oil, but it was of no use whatever.

Cold applications to the head have been very much used. We have employed them ourselves, and still use them whenever the head is hot, or when their use relieves the headache or soothes the patient, but we confess that they have not seemed to us of much use except as palliatives. They may consist of cloths wet with cold water, of affusions with cold water, or, as has been proposed by M. Guersant, of irrigation as employed in surgery. M. Guersant prefers this mode of applying cold to any other, believing it to be the most convenient and comfortable to the child, and from its continuous action, the most efficacious. To make use of it, the hair is to be shaved or closely cut, and the child placed upon a mattress without a pillow, and with its head near the edge of the bed. The head is then covered with compresses of soft rag, or, better still, of patent lint, while under it is placed a piece of oiled silk or india-rubber cloth, so arranged as to keep the thorax from being wet, and doubled into a gutter above to convey the water off into a vessel placed on the floor. A bucket or basin filled with fresh, cool water, is placed near the head of the bed, and from this a siphon made of lint or lamp-wick is so arranged as to convey a stream of water upon the compresses covering the head. If the heat of the whole body falls so much as to threaten collapse after the irrigation has been continued for some time, the stream of water should be stopped, and compresses, merely wet with water not quite so cool, kept on the head. The latter precaution is necessary in order to prevent injurious reaction from the sudden and total removal of so powerful a sedative as irrigation proves to be.

Some practitioners prefer the use of ice in a bladder. This seems, however, too severe a remedy to be long continued, and we should therefore rather use only cloths wet with iced-water, or irrigation. Dr. Abercrombie is of opinion that the application of cold is by far the most powerful local remedy that we have. M. Gendrin recommends cool or cold affusions over the whole surface, the temperature to be proportioned to the heat of the skin. When there is but little heat of head, only a slight febrile movement, and the headache is not relieved by cold applications, Guersant recommends the substitution of warm poultices to the scalp, in the place of irrigation or cold applications.

We have already stated that *calomel* has not succeeded in our hands, so

that we have abandoned its use. We deem it right, however, to lay before the reader the opinions of others upon this point. Thus, it is highly recommended by many of the English writers on acute hydrocephalus, and is asserted to have effected cures when it has been pushed to such an extent as to produce salivation. But little dependence, however, can be placed on these assertions, as in all probability the reported recoveries occurred in cases of simple meningitis. The French writers speak of having used it in very large quantities without any success. It was given to many of the patients of MM. Rilliet and Barthez, in the quantity of from six to ten, increased to twenty grains, in twenty-four hours, in connection with frictions with mercurial ointment, of which two drachms and a half were used at first, and the quantity afterwards doubled and trebled. They state that salivation did not occur in any of the cases, though fetor of the breath and inflammation of the gums were of frequent occurrence. Calomel may be given, as has been remarked, in purgative doses, at the beginning, and for the purpose of procuring its specific effects. With the latter view the dose may be from a quarter of a grain to a grain, every hour or two hours. Mercurial inunction, in conjunction with the internal administration of the remedy, has been highly recommended by several writers as an efficient means of procuring the full effect of the drug upon the constitution. About a drachm of the ointment is to be rubbed into the insides of the arms and thighs morning and evening, and the quantity gradually increased if no effect is produced. For our part, we will merely state that we have never known calomel given in large quantities, in order to procure salivation, of the least benefit in the disease. On the contrary, we cannot but think that the violent irritation of the digestive mucous membrane which it has determined, whenever we have used it largely, and the inflamed, irritated condition of the mouth which it caused in one case, must have been a serious aggravation of the state of disease under which the constitution was laboring. Mercury is well known to be an injurious and dangerous remedy in the tubercular diseases of adults, having for its effect to increase the dyscrasia of the constitution, which already exists, and thereby to hasten the progress of the malady. Why it should have a different effect in children is difficult to understand. It may be said, to be sure, that in the disease we are considering, it is given to overcome the inflammatory element of the malady, which, for the time, constitutes the danger of the case, and also to allow the patient the chance of its beneficial operation should the disease happen to be one of simple meningitis. In support of the views just expressed, we will quote the opinion of Dr. John Abercrombie (*Diseases of the Brain and Spinal Cord*, Philad. ed., 1831, pp. 173–6): "Mercury has been strongly recommended in that class of cases which terminates by hydrocephalus, but its reputation seems to stand upon very doubtful grounds. In many cases, especially during the first or more active stage, the indiscriminate employment of mercury must be injurious. . . . In the preceding observations, I shall perhaps be considered as having attached too little importance to mercury in the treatment of this class of diseases, particularly in the treatment of hydrocephalus; but in doing so, I have stated simply what is the result

of an extensive observation, . . . and I confess, the result of my observations is, that when mercury is useful in affections of the brain, it is chiefly as a purgative."

It has been recommended, within a few years, by Sir B. Brodie, to employ mercurial inunction as especially applicable in using mercury for children. He advises that a drachm or more of the ointment be spread upon one end of a flannel roller, which is to be applied, not very tightly, around the knee; repeating the application daily. "The motions of the child produce the necessary friction; and the cuticle being thin, the mercury easily enters the system." The editors of the journal in which this communication is made (*Braith. Retrosp. of Med.*, vol. iv, 1846, p. 147, from *Quart. Med. Rev.*, July, 1846, p. 169), state that they tried this plan in a case of acute hydrocephalus, in which some of the most urgent and fatal symptoms were present, "such as very dilated pupils, constant convulsions, hemiplegia, and more or less stertorous breathing; in short, so violent were the symptoms, that we considered the case perfectly hopeless; but on reflecting on Sir Benjamin's method, we ordered strong mercurial ointment to be smeared on each leg every twelve hours, and covered with a stocking made to tie tightly above the knees. The symptoms soon began to abate, and by following this up with small doses of iodide of potass., frequently repeated (gr. i, every three or four hours), the head symptoms vanished.

"In a second case, the same set of symptoms were approaching, but were stopped by the same mode of treatment."

When the convulsive symptoms are violent and distressing, they may often be moderated by the use of a warm bath, which must be carefully given, and by the administration of some of the *antispasmodics*. We prefer for this purpose the fluid extract of valerian, of which from ten to twenty drops may be exhibited every two or three hours to young children, and a larger dose to those who are older. Bromide of potassium has also been recommended on account of its peculiar sedative action, and M. Bazin (*Gaz. de Hôpitaux*, 1865) narrates a case in which large doses of this remedy were successful in checking the progress of tubercular meningitis, in a lad who presented at the same time the symptoms of pulmonary tuberculosis.

As a general rule, *narcotics* of all kinds are to be avoided, from their effect of increasing the constipation, and exciting more or less the cerebral circulation. When, however, neither antiphlogistics, evacuants, nor cold or warm applications relieve the sufferings of the child, it would be proper to employ small laudanum poultices or opium plasters upon the forehead or temples, or we may use morphia by the endermic method.

The treatment described in the preceding pages, is that which is proper for cases of the disease occurring in subjects previously in good health, or evincing but few signs of the tubercular cachexia. When, on the contrary, it occurs in children with extensive tubercular affections of other organs, by which they are already weakened and exhausted, the treatment must of course be modified to meet the circumstances of the case. It ought to consist chiefly of cold applications, and of an early use of cod-liver oil, of iodine, or of the iodide of iron. We should recollect that

experience has long since shown the weakness of our art in such cases, and for that reason avoid such a degree of interference as might possibly abridge the little span of life allowed the patient by this relentless malady.

Prophylactic Treatment.—It must be evident that the prophylactic treatment is of especial importance in a disease so little amenable to curative means as the one under consideration. When, therefore, there is reason to suspect a tendency to tubercular meningitis in a child, either from the fact that other children in the family have perished with it, or from a bad state of the general health, and frequent complaints of headache, it becomes proper and necessary to regulate both the moral and physical education with a view to its prevention. For this end the hygienic management of the child ought to be such as is best calculated to prevent the formation or development of tubercles in the constitution. During infancy, such a child should be nursed, if this be possible, by a strong, hearty woman, with an abundant flow of milk. If the mother is not possessed of these qualities, if there be, indeed, the least doubt upon the point, she ought without hesitation to give up the pleasure of nursing the child herself, and procure for it a wet-nurse of the kind described. This alone will, in all probability, often make a difference between a vigorous and a fragile constitution. When the time for weaning arrives, the change ought to be made with the greatest care and circumspection. During and for some time after weaning, the diet must consist principally of milk preparations and bread, and of small quantities of light broths, or of meat very finely cut up. As the child grows older, the meals ought to be arranged at regular hours, and should consist of four in the day. The principal food must be bread and milk, well-chosen, well-cooked meats, and rice and potatoes as almost the only vegetables. After the first dentition is completed, a moderate use of ripe and wholesome fruits may be allowed, but always with care, in order to avoid injury to the digestive organs, and also so as not to mar the appetite for more wholesome and nutritious food. Coffee and tea ought to be forbidden at all times; since, as we have often observed, when the palate of a child is taught, by habit, to become accustomed to these more highly sapid substances, it is very apt to abandon the use of milk, which ought to constitute a large proportion of its food, at least up to the age of twelve or fifteen years. In no circumstance of life is the old saying, "where ignorance is bliss, 'tis folly to be wise," a better rule of action than in regard to the diet of our children. The child should not taste improper articles of food, so that it may escape the torment of desiring what is improper.

After diet the most important points in the treatment are air and clothing. The child should inhabit, if possible, a large, dry, well-ventilated room, which ought to be kept as cool as possible in summer, and moderately warm in winter. Not a day should be allowed to pass, unless the weather is totally unfit, without the child's being sent for several hours into the open air, and we believe that it is much better for it to walk than drive, unless the weather be very hot. The clothing ought to be suitable to the season, cool in summer and warm in winter. In our country there is a great inclination to *harden* children by dressing them very slightly in

cold weather; so that they frequently suffer from catarrh, pneumonia, and spasmodic croup brought on by improper exposure. This cannot but be wrong in a child who shows the least evidence of a tendency to tubercular affections.

For our own part we are fully convinced from what experience we have had of the diseases of children, that by far the most certain and effectual means of preventing the development of a tubercular, or indeed any other cachexia in a child, is to have it brought up in the open country, or in some healthy village, until the epoch of puberty has passed by safely. A very good plan for parents whose occupations compel them to live in cities or large towns, is to have their residence a few miles in the country, and to come to town every day. Children brought up in this way have a far better chance of obtaining strong and vigorous constitutions, than those reared entirely in the close and confined dwellings and streets of crowded cities.

When a child, who, from the health of its parents, or from its own appearance, may be suspected of having any tubercular or scrofulous taint in its system, becomes subject to frequent attacks of apparently causeless headache, and especially when such headaches are associated with a constipated habit of body and with occasional vomiting, it ought to be looked upon as threatened with tubercular disease of the brain. Under these circumstances we would advise, in addition to the measures just now recommended as to diet, dress, exercise in the open air, and a residence in the country, that it be put at once upon the use of cod-liver oil, iodide of iron, and mild laxatives, and that these be persevered in for several weeks or months, until in fact the strength and general health are restored and the headaches cease. When the appetite is poor, and the digestion is imperfect, in such a case we may use with advantage, besides the above remedies, solution of pepsin, a teaspoonful three times a day with the meals, or tincture of nux vomica, three or four drops in a mixture of syrup and compound tincture of gentian, or in a teaspoonful of elixir of cinchona three times a day. If the child is of an age to be going on with its education, this should for the time cease, or be carried on in such a way as to avoid all excitement or fatigue. A case occurred to one of us in the course of the year 1852, which showed, we think, very clearly the utility of these measures.

A boy between seven and eight years old, whose mother had died of well-marked phthisis a few months before he was put under our charge, had been losing flesh and strength, and suffering from occasional headache for some time before we were called to see him. We found him in bed complaining of severe frontal headache; so severe at times, and usually in the after-part of the day, as to cause great distress, with crying. The intelligence was perfectly natural. The child was rather dull and listless, from suffering and from weakness, but not from any want of a healthful state of the mental operations. There was no sign whatever of spasmodic or paralytic affection. In the morning the skin was cool and natural, but in the afternoon it became warm and dry, but not very hot. The pulse was 62 to 68, and though not actually irregular, it was halting or hesitating. There was occasional, but not frequent, unprovoked vomiting, and he complained often of sick stomach, even when he did not vomit. The bowels were very much constipated, and had

been a good deal so for some weeks previous to his falling actually sick. There was no cough, no sore throat, and no soreness about the abdomen. The tongue was moist, soft, slightly furred, and not red nor gashed. The urinary secretion was healthy. Physical examination showed the lungs and heart to be without disease.

The treatment during the first week was small doses of calomel and rhubarb, half a grain of the former to two of the latter, given for a day, and followed by syrup of rhubarb and fluid extract of senna, until the bowels were copiously evacuated. After this the bowels were kept soluble by the administration every day, or every other day, of doses of Seltzer powder, sufficient to produce the effect. Blisters were applied behind the ears. In the after-part of the day, when the head and body became heated, cooling applications were made to the head, and the feet were put into mustard-water, once, twice, or three times. Two grains of iodide of potassium were ordered to be given three times a day. The diet was to be light but nutritious. It was to consist of bread and milk and a soft-boiled egg in the morning, oysters or light meats with rice for dinner, and milk with bread in the evening. Of these he was to have any reasonable quantity that he might desire. Under this treatment he improved slowly, with occasional drawbacks for a week, when the iodide of iron was substituted for the iodide of potassium. The bowels continued very costive, requiring daily doses of the Seltzer powder; the headaches diminished in frequency, duration, and severity; the pulse went up to 72 and 78, and became more free and even; the appetite had improved, but the child remained still very weak, pallid, and quite emaciated. After another week, as he continued to mend, and the stomach had become stronger, cod-liver oil was ordered in addition to the iron; a teaspoonful was to be taken three times a day in a wineglassful of table-beer. As he gained strength, the amount and kind of food was increased. He was, indeed, encouraged to eat heartily of plain and digestible substances.

He now improved gradually in health. The headaches subsided, and finally ceased; the bowels became soluble; the appetite grew hearty and strong, and all feeling of nausea disappeared; he regained his strength, flesh, and color, so that at the end of two months we saw him looking quite fat and well. The iodide of iron and cod-liver oil were, however, to be continued for a month longer. He is now (1869) a young man in very good health. He has passed several years in Germany pursuing a scientific education, and has returned lately to this country, and is about to marry.

As to the particular means likely to be of service in preventing a direction of the tubercular cachexia towards the brain, such as might produce tuberculosis of that organ, we have only to propose the course recommended by different writers, viz., to keep the head cool by not allowing it to be very warmly covered, and by keeping the hair short; to keep the extremities warm; to avoid stimulating the intellectual faculties to any considerable extent by education, until after eight or ten years of age; and to use every means to preserve the general health in a sound and pure condition. Some recommend the long-continued employment of a powerful derivative from the brain, as a small blister on the arm or a seton in the neck. We think, however, that such remedies ought not to be used unless there are positive symptoms of a tendency to cerebral disorder. The caution not to interfere much by powerful *local* applications, with eruptions which nature may have thrown out upon the scalp, is, we believe, wise and prudent; though there can be no objection to the administration of suitable internal remedies with a view to their cure.

ARTICLE II.

SIMPLE MENINGITIS.

Definition; Synonyms; Frequency.—By this term is understood inflammation of the membranes of the brain, independent of tuberculosis of those tissues, or of other organs of the economy.

The disease was for a long time confounded with tubercular meningitis under the titles of water on the brain, dropsy of the brain, and acute hydrocephalus. It has also been called arachnitis; and more rarely phrenitis.

Its frequency is much less than that of tubercular meningitis. West (*op. cit.*, 4th Amer. ed., p. 100), states that he has seen seven cases of fatal acute meningitis, in five of which post-mortem examination was made and confirmed the diagnosis. Vogel (*op. cit.*, p. 359) speaks of it as being much rarer than the tubercular form, and states that it is no more frequent in children than in adults. It appears that MM. Rilliet and Barthez, during their researches, met with only five cases of this disease, while they report thirty-three of tubercular meningitis. Bouchut states that he has met with two cases of simple meningitis to six of tubercular disease, whilst Barrier reports only four of the former in nearly thirty autopsies of meningitis. He states, however, that he has met with three cases of recovery, all of which he believes to have been instances of the simple form. Fabre and Constant met with nine cases of simple to twenty-seven of tubercular meningitis in a period of two years, at the Children's Hospital of Paris. (*Bibliothèque du Méd. Prat.*, t. vi, p. 166.)

Causes.—The causes of simple meningitis are not very clearly ascertained. It would appear, however that the disease is more common in infants than older children. M. Rilliet, who published a very valuable paper on this affection (*Arch. Gen. de Méd.*, t. xii, 1846), divides it into two forms, the convulsive and phrenitic, the former of which he believes to be most common under two, and the latter between five and fifteen years of age. This author is disposed to think, from the fact that the disease is most frequent in the first and ninth years of life, that the process of dentition has something to do in its production. It appears also to be more frequent in boys than girls, and in robust than in weak constitutions. Exposure to extremes of temperature predisposes to attacks of acute meningitis; and, in particular, continued exposure to the direct rays of the sun has been known to act as an immediate cause.

Guersant has known it to follow such exposure in several instances particularly in young infants; MM. Rilliet and Barthez report a case of the same kind, and Rilliet (*loc. cit.*), another. Other causes cited by authors are injuries upon the head, such as blows, falls, and wounds. It also occurs as a consequence of extension of inflammation to the membranes of the brain, and usually from the internal ear in cases of otorrhœa.

The disease seems to have sometimes occurred in an epidemic form. There is reason to believe, however, when we consider the purely sporadic

nature of its recognized causes, that the reported epidemics have for the most part been of cerebro-spinal meningitis, a disease which we shall treat of in its appropriate place, among the acute specific febrile affections.

Anatomical Lesions.—The dura mater is generally much injected, and its sinuses, together with the large cerebral veins, contain coagulated or semi-coagulated blood, sometimes in large quantities. On opening the dura mater, the whole, or nearly the whole of the convex surface of both hemispheres, or in some instances of one only, are found to be covered with a yellowish or greenish-yellowish layer, which consists of fluid or concrete pus, or of false membranes. These deposits exist also on the internal surfaces of the hemispheres, on the upper surfaces of the cerebellum, and often also at the base of the brain, though in some cases the latter presents none whatever. The inflammatory products are seated in the pia mater, and sometimes in the cavity of the arachnoid membrane, but in much smaller quantity than in the tissue beneath that membrane.

The *arachnoid* membrane which covers the brain seldom participates in the inflammation, but remains smooth and transparent. Its cavity, however, sometimes contains inflammatory products, which, when death occurs early in the attack, consist of a small quantity of pure pus, or of larger quantities of a turbid, yellowish serosity, consisting of serum and pus mixed together. When death has occurred later in the disease,—after five, six, or seven days,—the pus is mixed with lymph, or else true false membranes are found. The *pia mater* is observed to contain fluid or semifluid pus when death occurs before the fourth or fifth day; while in less acute cases there are patches or large layers of lymph, which sometimes dip into the anfractuosities, and give to the membrane under consideration a swelled and thickened appearance. These appearances are more marked on the superior and lateral, than on the inferior surface of the brain. Where the deposits exist the membrane presents a vivid injection, which is more marked in proportion as death has taken place earlier in the disease. The pia mater is generally easily detached from the cerebral substance, particularly when the fatal termination has occurred early. The *substance* of the brain is firm, and but slightly colored, in rapid cases. When the course of the disease has been slower, the cineritious portion is generally of a bright rose color, and the medullary substance abundantly dotted with red, showing that the inflammation has involved the superficial layer of the brain. In the latter class of cases the surface of the convolutions is usually softened, and the pia mater adherent. In very young children the whole brain is sometimes soft.

The *ventricles* do not, as a general rule, contain transparent serum, except at a very early age, when serous effusion takes place with great facility. They, often, however, contain one or two teaspoonfuls, and rarely more than one or two tablespoonfuls, of pus or purulent serum. The serous membrane of the ventricles and the plexus choroides exhibit signs of inflammation in some instances. They are of a bright red color, uneven, rough, and very much softened, in children who die early; and pale, opaque, slightly thickened, and rough, in those who die at a later period.

The central parts of the brain often retain their firmness, but are sometimes softer than natural, or even diffluent. This softening is particularly ...t to exist in very young children, in connection with large effusion into ...e ventricles; though it also occurs in those who are older, and in whom ...ere is only slight effusion of pus or purulent serum. In the former case ...is probably due to the macerating effect of the effusion, while in the latter ...is more likely to be owing to inflammation.

In some cases, and especially those of the epidemic form of the disease, ...e membranes of the spinal cord are found to present the same inflammatory appearances which have been described as existing in the cerebral ...eninges. These cases are, therefore, more correctly designated by the ...me cerebro-spinal meningitis.

The other organs are healthy except in secondary cases. Tubercles, ...hich so constantly exist in various other organs in tuberculosis of the ...eninges, are never found, according to M. Rilliet, in this form of meningitis. This author believes himself entitled from his researches to formu...e the following law of pathological anatomy: "That general meningitis ...d meningitis of the convexity of the brain occur only in non-tuberculous ...ildren, whilst meningitis of the base of the brain without inflammation ... the lining membrane of the ventricles, belongs exclusively to tubercu...s children." (*Op. cit.*, t. iii, 1846, p. 408.)

This law cannot, however, be adopted without exception, since we have ...eady seen, when speaking of tubercular meningitis, that there are, in a ...ge proportion of such cases, evidences of inflammation of the lining ...mbrane of the ventricles.

SYMPTOMS.—The following account of the symptoms of the disease is ...en chiefly from the paper of M. Rilliet. That author describes two ...ms of the affection, the *convulsive* and *phrenitic;* the former of which ...haracterized by a predominance of convulsive phenomena, and the ...er by disorders of the intelligence.

The disease may also be idiopathic or secondary, simple or complicated, ...radic or epidemic.

The *convulsive form* generally occurs in children under two years of age. ... disease usually begins suddenly or after a restless night, with a violent ... prolonged attack of *convulsions,* oftener general than partial, and is ...mpanied by violent *fever,* and sometimes by considerable quickness of ...*iration.* The existence of *headache* cannot be ascertained at this early ...

Vomiting is often absent, and the *bowels* generally continue regular ...is form, though they are sometimes constipated. After awhile the con...ions cease, and the child remains for the time in a state of quiet, som...nce, or coma, when they return with renewed violence. The returns of ... convulsions generally take place at intervals of one or two hours or ...e. In the intervals between the crises the child is restless or drowsy, ... a state of partial *stupor,* attended with tremulous movements of the ...emities; there is *strabismus, contraction of the pupils, trismus,* and some...s *hemiplegia.* The skin retains its warmth, the pulse is accelerated, ...ular, and unequal; the face is pale; the stools are spontaneous or ... procured by remedies. It is unusual to see the child regain its con-

sciousness so as to recognize objects in the intervals between the convulsions, or after the appearance of coma and other cerebral symptoms. Death occurs during coma or in a violent attack of convulsions. This form seldom lasts more than four days.

Occasionally this form begins in a different manner. The convulsions, though they still predominate, do not occur until later in the disease, and the whole course of the affection is slower. Such cases begin with a violent febrile movement, lasting several days, and accompanied by acceleration or unevenness of the respiration, or by almost constant drowsiness, preceded or followed by agitation, screaming, staring expression of the eyes, and dilatation of the pupils; vomiting and constipation are sometimes present, at others absent. After a time, however, convulsions make their appearance, and the case follows the course already described. The duration of this form may be the same as that of the first, or it may last about two weeks.

The *phrenitic form* of simple meningitis generally begins suddenly with fever, which is sometimes preceded by a chill; the skin is warm and dry, and the pulse, in idiopathic cases, full and accelerated. In secondary cases the pulse has been found slow and irregular; in all it becomes irregular, small and very rapid the day before death. Simultaneously with the fever there is frontal headache, which is often so violent as to draw cries from the child, and, according to M. Rilliet, is more severe than either in tubercular meningitis or typhoid fever. It is also more constant, and lasts generally one, two, or three days, until the appearance of restlessness, delirium, or coma. At the same time there is great sensibility to light and noise, and abundant vomiting of bilious matter. The latter symptom is one of the earliest; it generally ceases after a few days, but sometimes continues to the very end. Constipation exists in some cases, but is much less constant and more easily overcome than in the tubercular disease. The appetite is lost, and the thirst very acute. The abdomen is flattened and retracted, especially towards the end, while in secondary cases of this form, and in very young children, it retains its usual shape.

About the end of the first day, generally, or, in rare instances, after two or three days, appear various disorders of the intelligence. The first symptom of this kind is observable in the expression of the face, which becomes a little wild or wandering, and sometimes grimacing. Soon afterwards occur restlessness, which is sometimes extreme, and, in succession, delirium, somnolence, and later in the attack, coma. The restlessness and somnolence often alternate early in the case, though the former generally predominates and soon passes into delirium, which is usually violent. When in this condition the child seldom recognizes any one, and either refuses to answer questions, or answers incoherently. In connection with the disorders of intelligence there exist also trismus, grinding of the teeth, subsultus tendinum, partial convulsive movements, stiffening of the extremities or trunk, retraction of the head, strabismus, contraction first and then dilatation of the pupils, and in some cases violent convulsions, followed by deep coma. Death sometimes occurs at this period. In other instances, the disease continues longer, and other symptoms declare themselves.

Vomiting generally ceases; constipation increases; the abdomen is retracted; headache is no longer complained of; the fever continues, but the pulse becomes irregular; the respiration is uneven and irregular, being sometimes more and at other times less frequent than natural; the face is distorted and extremely pale, or there may be a purple flush on the cheeks; the restlessness is excessive, and accompanied by subsultus, carphologia, or partial convulsive movements; the delirium, at first so violent as to make it necessary sometimes to hold the child in bed, subsides into a state of coma and collapse, in which general sensibility is obtunded, and special sensibility extinguished; the respiration becomes stertorous, and at length asphyxia, coma, or a severe attack of convulsions terminates the scene.

The course of the disease is generally continuous. In very rare cases, however, occasional remissions occur, so that the child recovers its intelligence for a short time, and recognizes persons around. The duration has varied between a day and a half and nine days.

Diagnosis.—The convulsive form may be confounded with the essential or symptomatic, and with the sympathetic convulsions of children. The mistake may generally be avoided by attention to the following points. In essential convulsions, the attacks are usually less violent, seldom last more than a few moments, occur from some evident cause, and do not recur often. When they have ceased, the child generally soon regains its consciousness and health, or exhibits slight drowsiness, or derangement of movement for a short time only. In such cases the respiration is not permanently accelerated, as in convulsive meningitis; the pulse, if it has been increased in frequency, soon falls to the natural standard, and special sensibility remains undisturbed.

It is to be distinguished from sympathetic convulsions by the characters just described, aided by a reference to the disease which may have caused the attack of eclampsia, and which may be one of the eruptive fevers, enteritis, indigestion, pneumonia, or any other acute affection. In some instances, however, the distinction cannot be made except by attention to the progress of the attack.

The phrenitic form may be confounded with tubercular meningitis, with congestion of the brain, or with the early stage of the eruptive fevers. The distinction between it and tubercular meningitis has already been considered under the head of the latter disease.

It is sometimes difficult, as pointed out by Rilliet, to distinguish between simple meningitis and cerebral congestion and partial encephalitis.

In congestion, however, there is not the same intense headache, the febrile movement is not so marked, vomiting is usually absent, and the development of delirium or coma, or of convulsive or paralytic symptoms more sudden or even instantaneous.

Partial encephalitis is even more rare in children than simple meningitis. It may be distinguished from the latter by the less severity of the headache, by the less marked delirium, by the comparative infrequency of vomiting, and by the less activity of the febrile movement, and the more gradual course of the case in encephalitis.

From the invasion of variola, it is to be distinguished by attention to the contagious and epidemic nature of that malady, by the inquiry as to whether the patient has been vaccinated or has had a prior attack of that disease, by the absence of pains in the loins in meningitis, and by a consideration of the period at which the delirium makes its appearance, which, in variola, rarely occurs before the third day. To make the diagnosis between meningitis and malignant scarlatina, we must attend chiefly to the epidemic and contagious character, to the thick coating upon the tongue, redness of the throat, elevated temperature, and nasal respiration, which exist in the latter.

Prognosis.—The prognosis of simple meningitis is very grave, but much less hopeless than in the tubercular form. M. Valleix is disposed to think that most of the recoveries reported by M. Guersant were cases of sanguine congestion or effusion. M. Rilliet (*loc. cit.*), who has studied the subject more carefully than any other observer, cites several instances of recovery, but states that death is much the most frequent termination.

Treatment.—It must be evident, it seems to us, that but little dependence can or ought to be placed on any but prompt and powerful *antiphlogistic* treatment. *Bloodletting*, therefore, *mercury*, *cold* applications to the head, *purgatives*, *counter-irritants*, and the most rigid diet, ought to be employed from as early a period as possible, and in the most energetic manner.

Venesection ought always to be preferred to local bleeding, even in the youngest child, unless it is impossible to find a vein, or unless this is evidently too small to bleed well. When venesection cannot, from any reason, be employed, blood should be freely drawn by means of leeches or cups. It is customary to apply the leeches to the temples or behind the ears. We may remark that MM. Rilliet and Barthez object to the application of leeches to the head, and propose that they should be placed rather about the anus or on the inferior extremities. The quantity of blood to be drawn must depend upon the age and constitution of the subject, and the violence of the attack, in some measure. It should always, however, be large, as much or more, we think, than is necessary in any other of the acute affections of childhood. In a child two years old, of good constitution, from two to four ounces would not be too much at first, and should the symptoms not moderate in six or eight hours, as much more may be taken. Should these detractions of blood fail to produce a good effect upon the dangerous symptoms, it would be proper, unless there were evident and unmistakable signs of exhaustion, to take still more, either locally or generally. We are disposed to believe that in such a disease as this, bleeding is by far the most powerful remedy, and it is perhaps the only one which offers us any real chance of success, at least in those rapid cases in which extensive layers of pus and false membranes are found on the surface of the brain, in the pia mater, or in the subarachnoid tissue, in from two days and a half to three or four days after the commencement of the disease.

While the bleeding is being performed we should direct the preparation of means for the application of *cold* to the head, which constitutes another

most efficient remedy in inflammations of the brain and its membranes. These means may consist of a bladder containing water and pounded ice, which is perhaps the most convenient and powerful, of cloths wrung out of iced or very cold water, to be constantly renewed, of cold affusions upon the head, or lastly, of irrigation as recommended by M. Guersant, and described in the article on tubercular meningitis. *Purgatives* ought to be employed so as to empty the bowels thoroughly, and produce a decided revulsion upon the intestinal mucous membrane, but not in such quantity as to occasion inflammation of that tissue, which would be very apt to prove the case were the drastic substances and large doses recommended by some writers used. The remedy usually given and most highly recommended is *calomel*, which is chosen for its sedative alterative properties. About four grains may be exhibited alone, and followed in one, two, or three hours by castor oil, jalap, or infusion of senna and manna, sweetened with syrup of rhubarb. These doses ought to be given until the bowels are freely moved. It is always useful to employ a strong purgative enema immediately after the bleeding, without waiting for the operation of the internal remedies. After the purgative doses have been given, it is important to continue the mercury in smaller quantities, with the view of obtaining its specific influence upon the inflammation. The doses may consist of from a quarter of a grain to a grain every hour or two hours. Some writers also recommend very highly the use of mercurial inunction. Vogel (*op. cit.*, p. 361) states that a mercurial treatment is decidedly effectual, and adds that the only two children he has seen recover from this disease, were treated exclusively with mercury, internally and externally.

Counter-irritants are useful as adjuvants to the more powerful remedies already indicated. During the first day or two they should consist chiefly of sinapisms and mustard poultices, applied from time to time to the trunk and extremities. Authorities differ somewhat as to the effect of blisters, and as to the time at which they ought to be applied. M. Valleix (*op. cit.*, t. ix, p. 187), opposes their employment in this affection as often injurious and still more frequently useless. We think the advice given by Dr. Abercrombie, as to their employment, is probably the most prudent. This is, not to apply them in the early stage, but to wait until the active symptoms of the disease have been subdued. They may be applied to the head itself, to the nucha, or to the extremities. We believe that we have seen them most useful when applied to the neck and inside of the calves of the legs. Nevertheless, there is high authority in favor of their good effects when applied upon the head itself.

M. Rilliet (*loc. cit.*) recommends a vigorous revulsion upon the scalp when the disease has followed the suppression of an eruption. He proposes with this view the employment of pustulation by croton oil, and relates a case of recovery which followed this treatment under a most unfavorable train of symptoms. To make use of it the head must be first shaved; from fifteen to twenty drops of the oil are then to be rubbed over the scalp with a glove four or six times a day. Before making the friction, the eyes of the patient must be covered with a band to prevent the introduction of any of the oil into them, as this would be apt to occasion severe

ophthalmia. In the case reported by him, a considerable number of pustules were produced in twenty-four hours, and in a few more hours the eruption was general, so that the head was covered with a kind of cap of a fine yellow color.

ARTICLE III.

CEREBRAL CONGESTION.

CEREBRAL CONGESTION implies a condition in which the bloodvessels of the brain contain an excessive quantity of blood. It occurs under the two forms, of *active* congestion, where there is an increase in the amount of arterial blood, and of *passive* congestion, where the quantity of venous blood is excessive.

While it can no longer be doubted that the amount of blood circulating in the brain is thus liable to vary, and that such variations are of frequent occurrence, and are attended with very important symptoms, it is difficult to determine the relative frequency of cerebral congestion at different periods of life. Dr. West, whose publications upon the diseases of children are amongst the most valuable that the English press has afforded us, long ago claimed for cerebral congestion in childhood the position of a very important and frequent condition of disease. According to some more recent authors, also, it is much more frequent in childhood than at any later period of life. We are inclined, however, to regard this latter view as probably an overestimate, because, in our opinion, the symptoms which are detailed in this article as dependent on congestion of the brain, are, in some cases, rather due to mere excitement and undue rapidity of the circulation, and in others to the irritation of the brain caused by the circulation through it of blood vitiated by the poison of some of the acute specific diseases.

Rilliet and Barthez assert (1ère edit., t. i, p. 649) that they have found in children dying of different diseases, and who had presented no cerebral symptoms, congestion precisely similar to what they found in others who had exhibited more or less dangerous idiopathic or secondary nervous symptoms. They are not disposed, therefore, to attribute to cerebral congestion any large share in the production of eclampsia or other nervous phenomena. Other writers of the French school, also, as Valleix and the authors of the *Bibliothèque du Méd. Prat.*, express the view that it is rare to meet with true pathological and idiopathic congestion of the brain, either in the first or second infancy (t. vi, p. 118). We have alluded to this diversity of opinion not to depreciate the importance of this condition, but to show how much want of agreement exists among high authorities as to the explanation of symptoms (delirium, somnolence, coma, convulsions, etc.), which we believe are too often, in this country, set down as unquestionably dependent on cerebral congestion.

Causes.—Active congestion may occur during the process of dentition, or may result from exposure to the sun, from falls or blows on the head, or from excessive excitement or fatigue in children who are predisposed to the affection. The cerebral symptoms occurring at the outset of the eruptive fevers have been, by West and others, attributed to the development of intense cerebral congestion. We feel, however, that the nervous symptoms just alluded to ought, most frequently at least, to be regarded as the result of the presence in the nervous centres of a diseased and vitiated blood, rather than of congestion. That congestion does not always produce them is shown by the statement of Rilliet and Barthez (*op. cit.*, t. ii, p. 620) in regard to the cerebral symptoms of scarlet fever, "that a more or less sanguine congestion (of the cerebro-spinal apparatus) is the only alteration *generally, but not always found*, and sometimes the congestion is not more marked than in other diseases in which there had been no cerebral symptoms."

In reference to the cerebral symptoms which less frequently occur in inflammations of important organs, as, for instance, pneumonia or enterocolitis, we are not yet in possession of sufficient facts to determine whether they result from reflex irritation, from the elevated temperature and acceleration of circulation, or from changes in the quantity of blood circulating through the brain. Probably all three of these elements take part in varying proportion in the production of such symptoms; we do not, therefore, feel at liberty to regard them, in the majority of cases, as actually depending on cerebral congestion.

Passive congestion results from such causes as offer an impediment to the reflux of the venous blood from the brain. Among them may be mentioned the mechanical obstruction caused by the pressure of an enlarged thymus gland, or of enlarged cervical or bronchial glands, or by the partial or complete occlusion of a large vein or sinus from the formation of a fibrinous concretion (thrombosis) in its cavity, or from the pressure of a tumor upon its walls. Passive congestion occurs also in affections which, like hooping-cough, are attended with violent paroxysms of cough, during which the return of venous blood from the brain is greatly impeded. Finally it often appears that the state of feeble, languid circulation, depending upon want of pure air or of sufficient and nourishing food, strongly predisposes to, or actually induces, this form of cerebral congestion.

Symptoms.—Recognizing that cerebral congestion may occur at the outset or during the course of various acute diseases, it is evident that the symptoms due to the congestion itself must frequently be complicated by those of the primary affection. We may, however, give the following brief sketch of the symptoms which may be attributed to the two forms of cerebral congestion.

The *active* form usually appears suddenly, though it may be preceded for a few days by a state of indisposition, with irritability and peevishness, some fever, and a disordered state of the bowels generally, but not always consisting of constipation. The chief symptoms of the attack are great heat of the head, and complaints, in older children, of headache, intolerance of

light and sound, nervousness, with startings during sleep and twitchings of the muscles. The pulse is frequent, the carotids throb, and if the skull be still unossified the anterior fontanelle is tense and prominent, or the brain is seen and felt to pulsate forcibly through it. If these symptoms be not relieved by appropriate treatment, or, in some cases, without any premonitory stage, the child may pass into a state of more or less profound stupor or coma; or, on the other hand, an attack of partial or general convulsions may occur.

In *passive* congestion the symptoms are apt to be less suddenly developed, but when marked they resemble in many respects those which we have described as indicative of the active form. There is, however, less febrile excitement, and the force of the arterial pulsation and the prominence and tension of the fontanelle are notably less. Still there are usually present great irritability, restless, disturbed sleep, muscular twitchings, or even convulsions; or, on the other hand, deepening indifference to surrounding objects, resulting in profound stupor.

The *duration* and *termination* of these symptoms are very variable. If the anatomical condition present has been only one of great vascular distension, and appropriate treatment is promptly employed, the threatening symptoms subside in the course of two or three days. If, however, the congestion has been so extreme or has lasted so long as to lead to serous effusions or even to minute extravasations of blood, the symptoms may continue to deepen in gravity until the fatal result occurs, or else the attack subsides but leaves behind it some evidence of injury to the brain-tissue in the form of more or less lasting paralysis. Occasionally, however, complete recovery takes place, contrary to all expectation, after the grave symptoms above described have continued but slightly modified for days or even weeks.

The *diagnosis* of cerebral congestion must be based upon the symptoms above detailed, as well as upon the general considerations with which we prefaced this article. The reader is also referred to the remarks made under the head of diagnosis in the article on simple meningitis. It is, of course, essential not only that the existence of cerebral congestion should be recognized, but also that the form in which it presents itself should be determined, as this has a most important bearing upon the treatment to be employed.

Treatment.—Active cerebral congestion is to be treated like the first stage of simple meningitis, with cathartics and purgative enemas, calomel, cold applications to the head, baths, revulsives, full doses of bromide of potassium, low diet, and confinement to a cool dark chamber. We desire to lay particular emphasis upon the employment of bromide of potassium, as its power of lessening active congestion of the nerve-centres is established by very positive evidence. Belladonna, which exerts a similar action, may be associated with it. If the symptoms do not promptly yield to these measures, and there is no special contraindication, we should recommend the use of local depletion by leeches or wet cups to the temples or some part of the head.

In the treatment of the *passive* form, particular attention must be given

to the relief or removal of the primary cause. Unfortunately, however, in many instances this is not possible. The urgent symptoms themselves must be promptly treated by cold applications to the head, by active revulsion, by strict attention to the diet and the state of the bowels. If great danger exists, and the nature of the cause and the condition of the child justify it, mild local depletion may be cautiously employed. If, on the other hand, the case be associated with enfeebled nutrition, it may be necessary to employ quinia, ammonia, as nourishing a diet as can be digested, and small amounts of stimulus.

If the congestion terminate in extravasation, the treatment for this condition and the paralytic symptoms which may result, must be such as is recommended under the head of cerebral hæmorrhage.

ARTICLE IV.

CEREBRAL HÆMORRHAGE.

We shall consider hæmorrhage of the brain under two heads, that of the substance, and that of the membranes; the former is usually designated as cerebral, and the latter as meningeal apoplexy. Both these forms of hæmorrhage are of rare occurrence in childhood compared with other diseases of the brain, and with their frequency during adult life and old age. Of the two kinds, that of the meninges is the most common.

Definition; Frequency; Forms.—By cerebral apoplexy or hæmorrhage is understood an effusion of blood into the substance of the brain. By meningeal apoplexy or hæmorrhage is understood an effusion of blood between the dura mater and cranium, into the cavity of the arachnoid membrane, beneath the arachnoid, or in the meshes of the pia mater. Cerebral hæmorrhage is a very rare affection in childhood. This is proved to be the case by the facts that MM. Rilliet and Barthez met with only eight cases in their extensive experience, and that M. Barrier saw but one in 576 cases of disease of all kinds. Meningeal apoplexy is of more frequent occurrence, since MM. Rilliet and Barthez report eighteen cases. M. Barrier met with one case of this form in the 576 cases referred to. Dr. West (*London Med. Gaz.*, June 18th, 1847, p. 1062) says he has only twice met with distinct extravasation of blood into the substance of the brain in children. We have ourselves met with two cases of hæmorrhage into the substance of the brain, and with several of meningeal apoplexy.

Hæmorrhage into the substance of the brain occurs in two different forms: one in which the effused blood is contained in a cavity caused by a laceration of the tissue of the organ, and designated apoplexy in a cavity; and the other in which the blood is effused in a multitude of little points of different sizes, and designated capillary apoplexy.

In addition to this, as in a remarkable case published by Dr. Dulles (*Philada. Med. Times*, July 22d, 1876), the hæmorrhage may occur into the ventricles of the brain, completely filling these cavities.

In meningeal hæmorrhage the blood may, as we have stated, be effused between the dura mater and the bone. This form, however, is very rare, so rare, indeed, that several writers deny its existence. It is proved, however, to have occurred, by a case reported by MM. Rilliet and Barthez, which is the only one they have met with. In by far the most common form of the disease, the blood escapes into the cavity of the arachnoid membrane. Of this form the authors just quoted report 17 cases, while, according to the authors of the *Bibliothèque du Méd. Prat.* (t. vi, p. 193), the effusion always occurs in this situation. That this is not invariably correct, however, is proved by the case of effusion exterior to the dura mater already referred to, and by the fact that it sometimes takes place beneath or in the meshes of the pia mater. The latter class of cases is very rare, however, in proportion to those in which the hæmorrhage occurs within the cavity of the arachnoid. MM. Rilliet and Barthez did not themselves meet with a single instance of that kind, but they quote two from other writers; and M. Valleix refers to a memoir by M. Prus, in which others are given. It appears, therefore, that in the great majority of instances, the effusion takes place within the cavity of the arachnoid membrane.

Causes.—The causes of cerebral hæmorrhage are very obscure, so much so, indeed, that some writers have not attempted to ascertain them. They appear to be the same in both forms of the affection. Amongst the ascribed causes are the sudden disappearance of eruptions of the scalp, observed in two cases by MM. Rilliet and Barthez, in one of which this effect is stated to have been produced suddenly by medical treatment, while in the other it followed the application of poultices to a favous eruption upon the same part. This cause must, however, it appears to us, be regarded as purely illusory. The disease is stated by M. Legendre to have followed in one case a violent fit of anger. It is said also to have been produced by various causes which acted as impediments to the circulation. The obstacle may be situated within or exterior to the cranium. To the first class belong cases in which the sinuses and large venous trunks of the head have been found obstructed by coagula of blood, or by the pressure of tumors, generally of a tubercular nature; to the latter, those in which there is intense engorgement of the superior cava produced, as in prolonged paroxysms of hooping-cough, or in obstructive cardiac disease, or where there is compression of this vessel by enlarged and tubercular bronchial glands. Another cause is thought to be the existence of confirmed cachexia and general debility from any diseased condition whatever, in which the blood having become thin and lost its plasticity, escapes from the vessels with great facility. This last condition is one which almost always exists in connection with the causes cited as acting through the agency of obstruction to the circulation, and tends of course to augment their dangerous effects. Occasionally, also, aneurisms of the cerebral arteries, especially of the middle cerebrals, occur at an early age (several cases are on record at the age of 14 years), and by the rupture of the sac give rise to excessive and rapidly fatal cerebral hæmorrhage.

We have met with one case of extensive hæmorrhage into the left corpus striatum and adjoining tissue in a boy of 13, evidently connected with ac

vanced granular degeneration of the kidneys, resulting from a previous attack of scarlatina.

In some instances the hæmorrhage occurs in the healthiest and most vigorous constitutions, and cannot be accounted for in any way.

It appears that meningeal apoplexy is most frequently met with in very young children, according to MM. Rilliet and Barthez, between the ages of one and two and a half years, whilst M. Legendre did not meet with a single case after three years of age in 248 autopsies. Cerebral and ventricular hæmorrhage, on the contrary, are much more common after three years of age than before, which is just the reverse of the law in regard to meningeal effusion.

Anatomical Lesions.—The description of the lesions of hæmorrhage into the substance of the brain need not detain us long, for they are much the same as those observed in the adult. When the blood is effused into cavities (apoplexy in cavities), the latter are usually small in size, seldom exceeding from one to two-thirds of an inch in diameter, though in rare cases they have been found much larger. The cavity is formed by a laceration of the substance of the brain, and is filled with soft, dark coagula, or sometimes with fluid blood; the walls of the cavity consist sometimes of the substance of the brain, which may be of a rosy color and natural consistence, or yellowish and softened, while in other instances they are formed of more or less numerous points of capillary apoplexy. The capillary form of effusiom occurs in the shape of a number of points, scarcely so large as the head of a small pin, and of a dark or brownish color, which contrasts strongly with that of the cerebral tissue. These points evidently consist of true coagula, which are sometimes surrounded by small yellowish areolæ. The substance of the brain around the effusion is either white, firm, and perfectly healthy, or softened, and of a whitish, reddish, or yellowish color. The capillary effusions are generally limited within a space of from a third of an inch to an inch and a half in size, but they have been found scattered over a large portion of the hemispheres.

Both forms of hæmorrhage are much more common in the cerebrum than cerebellum, and occur more frequently on the left than right side. In addition to the sanguine effusion there is generally considerable congestion of the pia mater, of the venous sinuses, or of the substance of the brain itself.

In describing the lesions of meningeal apoplexy, we shall confine our remarks to the effusion which occurs into the cavity of the arachnoid, this being, as we have already remarked, by far the most frequent form of the disease.

The appearances presented by the cavity of the arachnoid into which the effusion has taken place vary greatly in different cases, according to the age of the child, the quantity of the hæmorrhage, and the period of time which may have elapsed between the accident and the death of the patient. It is very uncommon to find pure liquid blood, though this has been met with. In the case published by Dr. Dulles (*loc. cit.*), which occurred at the age of six months, the lateral ventricles were filled completely with firm and partly organized clots, a large firm clot filled the third ventricle. The surrounding brain tissue was deeply stained, but was not lacerated.

In most instances, there is a bloody serum mixed with thin, reddish coagula, contained in a soft and very delicate membrane lining the internal surface of the arachnoid. Sometimes the effusion is thin, limpid, and more or less yellowish in color, while at other times it is thick and brownish, or chocolate-colored. In some rare cases it is perfectly transparent and colorless. The fluid, in whatever state it exists, appears to be the result of transformations undergone by the effused blood. The solid portion of the blood or clot is found either in the condition of more or less recent coagula, or changed into false membranes, which sometimes resemble very closely the arachnoid itself, and sometimes a true fibrous membrane. The coagula are found in the form of thin membranes, varying between one or two lines in thickness, and an inch and a half to two inches in size. They are thickest generally in the centre, where they measure between a fifth of a line and two lines, and are brownish or greenish in color, and of variable consistence, according to their age. These coagula may exist upon any portion of the brain, but, according to MM. Rilliet and Barthez, are most frequently met with upon its convex surface.

The coagula just referred to undergo in some instances a curious change, of which we shall give a short description. In the course of time, the fibrinous portions of the blood are deposited upon the internal surfaces of the cavity of the arachnoid, in the form of a new membrane. When death occurs soon after the onset of the attack, the parietal layer of the arachnoid is found to be completely lined with this membraniform production, whilst the visceral or cerebral layer is covered by it only in certain points. When the case has lasted a longer time, on the contrary, the visceral as well as the parietal layer of the arachnoid may be covered with the new production, and when this happens there is formed a true sac or cyst, destitute of opening, which lines the whole interior of the arachnoid, and contains within its cavity bloody serum and coagula. At first this new membrane is reddish in color, elastic, and of a stronger texture than might be supposed from its apparent thinness and softness. Its thickness is generally about a tenth of a line. At a later period the walls of the cyst become so thin and transparent that they have been mistaken for the arachnoid itself. They differ, however, from the latter in being rather less transparent and thin, and particularly in the circumstance of presenting numerous vascular arborizations. When death occurs at this stage, which M. Legendre (whose description we chiefly follow) calls the second period, or that of complete organization of the cyst, the external surface of the latter is found to adhere intimately to the parietal portion of the arachnoid membrane, by very delicate cellular tissue, though not with so much force but that it may be detached by traction. The internal portion of the new membrane, on the contrary, which is lubricated by the serosity of the arachnoid tissue, is very slightly adherent to the layer of that membrane covering the brain.

So long as the cyst formed by the new membrane, or, as it is called by MM. Rilliet and Barthez, the *pseudo-arachnoid* membrane, contains an amount of fluid sufficient to keep its surfaces separated, its cavity is single. When, on the contrary, the walls of the cyst have come into contact, either because of the partial absorption of the contained fluid, or because the fluid has accumulated at the lowest points, or wherever there is the least resist-

ance, the cavity becomes multilocular in consequence of the cohesion of its walls at certain points.

The size of the cyst varies exceedingly. Sometimes it covers the greater part of the convex surface of one hemisphere, sometimes the whole, while in other instances it extends to the base, forming in that case a nearly complete shell for the whole brain. The quantity of fluid varies in different cases. Sometimes it amounts only to a few large spoonfuls; in others, to one or two, or eight or nine ounces; in one case observed by MM. Rilliet and Barthez there was upwards of a pint on each side, or more than a quart in all. In most instances the hæmorrhage occurs into both halves of the arachnoid membrane, so that there is a cyst for each hemisphere. More rarely it occurs only on one side.

In the second stage, and when the effusion is very large, which rarely happens except in young children, and prior to ossification of the fontanelles or sutures, the lesion constitutes a form of chronic external hydrocephalus, and the symptoms are such as will be detailed under the head of this latter disease. The vault of the cranium is enlarged by the unnatural prominence of the frontal and parietal bones; the sutures are more open than usual, and the anterior fontanelle is distended and protuberant. When the effusion occurs thus early in life before complete ossification of the skull, the brain does not appear compressed or flattened, as it does when the disease occurs at a later period.

The visceral portion of the arachnoid is often thickened, opaque, and more resisting than natural. The pia mater is frequently infiltrated with a good deal of serosity, which sometimes has a gelatinous appearance. When death has occurred in the first stage of the disease, the brain usually presents signs of hyperæmia. The veins on the surface of the hemispheres are enlarged, the cortical substance is of a bright rose-gray color, and the medullary portion is dotted over with drops of blood. Sometimes the cellular substance beneath the arachnoid is slightly infiltrated with serosity, at other times not. The ventricles contain a very small quantity of fluid.

The exact anatomical cause of the cerebral hæmorrhage in children is still subject to some doubt. It appears probable that it usually results from intense determination of blood to the head, or from extreme passive congestion, which lead to the rupture of vessels so minute as to escape notice, or possibly in some cases to the transudation of blood through the capillary walls without actual rupture. We are not aware that any careful microscopic examination has yet been made of the condition of the walls of the vessels in such cases. In some rare instances, however, as in one witnessed by M. Legendre, the effusion is the result of the rupture of a vessel of some size. In the case observed by him, death took place in twelve hours from the attack, and the left hemisphere was found covered with a layer of coagulated blood, which had escaped from a ruptured vein. (*Biblioth. du Méd. Prat.*, t. vi, p. 192.)

Symptoms; Duration.—The symptoms of *hæmorrhage into the substance of the brain* in the child are, as a general rule, extremely obscure and uncertain, though in some few cases that have been observed, they were as characteristic as those which occur in adults. In obscure cases, the chief

symptoms that have been noticed were restlessness, delirium, headache, violent fever, grinding of the teeth, and, after a time, complete abolition of the intelligence, fixity of the eyes, invariable dilatation of the pupils, stertorous respiration, and general insensibility. Of three cases reported by M. Valleix (*Clinique des Mal. des Enf.*), the nature of the disorder was easily diagnosticated in one by the existence of complete hemiplegia, while in the two others the only marked symptom was entire immobility. The only certain symptom of the disease, therefore, would be a sudden attack of hemiplegia, either as the primary symptom, or following coma or convulsions, and lasting for at least several days. An attack of general paralysis would not be by any means so certain, as this may exist in several other diseases of childhood.

In a case which came under our charge, we believe the attack to have been one of apoplexy of this kind.

CASE.—A girl, two years and a half old, apparently in the enjoyment of excellent health, was suddenly, and without ascertainable cause, attacked with violent general convulsions and entire insensibility, which lasted with very slight remissions of the convulsive movements, but without any return of consciousness, for twelve hours. At the end of that time the convulsions ceased entirely, and she very soon regained her consciousness, remaining merely peevish and languid. She was, however, completely hemiplegic on the left side, so that she could neither rise in bed, nor turn towards the right side. The paralysis diminished rapidly, but regularly, so that at the end of three days she could sit up in bed, and in a few weeks was perfectly well. This child remained well, with the exception of rather unusual excitability, and some peevishness of temper, for three years, when she died of scarlet fever. No autopsy could be made.

The obscurity which exists in these cases will be clearly understood by any one who will read two examples given by Dr. West (*loc. cit.*, p. 1062).

With a short quotation from the work of MM. Rilliet and Barthez, we shall pass on to the subject of meningeal apoplexy. These authors remark (*op. cit.*, t. ii, p. 54), in speaking of this affection, that "cerebral symptoms have been observed to exist, but of so unusual a character, and so different from what have been assigned by writers to apoplexy, that they could not lead to a diagnosis of the disease."

We shall describe the symptoms of the *meningeal form* of hæmorrhage under two heads: first, as they present themselves in the acute, and, second, as they occur in the chronic or second stage of the affection.

Unfortunately the symptoms of the acute or first stage are not much more certain and distinct than those of cerebral hæmorrhage. The disease may begin with fever and some convulsive movements, or, as happened in a case reported by M. Valleix, with violent general convulsions. Vomiting sometimes occurs at the beginning, but is usually very slight. It is difficult to know whether headache exists or not at the early age at which this disease commonly occurs. The convulsive movements generally affect particularly the eyes, and are followed by some degree of strabismus. The appetite is lost from the first; the thirst is moderate; there is no constipation. Soon after the symptoms just described, appear permanent contractions of the hands and feet, which are followed by attacks of tonic

or clonic convulsions, during which sensibility and intelligence are abolished. Between the attacks of convulsions there is somnolence, which, though slight at first, becomes more marked as the case goes on. The attacks of convulsion become more and more frequent as the case progresses, until at last they are nearly constant. The tonic convulsions affect the limbs and trunk both, but particularly the former, whilst the clonic spasms occupy sometimes one side of the body, sometimes the upper extremity alone, and at other times the whole body, but even then are usually stronger on one side than on the other. Paralysis is rarely noticed in the disease; it occurred only in one out of nine cases observed by M. Legendre, and in one out of seventeen observed by MM. Rilliet and Barthez.

Dr. West remarks (p. 1061): "The absence of paralytic symptoms, however, is not the sole cause of the obscurity of these cases, but the indications of cerebral disturbance, by which they are attended, vary greatly in kind as in degree. The sudden occurrence of violent convulsions and their frequent return, alternating with spasmodic contraction of the fingers and toes in the intervals, appear to be the most frequent indications of the effusion of blood upon the surface of the brain. I need not say, however, that such symptoms, taken alone, would by no means justify you in inferring that an effusion had taken place." Dr. West adverts particularly to the fact that apoplexy in the child is especially apt to occur in those who are weakly and feeble, and gives to this form of the disease the appellation of the cachectic form of cerebral hæmorrhage.

It must be remembered that in cases of valvular disease of the heart, embolism of one of the cerebral arteries may occur from the detachment of a fragment of a vegetation. We have observed this accident in a young girl, eight years of age, where the symptoms which marked the occurrence of the embolism were brief unconsciousness, followed by complete left-sided sudden hemiplegia. The diagnosis may be made in these rare cases by the detection of the physical signs of organic disease of the heart, and by the less severe cerebral symptoms which, as a rule, attend it. The hemiplegia which follows embolism may be partial or complete. In our cases it persisted, with contraction of the paralyzed members, until death.

The chronic form presents most of the symptoms which exist in acquired chronic hydrocephalus from serous effusion into the ventricles. The cranium is very large in proportion to the face; the sutures are not ossified; there is strabismus, with dilatation of the pupils; the sense of sight is generally but not always retained; the face loses its expression; if the child was old enough at the moment of the attack to show signs of intelligence, the latter are found to diminish rather than increase, and sometimes they are lost entirely, as the size of the head augments; and the child is apt to utter loud cries, particularly during the night. The cutaneous sensibility is in general neither lost nor diminished. The power of motion usually remains, though it was entirely lost in one case. The appetite and thirst persist.

The *duration* of cerebral apoplexy is very irregular. In one case quoted by MM. Rilliet and Barthez, it was a quarter of an hour; in another, an hour; in a third, forty-eight days; and in one reported by M.

Valleix, in a very young infant, recovery was nearly perfect in a little less than two months, when the child was seized with pneumonia and died.

The duration of meningeal apoplexy is also irregular. According to M. Legendre, all the recent cases seen by him in the Children's Hospital, died in from eight to twelve days, apparently rather from intercurrent diseases than from the primary affection itself, whilst cases occurring in subjects placed in better hygienic conditions, and not attacked with intercurrent affections, passed into the second or hydrocephalic stage of the disease. The second stage lasted, according to the same author, in the four cases which he witnessed, from eight to thirty months, and then death was the result, not of cerebral symptoms, but of complications affecting the thoracic organs.

Diagnosis.—The diagnosis of cerebral hæmorrhage is, as we have already stated, very difficult, unless hemiplegia exist. When the case commences, as it often does, with convulsions or with inflammatory symptoms, it is often impossible to distinguish it from acute or tubercular disease of the brain.

The diagnosis of meningeal hæmorrhage is also very often extremely difficult. Not unfrequently it occurs in the course of other diseases, and is then entirely latent. In acute, primary cases, the most important and distinctive symptoms are the early age of the subjects, between one and three years generally; the violent fever from the commencement, marked by full, frequent, and *regular* pulse; the absence of constipation; the frequency of the convulsive attacks, and particularly the permanent contraction with rigidity of the feet and hands.

The diagnosis between the form of hydrocephalus which follows meningeal apoplexy, and ventricular serous hydrocephalus, is exceedingly obscure. The only circumstances which seem to have any real value are the acute commencement of the disease with the symptoms above detailed, and the early age of the patient. MM. Rilliet and Barthez state that they have never known a child of two years old, or younger, to die of ventricular serous hydrocephalus from tumors, whether tubercular or not, of the brain; in all such cases the effusion has been the result of a hæmorrhage.

Prognosis.—The prognosis of both forms of the disease is very grave. It is impossible, however, to ascertain the prognosis with any certainty, so long as the symptomatology of the two affections is so obscure as we have found it to be. That cerebral hæmorrhage is susceptible of cure, however, is proved by the case reported by M. Valleix, already referred to, in which the child had nearly recovered, when it was seized with another disease which destroyed it. Recovery from meningeal apoplexy is certainly extremely rare; we believe, however, that we have met with one case in which this affection terminated favorably.

Treatment.—The treatment must depend on the diagnosis and the special character of the symptoms in each case. In a sudden and severe attack, occurring in a strong and hearty child, in which the symptoms of congestion of the brain are strongly marked, and where we are not yet certain that actual hæmorrhage has taken place, we should immediately resort to a general or local bloodletting. It was formerly customary to

employ venesection in all such cases, but we believe that equal relief can be obtained by freely cupping or leeching the back of the neck.

When, however, we have every reason to believe that blood has been effused either in the membranes or into the substance of the brain, it is evident that bloodletting can produce but little effect, and that only in reducing the general fulness of the cerebral vessels. In such cases we should certainly limit ourselves to the application of a few cut cups or leeches to the nucha.

It must further be remarked, however, that in many cases of cerebral or meningeal apoplexy, depletion in any form is entirely contraindicated; since, as has already been stated, the effusion of blood occurs frequently in feeble and weakly children, and either in the course of some acute or chronic disease, or as a consequence of previous diseases which have exhausted the forces of the constitution and induced a state of dyscrasia and diffluence of the blood. In such cases as these we must depend upon the use of rest, cold applications, purgatives, and counter-irritants as recommended below.

Cold applications should be immediately made to the head, either by wet cloths, the ice bladder, or by cold affusion. At the same time, or as early as possible after the invasion, a dose of some purgative medicine must be given. The best is calomel, either alone or combined with jalap or rhubarb. If given alone, it ought to be followed in an hour or two by castor oil, infusion of senna and manna, salts, magnesia, or some active cathartic. When the symptoms are very urgent, it is well to open the bowels still more speedily by a purgative enema.

Counter-irritants are always useful adjuvants to the remedies already mentioned. They should consist at first of mustard plasters applied to the extremities, and shifted from place to place. When the symptoms do not yield after proper depletion and the use of sinapisms for some hours, it is well to apply blisters to the calves of the legs, and to the nape of the neck.

The diet must be very strict, and should consist only of barley or arrow-root water, for a few days.

The temperature of the room should be kept cool; and the child should be placed with the head and trunk somewhat elevated, and kept profoundly quiet.

For the paralysis which follows apoplexy in children, we believe that the most important, and indeed the only treatment necessary, is attention to the general health of the patient, in order to give to nature time and opportunity to effect the absorption of the clot which has been thrown out into the substance of the brain, or into the cavity of the arachnoid membrane. This process may, however, be aided and hastened by the prolonged administration of iodide of potassium with the iodide of iron. In cases of meningeal apoplexy, when the disease assumes the chronic form, occasioning the kind of hydrocephalus we have described, there is little more to be done than to attend to the general health of the child, and to endeavor to promote absorption of the fluid by the internal administration of diuretics, and the preparations of iodine. It has been proposed also to get rid of the fluid by tapping, as has been done in congenital hydrocephalus, and it is

indeed in cases of the form we are now considering, when the fluid is entirely external to the brain, and where no malformation or organic disease of the brain exists, that this operation has been found most successful. (See treatment of chronic hydrocephalus.)

ARTICLE V.

CHRONIC HYDROCEPHALUS.

This term is applied to an affection characterized by an excessive accumulation of serous fluid, either within the ventricles of the brain or the sac of the arachnoid.

The names *internal* and *external* have also been applied to it, in accordance with the position of the fluid: the former being given to those cases where the ventricles are the seat of the morbid collection, and the latter indicating that the fluid has accumulated in the cavity of the arachnoid and consequently surrounds the exterior of the brain. Chronic hydrocephalus may either be *congenital* or *acquired*, the latter variety presenting the most interest in a practical point of view, since congenital hydrocephalus is usually associated with some malformation of the brain which renders extra-uterine life almost impossible.

In either form it is a comparatively rare disease in Philadelphia. Our more recent experience however has furnished us with numerous opportunities for studying its symptoms, treatment, and pathology.

Morbid Appearances.—There are indeed few diseases in which it is of more importance to correctly establish the exact nature of the morbid process and the resulting lesions, since, as we shall see in a later part of this discussion, questions of the utmost practical value hinge upon the determination.

Internal Hydrocephalus.—In this condition the amount of fluid is often very large, and varies from half a pint or a pint, to even as much as a gallon. Trousseau mentions a case where the fluid weighed 30 pounds, and Frank one in which it weighed 50 pounds. The formation of this accumulation being gradual, the cavities of the brain accommodate themselves to it, the ventricles become distended, and the communications between their cavities are all enlarged; and occasionally the septum lucidum is perforated. This distension is usually most marked in the lateral ventricles. The hemispheres of the brain yield to the pressure of the increasing collection in the ventricles; their convolutions are unfolded and flattened, so that the interval between them is only marked by a sinuous shallow groove, and the hemispheres are so thinned out as to form a layer not exceeding a few lines in thickness. It is not unusual, however, even when the distension of the brain has proceeded to this extreme degree, to be able to trace the cineritious and white layers, preserving their normal relations. The consistence of the expanded brain-substance varies in different cases; usually, however, it remains normal, or is even increased, though in some cases it has been found so soft as to tear upon the slightest

traction. The structures at the base of the brain present the same changes in consistence.

One of the most important questions in this relation, as bearing upon the causation of the affection, concerns the condition of the lining membrane of the ventricles.

The analogy of all other serous membranes would lead us to infer that in those cases where no mechanical obstruction to the circulation exists, such as a tubercular tumor pressing upon the sinuses of the brain, we should look for the cause of the serous accumulation in a morbid state of the lining membrane of the ventricles. This view is fully confirmed by the study of fatal cases of internal hydrocephalus, since in many cases this membrane is found much thickened, and either softened or roughened and granular. The granular condition of the membrane presents many degrees: in some cases it is merely a slight irregularity of the surface, while in others there is an unevenness as marked as that of shagreen, or even a formation of granules, which, at times, measure one-third of an inch in diameter, or even become distinctly pedunculated.

Occasionally, a false membrane is found lining one or both ventricles, as the result of the chronic inflammation of the lining membrane of these cavities.

Even when the symptoms of hydrocephalus have not appeared until some time after birth, the brain may be found to present positive evidences of congenital malformation, in the retarded development of some of the structures at its base.

The veins of Galen and sinuses of the dura mater are usually found in a healthy state, with their calibres quite free; a fact which is of importance in considering the mode of production of internal hydrocephalus.

In *external* hydrocephalus, the collection of fluid occurs in the sac of the arachnoid, or in a pseudo-cyst resulting from the transformation of a blood-clot, as described in our remarks on meningeal apoplexy: the brain is separated from the cranial vault and compressed against the base of the skull, as the lung is forced back against the spinal column by the fluid of hydrothorax.

The superior cerebral veins, passing from the surface of the brain to the longitudinal sinus, traverse the fluid, and at times are so much stretched as to raise the surface of the brain into points.

Excepting in cases, however, where the disease is congenital and coincident with some original malformation of the brain, there is no absolute diminution in the size of this organ.

The character of the fluid varies considerably in different cases, and probably depends to a great extent upon the cause.

In an analysis by Spengler of the fluid evacuated in a case of hydrocephalus by puncture, the fluid was clear and colorless; specific gravity 1.010, of acid reaction, and contained no albumen. It also contained chlorides and phosphates of soda and potassa, but no sulphates. It appears, therefore, in such cases as this, that the fluid is not the result of inflammation, but rather due to a passive dropsy. It is, we believe, especially in cases of external hydrocephalus, where the fluid results from the transformation of a sanguineous effusion, that it possesses these characters.

On the other hand, the fluid frequently contains a large amount of organic matter, and closely resembles the effusion in pleurisy or pericarditis. Thus, in a case reported by Battersby, which was tapped eight times, the fluid always contained varying, and sometimes very large, proportions of albumen.

Causes of Internal Hydrocephalus.—The opinions of the highest authorities and most experienced observers still differ widely upon this important point.

We have alluded to the fact that not unfrequently the brain is found to present evidences of congenital malformation, and this fact has led to the opinion that internal hydrocephalus is almost invariably the effect of arrested development of the brain.

Rilliet and Barthez place the effusion in this affection in the class of passive dropsies, and express their belief that most frequently the cause of internal hydrocephalus is to be found in compression of the veins of Galen or ventricular veins, caused by the development of a tumor in the cranial cavity, and usually in the lobes of the cerebrum.

The unfavorable influence which either of these views would have upon the prognosis and treatment of this disease, is of course evident.

On the other hand, however, the opinion is advanced that the starting-point of internal hydrocephalus is, in fact, a morbid condition of the lining membrane of the ventricles.

We have briefly described the appearances of this membrane which have now been observed in numerous well-authenticated cases of internal hydrocephalus, and which plainly indicate the pre-existence of a chronic inflammation, so that we are led to believe that in a certain number of cases, at least, the effusion is due to a slow inflammatory action in the lining membrane of the ventricles. Those cases in which these appearances have been found associated with retarded development of the brain, may be readily explained upon the supposition that the inflammation has been excited at a more or less advanced period of intra-uterine life, and that the resulting effusion has so compressed the structures at the base of the brain as to prevent their normal development. We may add that many eminent authorities, as Trousseau, now adhere to this view.

In a very interesting case of this form which we have lately had under observation, the mother, a very intelligent and healthy woman, had quite a severe fall about the fourth month of pregnancy. In addition to this, however, she lost a favorite brother-in-law from a violent attack of cerebro-spinal meningitis about the same time. She nursed him constantly during his illness, and was very deeply impressed with the unnatural appearance of his face and head which had been shaved. This became so fixed an impression that more than once, between the time of his death and the birth of her child, she said it would not be strange if something were to prove wrong about the baby's head. We attributed the hydrocephalus which did actually develop in her infant to inflammatory changes, perhaps induced by the fall; but the powerful maternal impression above mentioned certainly constituted a curious coincidence.

In cases, however, where the effusion into the ventricles depends upon the

development of a tumor in the cranial cavity, the growth will usually be found to occupy the cerebral lobes in such a manner as to compress the veins of Galen, which pass along the under surface of the corpus callosum, and are indeed the only true ventricular veins.

The causes of *external hydrocephalus* are perhaps less obscure and uncertain than those of the internal form.

In some cases, the effusion in the sac of the arachnoid is evidently due to a rupture of some portion of a brain distended by accumulation of fluid in the ventricles, and hence is merely a sequel of internal hydrocephalus.

According to the able investigations of Legendre, and Rilliet and Barthez, one of the most frequent causes of external hydrocephalus is hæmorrhage into the arachnoid space; the effused blood undergoing changes which result in the presence of large quantities of clear fluid, as described at length in our remarks on meningeal apoplexy. We have alluded to the fact that in many cases of external hydrocephalus the diminution in size of the brain is comparative rather than real; but there are instances where this form of the disease is found associated with malformation of the brain, which appears as a small, misshapen mass, pressed against the anterior part of the base of the skull. In such cases, it appears as though the fluid were poured out to fill up the vacuum between the skull and atrophied brain. It is also possible that these conditions may be produced by the occurrence of hæmorrhage into the arachnoid space during intra-uterine life, and before the brain had attained its normal development.

Symptoms; Physical Appearance.—The unusual size of the head is one of the most striking symptoms of hydrocephalus. In many cases associated with atrophy or retarded development of the bones of the face and the rest of the body, this enlargement appears even more monstrous than it in reality is. The diameters of the cranium are, however, very much enlarged; cases being on record in which at the age of a few weeks the circumference of the head has been twenty-three inches, or even more.

The increase in the size of the head is not, however, invariably the earliest sign of the disease, being frequently preceded by marked symptoms of nervous disturbance, or of impaired nutrition.

The bones of the cranial vault which contribute to this enlargement are the frontal, the parietals, the occipital, and the squamous portions of the temporals. When the disease makes its appearance before the ossification of the sutures and fontanelles has been completed, the gradual increase of the fluid separates these bones more and more widely. The occipital bone thus is pushed backwards, the parietals outwards and backwards, the frontal upwards and forwards. The increase in the size of the head is thus effected by the widening of the sagittal and coronal sutures, and by enlargement of the anterior fontanelle.

The displacement of the frontal bone gives rise to a marked prominence of the forehead, which overhangs the diminutive features: while at the same time the pressure of the fluid depresses its orbital plate into an ob-

lique position, contracts the orbital space, and gives rise to the characteristic appearance of the eye, the globe being prominent but directed downwards so as to be buried beneath the lower eyelid, which conceals almost the entire cornea.

The membrane which covers in the enlarged sutures is often distended and prominent, or remains on the normal level. A distinct sense of fluctuation is readily obtained by palpating one of these spaces, and in some cases, principally in young infants, and where the collection is very large, the head is absolutely translucent. When life is prolonged, and the disease arrested, the ossification of the cranial vault is effected by the development of numerous supernumerary bones, or ossa triquetra, in the membranous spaces. These little bones are consequently found in the largest numbers in the coronal and sagittal sutures, where the deficiency is greatest and most wide. When, on the other hand, the disease does not begin until the sutures have united and the fontanelles ossified, it is rare for the head to attain any very large size. In a few cases, however, occurring in children of even nine years of age, the sutures have reopened under the continuous pressure, and the bones have been found separated as much as half an inch.

More usually, however, in such cases, the pressure seems to expend itself in thinning the cranial bones, which become reduced to mere shells of light, fragile compact bone. Occasionally, so far from inducing thinning of the bones, actual hypertrophy occurs, and the bones of the cranial vault acquire an unusual thickness, and at the same time are dense and indurated.

The early symptoms of the disease vary much. When it is congenital, there are nearly always evidences of cerebral disturbance either from the date of birth, or appearing within a few days. These symptoms are occasionally slight, consisting merely in an unnatural expression, with oscillation of the eyes or strabismus: or, on the other hand, there may be attacks of convulsions frequently repeated.

These symptoms speedily become associated with enlargement of the head and the characteristic alteration of physiognomy. When the disease is strictly acquired, the early symptoms are even more varied. In one set of cases they are those of hæmorrhage into the arachnoid; in another the evidences of inflammation of the serous lining of the ventricles, of more or less acute character, are present; whilst in numerous cases the only symptoms which precede the enlargement of the head are those of failing nutrition.

Usually the aspect of children suffering with this affection is tranquil, or they may even present a certain unnatural gravity and apathy of expression.

Cerebral Symptoms.—At times the intelligence of the child, though perhaps poorly developed, remains intact, and there is no marked cerebral disturbance.

In other cases, however, the advance of the disease is attended with a gradual failure of the intelligence, and impairment of the special senses, and especially of vision.

In addition to the displacement of the globes of the eyes and alterations in the pupils already mentioned, the accumulation of fluid rapidly causes obstruction to the return of venous blood through the sinuses, so that even at an early stage, ophthalmoscopic examination shows marked changes in the fundus of the eyes. These consist in increase in the number and size of the veins of the retina, with later serous infiltration or even atrophy of the optic papilla.

The nervous symptoms are at times much more marked; and there may be frequently recurring convulsive attacks, or, as West mentions having seen in several cases, spasmodic attacks of difficult breathing, with a crowing sound in inspiration (laryngismus stridulus).

According to Rilliet and Barthez, the common sensibility of the surface is often impaired; and there may be more or less complete paralysis, or contraction with rigidity of the extremities.

It is, of course, difficult to estimate the amount of suffering experienced by the little patients; ordinarily it does not appear great, and indeed in some cases it has seemed chiefly due to the opposition offered by the cranial walls to the distension of the brain.

In one case of MM. Rilliet and Barthez, the development of acute pain coincided with the ossification of the fontanelles.

The *general condition* of children suffering with chronic hydrocephalus varies greatly.

In some cases they preserve their appetite and digestion, and appear well-nourished and strong to a late period in the attack; but more frequently they present marked evidences of impairment of nutrition.

The appetite may indeed remain, but the child loses both flesh and strength; the bowels are irregular; usually constipated, but alternating with temporary attacks of diarrhœa.

In the majority of cases, perhaps, these symptoms are not sufficiently pronounced to establish the character of the attack, until the increasing size of the head becomes manifest, and the child acquires the distinctive physiognomy of hydrocephalus. Even after marked enlargement of the head has occurred, however, the advance of the case is far from being uniform. In almost every instance there are pauses of the most variable frequency and duration, during which the child seems free from pain, improves in general condition, and the development of the head is temporarily arrested.

Death is frequently directly induced by some intercurrent affection, wholly unconnected with the disease of the brain: while, in other cases, it immediately follows a violent attack of convulsions, or is preceded by symptoms of an acute exacerbation of the cerebral disorder. In some cases, also, the patients sink into a condition of atrophy, and die worn out by the protracted suffering and malnutrition.

Diagnosis.—During the early stage of the disorder, if the nervous symptoms are slight, consisting merely in occasional attacks of heat of the head, attended with pulsation or tension of the anterior fontanelle, and restlessness, and crying, the diagnosis must remain uncertain. After the enlargement of the head has progressed to any considerable degree, the

expression of the little patient, taken in conjunction with the other symptoms, is usually perfectly characteristic and conclusive.

The morbid condition with which it is most likely to be confounded, is rickets of the skull. In fact, in some cases, the enlargement of the head, which results from these two affections, is quite identical. Usually, however, this is not the case; and the hypertrophy of the rachitic bones takes place irregularly, so that the skull acquires a square instead of a rounded form; the orbital plates of the frontal bones are not displaced; so that, although the forehead may be large and overhanging, the axes of the eyes are not disturbed; the fontanelles are not widely open, prominent, or distended; and, finally, of course, fluctuation on palpation is never present. In addition to this, the evidences of rickets in other portions of the body, and the peculiar symptoms of that affection, as detailed in the article devoted to its consideration, nearly always enable the diagnosis to be readily made.

We have already mentioned the changes which ophthalmoscopic examination shows in the retina in this disease, and as a similar examination reveals no lesion whatever in cases of rachitic enlargement of the head, it is evident that the use of the ophthalmoscope may be of material aid in establishing the diagnosis between these affections, which is, despite all the points of distinction above referred to, obscure and difficult in some few cases.

In doubtful cases assistance may possibly also be derived from cerebral auscultation; the presence of a bruit over the anterior fontanelle being thought by some authors to be a valuable indication of the rachitic nature of the enlargement of the skull. The significance of this cephalic bruit is, however, so much disputed, that it is at present impossible to assign any definite value to it.

The only other pathological condition with which chronic hydrocephalus is apt to be confounded, is hypertrophy of the brain, an extremely rare affection, due to an increase of the interstitial connective tissue of the brain, the so-called neuroglia.

In hypertrophy of the brain, however, the symptoms do not usually appear so early as in chronic hydrocephalus, nor is the cerebral disturbance so marked as in the latter affection. The enlargement of the head, also, which is the most characteristic feature of both conditions, is not so great in hypertrophy of the brain, and, instead of being uniform and assuming a rounded form as in hydrocephalus, occurs especially at the occiput. There is, further, no depression of the orbital plates of the frontal bones in hypertrophy of the brain, so that the axes of the eyes are not disturbed, and the globes are not displaced in the way we have already described as so characteristic of hydrocephalus.

Finally, the sutures are not so widely open, nor the fontanelles tense and prominent as in hydrocephalus; and, of course, the fluctuation which can be detected on palpation in some cases of this latter disease is never present.

Prognosis.—Chronic hydrocephalus still ranks among the most fatal diseases; so much so that Rilliet and Barthez—who, however, attribute

its production usually to the presence of a tumor in the brain—express their belief that it is invariably fatal. Indeed, it must be borne in mind that in many cases treatment must necessarily fail from the coexistence of some extensive congenital malformation of the brain. We should suspect the presence of this complication when there is serious disturbance of the nervous system, such as paralysis, or frequent and apparently causeless convulsions. Unfortunately, however, these hopeless cases cannot always be distinguished.

While the prospect of a complete cure is very slight, it must be remembered that even a high degree of hydrocephalus is not incompatible with considerable prolongation of life. Thus cases have been known to attain the age of 15, 20 or even 25 years, with the maintenance of a fair degree of mental and bodily power.

The prognosis in cases of external hydrocephalus, especially when of acute origin, is less unfavorable than when the effusion takes place into the ventricles.

Whatever be the seat of the effusion, however, and the size of the head, the case must not be regarded as hopeless and beyond reach of remedial measures, so long as the functions of the brain are well performed, since there are well-authenticated cases of complete recovery from chronic hydrocephalus, even when congenital.

In a case we have recently had under observation, the symptoms of hydrocephalus, apparently of congenital origin, advanced rapidly up to the age of three and one-half years, at which the enlargement of the head was arrested, the mental and physical powers of the child developed regularly, and at the age of seven years it seemed probable that complete recovery would result.

Treatment.—It must be sufficiently evident, from the previous consideration of this affection, that there are numerous cases in which all treatment must prove unavailing, from the serious organic disease of the brain which accompanies it. Under any circumstances, however, the nature of the treatment and its efficiency will be much influenced by the early stage at which it is instituted.

In regard to the utility of various special remedies, also, there is the greatest diversity of opinion; and, indeed, there is no plan of treatment which possesses so much evidence in its favor as that originally proposed by Professor Gölis, of Vienna.

If the disease be in its incipience, and the constitution and hereditary tendencies of the child free from taint, this distinguished physician recommends that the head should be shaved, and one or two drachms of dilute mild mercurial ointment rubbed daily into its scalp. While this treatment is being carried out, the head should be constantly protected by a flannel cap. At the same time, calomel should be given in doses of one-sixth to one-fourth gr. twice daily, unless it irritate the bowels, when the inunction alone should be continued.

If after pursuing this treatment, conjoined with the most careful attention to diet and all hygienic precautions, for five or six weeks, there is

marked improvement in the condition of the child, the mercurials may be gradually discontinued.

The iodide of potassium has been highly recommended as a substitute for the mercurials above mentioned, and several cases of apparent recovery under its use are on record. It should be given in large doses, and for a considerable length of time. Trousseau, who recommends its use, joins to its internal administration the external application to the head of lotions containing iodine.

Should the disease remain uninfluenced at the end of this time, it is proper to add to the treatment diuretics and counter-irritants, in the form of issues in the back of the neck, which may be kept open for several weeks. Dr. West recommends the frequent application of blisters as a substitute for the use of issues.

During the employment of this or any other mode of treatment, it will be occasionally necessary to have recourse to antiphlogistic remedies, to subdue the exacerbations of heat and restlessness which occur more or less frequently, and threaten the development of an acute inflammatory condition. Nor should we fail to pay attention to the proper performance of all the functions; to the maintenance of the appetite and digestion by the use of tonics; and in case of the existence of a scrofulous diathesis, to the administration of cod-liver oil, iodide of iron, etc.

When, despite the most careful employment of well-directed measures, the disease is clearly advancing, it is worse than useless to persist in any plan of treatment which annoys or absolutely pains the doomed child; our only endeavor should then be to subdue any intercurrent disorder which might hasten the fatal result.

More than twenty-five years ago, the use of compression of the head, to prevent its yielding to the accumulating fluid, was urged by Barnard, and experience has shown it to be a valuable adjunct to other treatment, though it is inapplicable while any acute symptoms are present, and according to West is best adapted to cases of external hydrocephalus succeeding to hæmorrhage into the arachnoid space.

M. Trousseau recommends the following mode of applying this pressure: Strips of adhesive plaster, about one-third inch wide, are passed from each mastoid process to the outer part of the orbit of the opposite side; from the nape of the neck along the longitudinal sinus to the root of the nose; across the whole head, intersecting at the vertex; and finally are kept securely in position by a strip passed thrice around the head, the ends of the previous strips being turned up over the first coil of this strip, and secured by the succeeding turns.

It becomes necessary to loosen these strips instantly, if any symptoms of compression of the brain develop themselves, since the increasing pressure of the accumulating fluid may produce irreparable injury to the base of the brain, or even, as happened to M. Trousseau, detach the ethmoidal bone from its connections.

The unfavorable results of all strictly medicinal treatment, impelled physicians, at an early date, to resort to active surgical interference in

chronic hydrocephalus, by puncturing the cranium and evacuating the fluid.

The operation should be performed with a delicate trocar and canula, the puncture being made in the coronal suture, about an inch or an inch and a half from the longitudinal sinus,—and in a majority of cases, no evil consequences appear to follow the operation itself. Much difference of opinion still exists, however, as to its curative influence. From a rigid analysis of 56 reported cases in which this operation had been performed, Dr. West came to the conclusion that in only 4 had a permanent cure been effected. Other successful cases have been since reported, so that the operation must be recognized as at least a justifiable one in certain cases.

The circumstances favorable to its performance are, when the hydrocephalus is external; or when internal, is due to previous inflammation of the lining membrane of the ventricles; when there is no reason to believe that the disease is congenital, and attended with arrested development of the brain; when, though the head may be very large and increasing in size, the cerebral functions are not seriously impaired; and, finally, when the nutrition of the child is still good.

Until, however, the treatment previously recommended has been faithfully tried, and unless the disease be evidently advancing, a resort to this operation would be incurring grave risks with but slight prospect of success.

Brainard, of Chicago, has recently recommended the injection of solutions of iodine into the cranial cavity, after puncture and evacuation of the fluid. He has employed this in at least two cases, without the development of any severe symptoms as a direct consequence of the treatment.

One of the cases died at the end of eight months; the other, at the date of the report, only thirty-five days after the operation, had shown no unfavorable symptoms.

He advises the use of an aqueous solution of iodine, in the proportion of one-third gr. with one gr. of iodide of potassium, to f℥j distilled water; of this from f℥j to f℥j, may be injected; the strength of the solution and the amount injected being increased at subsequent punctures.

In one of his cases, twenty-one injections were practiced in the course of seven months.

Injections of this strength are usually followed by no symptoms of inflammation whatever; and this exemption has led to the employment of much stronger solutions.

Thus Dr. Tournesko of Bucharest (quoted by Bouchut), injected f℥iij gr. iodine in f℥v distilled water, immediately after having drawn off by puncture f℥xxiv of serum. The operation was followed by slight febrile excitement; but, at the expiration of fifteen days, the child seemed in excellent health, the circumference of the head having diminished from 43½ to 43 centimetres.

ARTICLE VI.

GENERAL CONVULSIONS, OR ECLAMPSIA.

General Remarks.—The word convulsions is a generic term applied to different forms of spasmodic disease, very dissimilar from each other in many of their characters.

Writers make different classifications of convulsions according to their peculiar notions in regard to the nature and causes of these disorders. The best division is, it seems to us, that adopted by most French writers, who arrange them by their supposed causes, making three classes, *idiopathic* or *essential*, *sympathetic*, and *symptomatic* convulsions. The first two classes are unaccompanied by appreciable lesions of the nervous centres, while the third is called symptomatic, because it includes cases of convulsions which are the sign or symptom of an appreciable lesion of the cerebro-spinal axis, as for instance, those which occur in the course of meningitis, tubercular disease, hydrocephalus, apoplexy, etc. In idiopathic or essential convulsions, the cause of the attack acts directly upon the nervous centres, while in those to which the term sympathetic is applied, the cause lies in the influence or effect upon the brain or spinal marrow of disease of some other organ; to the latter class belong the convulsions which occur in the course of pneumonia, bronchitis, the eruptive fevers, etc.

We shall not pretend to give an accurate account of symptomatic convulsions in this article, as they have already been treated of under the head of the different organic diseases of the brain in the course of which they occur. We shall refer to them in the present article only so far as may be necessary to elucidate the pathology, diagnosis, prognosis, and treatment, of idiopathic and sympathetic convulsions.

There is a form of eclampsia occurring in children, which we shall describe separately, as it differs in many of its characters from ordinary convulsions. This is the disease known by the names of spasm of the glottis, thymic or Kopp's asthma, laryngismus stridulus, and eclampsia with suffocation.

Definition; Synonyms; Frequency.—By the term *convulsion* is meant a paroxysm of variable duration, usually attended with unconsciousness, and followed by stupor, and characterized by a primary involuntary *tonic* contraction followed by irregular clonic spasms of the affected muscles.

In general convulsions, to which the above definition especially applies, the entire system of voluntary muscles is usually affected; though, as will be described hereafter, the attack may be a complete and genuine one of eclampsia, and yet the convulsive movements be limited in their extent to a single group of muscles, or even a single muscle.

The only synonyms which it is necessary to mention are *epilepsia puerilis*, *insultus epilepticus*, and *eclampsia*. The latter term, eclampsia, is, we believe, preferable to any other, and we would gladly introduce it instead

of convulsions, which is too general a term to express the form of disease under consideration.

The frequency of eclampsia is very great. During the two years 1873–74, 1392 children under fifteen years of age died in this city of convulsions; whilst, during the same time, 1973 died of infantile cholera, and 893 of pneumonia. It must be recollected, however, that a very large number of these cases of eclampsia ought, beyond doubt, to have been returned under other titles, as many of them must have been a mere result of organic disease of the cerebro-spinal axis, or of other acute local or general diseases.

Predisposing Causes.—Essential and sympathetic convulsions are much the most frequent before the age of seven years, which is the case also in regard to symptomatic convulsions, though the latter often occur after the age mentioned. We have ourselves met with not less than 200 cases of convulsions, though we have preserved records of but 96. Of these, the age is noted in 91 cases, 19 of which occurred in the first year, 26 in the second, 20 in the third and fourth, 23 between the fourth and ninth, and 3 between the ninth and thirteenth years of life. Dr. West (*op. cit.*, p. 42) states that according to the Fifth and Eighth Reports of the Registrar-General, the deaths from diseases of the nervous system in London, under one year of age, bore a proportion of 30.5 per cent. to the deaths from all causes; from the first to the third year, the proportion was 18.5 per cent.; from the third to the fifth year it was 17.6 per cent.; from the fifth to the tenth year, it was 15.1 per cent.; whilst from the tenth to the fifteenth year it was only 10.6 per cent., and the total above fifteen years was but 10.4 per cent. Again, to show the very great influence of age upon the predisposition to convulsions, Dr. West states that, within the first year, the deaths from convulsions constituted 73.3 per cent. of the total mortality from diseases of the nervous system; between the first and third years, the proportional mortality from convulsions to the total mortality from affections of the nervous system, was 24.9 per cent.; between the third and fifth years, it was 17.8 per cent.; between the fifth and tenth years, it was 9.9 per cent.; while between the tenth and fifteenth years it had fallen to 2.4 per cent.; and above fifteen years it was but 0.8 per cent.

It is generally stated that convulsions are more common in girls than boys. MM. Rilliet and Barthez found this to be the case in their private practice, whilst in the hospital, sympathetic and symptomatic convulsions were most frequent in boys. According to our experience, they have been almost equally frequent in the two sexes, since of 92 cases that we have seen in which the sex was recorded, 47 occurred in boys and 45 in girls.

It has been generally supposed that a delicate and nervous constitution is a powerful predisposing cause to convulsive attacks. This has been denied, however, by several recent writers, whose observation is very careful and accurate. We are disposed to believe that it is not so much a feeble or delicate constitution that predisposes to convulsions, as it is one characterized by a highly susceptible, irritable, and nervous temperament, which often exists, in our opinion, in connection with a healthy and vigorous physical organization. Of 96 children in whom we have seen convulsive attacks, and in whom this point was noted, these occurred more than once

in 13. Of the 13, nine presented every appearance of strong and vigorous health, with the exception that when laboring under any kind of sickness, as dentition, indigestion, the fever accompanying simple angina, in two the invasion of measles, and in one that of erysipelas, they immediately became extremely restless and irritable, or heavy and drowsy, and at a very early period, and sometimes with very little warning, were seized with convulsions. In one, a well-developed infant in its first year, the convulsions occurred every month or six weeks, without any appreciable cause. Three of the 13 were delicate: one was puny and feeble until after the completion of the first dentition, when it grew strong and hearty; one had had an apoplectic attack when an infant which had caused partial loss of power of one side; and the third was very weak at birth, then grew stronger, and died in its second year of hydrocephalus following scarlet fever. The number of convulsions varied in the different subjects. In 1 there were five different attacks, in another four, in 4 there were three, and in 5, two. In two the attacks were very numerous, recurring frequently, and from very slight causes, or without any appreciable cause. They all recovered but two, and are still living. Of the 11 now living at various ages, all but one are free from anything like epilepsy, and that one, though liable during three years to attacks of an epileptiform character, became gradually less and less subject to the seizures, and has now been for several years perfectly well in all respects.

We have another patient, a boy, whose case is not included amongst the above, now five years old, who has had ten different attacks of convulsions. These attacks were all produced by some disturbance of his health. Several of them have occurred at the outset of a febrile reaction caused by a simple catarrh of the upper air-passages,—the convulsions ushering in the catarrh just as they sometimes do an attack of measles or scarlet fever. On other occasions, the seizure has evidently been the result of a febrile movement caused by indigestion or gastric irritation. After having had nine different attacks, he remained free from them for a whole year, and then had the tenth at the very beginning of a catarrh of the larynx, fauces, and nasal passages. This child has never as yet exhibited any symptom whatever of disease, either acute or chronic, of the cerebro-spinal axis, and as the convulsions have always been connected with a febrile movement, there is every reason to hope that they are not epileptic. Another patient, likewise not included amongst the above, a girl now five years old, has also had frequent attacks, but as they are of short duration, always coincident with the fever of catarrh, or digestive disorder, and on one occasion that of measles, and as between the seizures her health is excellent, there is but little reason to fear epilepsy.

It is generally believed that the predisposition to convulsions is sometimes hereditary. We have remarked in regard to this point, that several children in the same family sometimes suffer from the disease, and that the nervous temperament to which we alluded above, appeared in some instances to have been inherited by the child from its parents.

In one family that we attend, out of six children, all but one have had attacks of convulsions: one of these children had but one attack, and that

was at the age of ten years, and was caused by a fit of indigestion occurring during convalescence from pneumonia. The other four children had each several attacks, occasioned always by the febrile movement resulting from some of the numerous disorders of infancy. In none of these has there been any reason to suppose that the attacks were settling into epilepsy.

Some very interesting evidence confirmatory of this view has recently been furnished by Dr. Robert P. Harris, of this city, in an article read before the Philadelphia Obstetrical Society (see *Amer. Jour. of Obstet.*, vol. ii, No. 2, August, 1869).

His record embraces 38 cases of eclampsia, 37 of which occurred in 13 families, in which, collectively, there were 55 children who lived long enough after birth to prove their liability or exemption; 4 having died too early to determine whether they were subject to convulsions or not.

All of the individuals included in the statistics were descendants of the first, second, or third generations, of two pairs of ancestors; of the present rising generation (the second) there are 31 members, only one of whom has as yet married; twenty of the 31 have had convulsions.

The *exciting causes* of convulsions are exceedingly numerous and dissimilar. Amongst the causes of essential convulsions are cited vivid moral emotions, violent pain, high temperature, exposure with the head uncovered to the sun, and sudden exposure to cold. In many cases, however, the exciting cause cannot be detected. The exciting causes of sympathetic convulsions may be almost any of the diseases incident to childhood. Amongst them we will cite as the most frequent, hooping-cough, pneumonia, catarrh, scarlatina, measles, violent fever from any cause, dentition, and indigestion.

It will be observed that many of the causes here assigned for convulsions are also regarded as inducing cerebral congestion, either of the active or passive form. It is accordingly held by some authors that the way in which such influences act is to cause congestion, and that the condition of cerebral congestion is the cause of the convulsions. In our article on congestion of the brain will be found a brief statement of the considerations which lead us to doubt the propriety, in many cases, of ascribing to that condition the convulsive and other nervous symptoms which occur so frequently in connection with the acute local or general diseases of childhood. In regard to some of the other causes above mentioned, however, there can be no doubt that they are likely to induce extreme cerebral congestion. We have seen that in both the active and passive forms of such congestion, convulsions are of frequent occurrence. It is proper then to say that congestion of the brain, of either form and however produced, is among the frequent causes of eclampsia in children.

Of 96 cases of convulsions, of which we have preserved notes, we have regarded only 4 as essential, while 70 were sympathetic, and 22 symptomatic. Of the 4 essential cases, we could not detect the exciting cause in any. Of the 70 sympathetic cases, it was scarlet fever in 12; pertussis in ; indigestion in 13; pneumonia in 3; the fever of simple angina in 6;

cholera infantum and bronchitis, each 3; dysentery, 4; measles and dentition, each 6; enteritis, the fever and irritation caused by a burn upon the back, and the onset of erysipelas, each 1; an overdose of castor oil (℥vj) given to a young child with a slight cholera, 1; and lastly, fecal accumulations in the large intestine, 1.

Symptoms.—*Prodromic Symptoms.*—It has been asserted by some writers that most attacks of convulsions in children are preceded by prodromic symptoms, which indicate to the experienced eye their approach. This does not agree exactly with our own experience, at least in regard to the essential and sympathetic forms, since of the cases of the former variety, well-marked prodromes did not occur in any, and of 64 cases of the latter, in which the early symptoms were noted, strongly-marked precursory phenomena occurred only in 8. We do not mean to say that there were no symptoms in the other 56 cases which might have indicated to an experienced eye the probability of an approaching attack of convulsions, but merely that there were none that were strikingly characteristic, none which pointed out clearly and decisively that such a crisis was close at hand. In many of the 56, there were symptoms that might be regarded as indicating, with various degrees of probability, the approach of the convulsive seizure; but, inasmuch as they were such as constantly exist in children not predisposed by temperament or constitution to eclampsia, without the development of the disease, they scarcely deserve to be called precursory symptoms.

The precursory symptoms of idiopathic and sympathetic convulsions are, therefore, difficult to describe because of their variable and uncertain character. They consist in general, however, of whatever indicates a highly disordered condition of the nervous system. The most marked symptoms are unusual drowsiness, excessive irritability, a peculiar physiognomical expression, general tremors, and the drawing of the thumbs into the palms of the hands, or rigid flexion of the toes. The drowsiness which precedes an attack of eclampsia, is almost always accompanied with some restlessness. The sleep is light and easily disturbed; the child moves and turns, or starts and moans; often it seems to have frightful dreams, and will scream out or wake suddenly bewildered and terrified, and when roused is generally exceedingly irritable, crying violently or fretting at the slightest contrariety, or without cause. The face, and particularly the eyes, often exhibit a peculiar expression, altogether different from their usual appearance. The expression which has most struck us, and which we have seen on several occasions, is a fixed and staring look, lasting but for an instant, as though the child were looking intently at some object, while in fact it is gazing at vacancy; at the same time the expression is entirely without meaning. The child seems, in fact, for a moment, to be in a state of ecstasy. In some instances a sardonic smile is seen to pass over the countenance just before the attack. The tremors or tremblings alluded to above, occur both in the sleeping and waking state, but particularly in the former. Flexion of the thumbs and toes has been noticed by different observers, but is, we believe, a sign

rather of the approach of symptomatic, than of essential or sympathetic convulsions.

The precursory symptoms of symptomatic convulsions will depend on the nature of the disease in the course of which they occur. Not unfrequently the convulsions occur at the very outset of the disease of the brain or spinal marrow, when of course there will be no prodromic symptoms whatever. According to Dr. Marshall Hall (*Diseases of the Nervous System*, p. 149), the first and most frequent sign showing that the excito-motory system is becoming complicated in diseases of the brain is vomiting, after which come strabismus, a contracted state of the muscles of the thumbs or fingers, or some unequivocal spasmodic or convulsive affection of the respiratory muscles, or of the muscles of the limbs.

Symptoms of the Attack.—With or without the precursory symptoms just described, the convulsion itself usually begins suddenly. The child often utters a cry; loses consciousness and is seized with powerful tonic contraction of the voluntary muscles; the eyes are for a moment fixed and staring, and then drawn obliquely upward under the upper lid, so that the white portions of the balls alone are visible for an instant between the partially open lids; the trunk is rigid and stiff, the thorax immovable, the respiration suspended by rigid spasm of the respiratory muscles; the face, for a moment pale, usually becomes livid and congested, and the veins of the neck are distended.

This state of tonic spasm is followed quickly by the stage of clonic spasm, in which involuntary and most irregular convulsive movements occur. The eyes are rarely fixed in one position, but are constantly agitated in various directions, from side to side, or upwards and downwards; very often there is the most violent strabismus; the eyelids are sometimes open, at others shut; the pupils may be contracted or dilated. The muscles of the face next enter into contraction, and occasion the most hideous contortions of the features. The mouth is distorted into various shapes, the lips are often covered with a whitish or sanguinolent froth, and the jaws tightly clinched together by tonic spasms, or agitated by convulsive movements, so as to produce grinding of the teeth. The trunk of the body is also sometimes variously contorted by clonic convulsions. The head is usually strongly retracted upon the trunk, but in other instances is drawn to one side, or violently rotated. The muscles about the front of the neck enter into action, and alternately elevate and depress the larynx; the tongue, when it can be seen, is observed to be moved in different directions, and is sometimes caught between the teeth and severely bitten. The extremities, particularly the superior, are more violently convulsed than any other parts. The fingers are drawn into the palms of the hands, the forearms are flexed and extended upon the arms by short, rapid, and generally rhythmical movements, the hand is quickly pronated and supinated upon the arm, or finally the whole upper extremity is twisted and distorted into various positions, which it is impossible to describe. The inferior extremities undergo similar movements, but almost always in a less degree than the upper. The respiration during the attack is irregular, sometimes suspended by rigid spasm of the respiratory muscles, and sometimes accel-

erated. A spasmodic contraction of the larynx, producing noisy inspirations, has been noticed by several writers. We shall find when we come to consider the nature of this disease, that Dr. Hall was of opinion that a more or less complete closure of the larynx is the most important feature of the convulsive crisis. The face is often livid and deeply congested, especially when the respiration is embarrassed; the head is hot, whilst the extremities are cold; the pulse becomes large and full, or frequent and small, and sometimes cannot be counted in consequence of the contractions of the muscles of the forearm. The face is not always however congested. We have sometimes seen it perfectly white, while the convulsions were severe, and the child profoundly insensible. The action of the heart is tumultuous, and sometimes irregular or intermittent. When the attack is very violent, the urine and fæces are occasionally discharged involuntarily, but these are rare symptoms. Deglutition is seldom impossible even in the severest fit. In severe, and especially in long-continued attacks, intellectual consciousness, and general and special sensibility, are all abolished. In milder cases, though consciousness is destroyed, some of the special senses still respond to irritants, whilst in still slighter cases, the intelligence also is more or less preserved.

As the termination of the attack approaches, the convulsive movements become more and more feeble, until they finally cease entirely, and the child falls into a state of deep sleep, or of more or less profound stupor.

Convulsions are not always, as we have just described them, general. They may be circumscribed or partial, affecting one side of the body more than the other, or one side alone, or a single arm, or in some cases, indeed, only a single muscle, as the biceps. Sometimes they implicate the eyes only. The inferior extremities are rarely affected alone. Of the partial convulsions the most frequent are those in which some parts of the face and upper extremities are attacked. In this form of the disease, the disorders of the circulation and respiration, the congested tint of the face, the froth upon the lips, and the derangements of intelligence and sensibility, are much less strongly marked than in general attacks.

In still other cases, which have been by various authors grouped together under the objectionable title of "inward convulsions," the spasm affects chiefly the muscles of respiration; at times being limited to the muscles of the larynx, and constituting the affection we shall describe in a special article under the name of laryngismus stridulus; at others affecting principally the diaphragm and the thoracic and abdominal muscles of respiration.

The *duration* of an attack of eclampsia concerns both the length of the convulsive crisis and the continuance of the disposition to renewals of the crisis. Both of these are very uncertain. We have known the attack to last in all its violence eight hours and a half in one case, and twelve in another, and it is said to have lasted much longer in some instances. When the spasmodic movements continue during a long period, they are almost always interrupted by remissions. As a general rule, the duration is much shorter than the periods above mentioned,—from a few minutes to half an hour. When the attacks cease and recur, as they often do,

several times a day, they leave the patient during the intervals in a state of more or less perfect consciousness or somnolence, restlessness or delirium, or finally of coma. The period during which the disposition to recurrence continues, depends principally upon the cause of the convulsions. If this continue in action, they will be apt to return until it is removed.

Idiopathic and sympathetic convulsions generally consist of a single attack, though there are sometimes several, which occur at intervals of some hours, or of one or two days. Sympathetic convulsions usually occur either at the beginning or termination of the disease which they complicate, and much less frequently during its middle period. Of 46 cases of this form observed by ourselves, complicating measles, scarlet fever, erysipelas, pneumonia, bronchitis, cholera infantum, simple angina, and dysentery, in which the period was carefully ascertained, they occurred at the invasion alone in 25, at the termination alone in 15, at the middle period alone in 3, and at the invasion and termination both in 3. It is curious to remark, that of the 25 cases that occurred only at the invasion of the disease, all but 7 recovered; that the 3 occurring in the middle period alone, also recovered; that of the 3 occurring both at the invasion and termination, 2 died; and that all of those which occurred at the termination alone, proved fatal.

MM. Rilliet and Barthez state that half the cases of symptomatic convulsions observed by them, occurred at the commencement of the encephalic disease. This form seldom consists of a single crisis; the attacks, on the contrary, are repeated from time to time. The authors just quoted state that whenever the convulsive attacks have recurred repeatedly within a period of a few days, they have proved symptomatic of disease of the brain.

Nature of the Disease.—One of the most important contributions which has been made towards a plausible and satisfactory explanation of the pathology of convulsions in children, was afforded us in the writings of Dr. Marshall Hall; and, although more advanced knowledge of the physiology of the nervous system has shown that the part of the cerebro-spinal axis involved in the production of convulsions is not limited, as he supposed, to the *true spinal system*, his theory of excito-motor action furnishes the most ready explanation of very many cases of eclampsia. Dr. Hall says (*Diseases and Derangements of the Nervous System*, p. 145): 'That the whole *class* of convulsive diseases consists of affections of the true spinal system, there is no longer any doubt. But these diseases do not all *originate* in this system." All convulsive disorders are, according to this doctrine, affections of the true spinal or excito-motory system. The causes of these disorders may be of incident origin, acting upon excitor nerves; of centric origin, seated in the brain or spinal marrow; or of reflex origin, acting upon reflex or motor nerves. They are called, therefore, according to their causes, central or centric, when they depend on disease of the nervous centres; centripetal when they are excited through excitor nerves; and centrifugal when they depend on disease of the motor nerves.

Dr. Hall, as is well-known, ascribed great importance to the condition

of the glottis in convulsions. He says (p. 323), in speaking of epilepsy, "The second symptom is a forcible closure of the *larynx* and *expiratory efforts*, which suffuse the countenance and probably congest the brain with venous blood." At page 327, he says: "A spasmodic affection of the larynx has obviously much to do in this disease (epilepsy), as well as in the crowing inspiration or croup-like convulsion of infants; so much, indeed, that I doubt whether *convulsion* would occur without closure of this organ." In describing the croup-like convulsion or laryngismus stridulus (p. 180), he says: "I must repeat the observation that the respiration is actually arrested by the closure of the larynx; and there are forcible expiratory efforts only or principally in the actual convulsion." In a later publication, Dr. Hall says: "Without closure of the larynx, extreme laryngismus, and the consequent congestion of the nervous centres, there could, I believe, be no convulsion! This closure of the larynx must be complete in the affection under consideration (laryngismus stridulus), as in all others, before convulsions *can* take place." (*Braith. Ret.* from *Lancet*, June 12th, 1847, p. 609.)

It is, however, evident that the obstruction to respiration exists not only in the larynx, but in the thorax, the muscles of which are rigidly contracted. Nor can we at present admit that this spasm of the muscles of respiration is more than coincident with the other phenomena of the convulsive attack: and, indeed, there are reasons for believing that the accumulation of venous blood in the nervous centres which follows the obstruction of respiration, so far from causing the convulsion, has a tendency to arrest it, and to induce a state of coma.

It is, however, easy to comprehend the mode of production of sympathetic convulsions by reference to these doctrines. They evidently depend upon morbid impressions conveyed to the cerebro-spinal axis through the excitor nerves having their origin in the diseased organs, probably conjoined with a state of undue reflex excitability of certain parts of the nervous centres. Thus it is easy to understand why inflammation of the parenchyma of the lung in pneumonia, of the bronchial mucous membrane in bronchitis, of the mucous membrane of the bowel in entero-colitis or dysentery, or the pharynx in angina; why the pressure of a tooth upon an inflamed gum during dentition, the presence of a foreign body, as newspaper (in one of our own cases), or crude food, in the stomach, or fecal, or lienteric accumulations in the intestine, should produce a degree of irritation in excitor nerves, sufficient, when transmitted to the sensori-motor ganglia, to occasion the convulsions we have been considering.

It is more difficult to explain the mode in which continued fevers, measles, scarlatina, etc., give rise to convulsions. To us, however, their occurrence is explicable by the morbid effect produced upon the nervous centres by the blood, which is known to be more or less changed in these affections from its healthful condition, and also by the mere fact of the existence of fever; for we have met with a number of children in our own practice, who are almost certain to have a convulsive seizure, whenever the circulation becomes greatly excited in force and frequency by the existence of fever, no matter what be its cause.

The explanation of the production of idiopathic or essential convulsions is not always so easy, because we are sometimes unable to detect any cause, either centric, centripetal, or centrifugal, to account for the excitation of the nervous system. It seems probable, however, that they must depend, like those of the sympathetic form, upon some unhealthful, and therefore irritating condition, acting upon the excito-motory system of nerves. The cause may be so slight as to escape the notice of the physician, and yet sufficient to produce a convulsive crisis in a child predisposed to eclampsia. It may be an unnoticed dentition, some undigested food in contact with the stomach or intestines, or accumulations of unhealthy fecal substances, or of vitiated secretions, in the intestines. When convulsions have followed a vivid mental emotion, as passion or vexation, they are evidently a result of the influence of that condition upon the nervous centres. Acute pain, which is said to have occasioned essential eclampsia, as well as exposure to violent heat or severe cold, must produce their effects through their action upon incident excitor nerves. There is also in all probability, in most children who suffer with convulsion, a state of preternatural mobility and increased reflex excitability of certain parts of the cerebro-spinal axis, which predisposes to disorderly nervous action, even upon trifling causes. There can be no doubt that this irritability of the nervous system is frequently inherited, though it may be acquired in the course of chronic debilitating diseases. Although we have described these convulsions under the title of essential and sympathetic, we do not mean to assert that they are absolutely independent of any material changes in the nervous centres, but merely that, up to the present time, no appreciable lesions have been detected as their causes. It is indeed true that, in a certain number of instances, after death from eclampsia, there are found engorgement of the vessels of the membranes and of the substance of the brain, serous effusion into the cavity of the arachnoid or the lateral ventricles, or even actual cerebral hæmorrhage. In a certain proportion of cases, undoubtedly, cerebral congestion acts as the direct cause of eclampsia, as we have stated in our article on the former subject. But in the majority of cases, the lesions above mentioned cannot be considered as the *causes* of the convulsive attack, but on the other hand must be regarded as the direct *result* of the convulsion, and due to the intense vascular engorgement caused by the spasm of the respiratory muscles and the consequent arrest of the venous circulation. And indeed it is the danger of the occurrence of such lesions which imparts much of the gravity to the prognosis in all severe attacks of eclampsia in young children.

All symptomatic convulsions belong, of course, to the class of centric diseases. These need no further remarks.

Diagnosis.—There are two important points to be considered in treating of the diagnosis of eclampsia: the diseases with which it may be confounded, and the causes which may have produced the convulsions, or, in other words, their distinction into essential, sympathetic, and symptomatic.

The only disease with which eclampsia is likely to be confounded, is epilepsy; the mistake could only be made when the former is violent, and when it is accompanied and followed by unconsciousness. In epilepsy,

however, the invasion is more sudden, the convulsions are accompanied with greater rigidity, there is always frothing at the mouth, the duration of the crisis is shorter, and it is generally followed by more marked stupor. If the convulsive attack have occurred under the influence of an appreciable cause, if the parents are not epileptic, and if the child is very impressionable, it is probably eclampsia. Again, the younger the patient, the more likely is the case to be one of eclampsia; whilst if the child is approaching towards puberty, if the attacks are frequently repeated, and yet not dependent on fever, and if they are followed by complete restoration to health in the interval, the disease is much more likely to be epilepsy.

The diagnosis of the form of the attack, whether idiopathic, sympathetic, or symptomatic, is exceedingly important, as upon this must depend in great measure the prognosis and treatment. It is often very difficult, and sometimes impossible, to determine at the moment to which class the convulsions belong. The most difficult points in the diagnosis are the following: first, when a child previously in good health, is suddenly seized with the disease, to determine whether it is essential; whether it is sympathetic and occasioned by disease which, up to this instant, has been latent, or by the invasion of some one of the acute local diseases, or of one of the continued fevers; or lastly, whether it is symptomatic, marking the invasion of a disease of the cerebro-spinal axis: second, when the convulsion occurs in the course of a disease not primarily implicating the nervous centres, to determine whether it is merely sympathetic of that disease, or whether it is symptomatic of an intercurrent affection of the brain or spinal marrow.

It is impossible for want of space, to treat of all these points in detail. The enumeration of them, however, will be useful in calling the attention of the reader to their importance.

An essential convulsion is only to be distinguished by careful study of the antecedent history and present condition of the patient. If, after a thorough examination of all the organs, no diseased point can be detected, and if the child recover perfectly from the convulsion, we must conclude that the case has been an idiopathic one, in which the cause is beyond our reach. We are disposed to believe, however, as has already been stated, that in most such cases there has been a source of irritation in some of the organs of the body, which has acted as the excitant to the excito-motory system, and which, if we could but detect it, would warrant us in classing the case amongst sympathetic convulsions; and on this account a searching physical examination should be made in every case, as a matter of course.

The sympathetic and symptomatic forms of eclampsia are to be diagnosticated by the same careful attention to the antecedent history and present condition of the child. If the latter is teething at the time of the fit, and there is no other cause to explain the attack, and should there be nothing in the consecutive symptoms to render such an explanation inadmissible, we may refer it to that condition. We may remark merely, that, as a general rule, eclampsia depending entirely upon the irritation of dentition, is seldom either violent or long-continued, and that the return to

consciousness and health is speedy. The probable dependence of the attack upon indigestion is to be ascertained by the absence of other causes, and by our learning upon inquiry that the child had eaten of some indigestible substance within a few hours or a day or two before the attack. Its dependence on intestinal accumulations is to be arrived at by the same negative or exclusive method, and by learning that the patient is usually, or has been of late, of a constipated habit.

When the attack occurs in the course of some other disease, as pneumonia, catarrh, enteritis, pertussis, scarlatina, or measles, it is almost certainly sympathetic. It may possibly, however, be indicative of an intercurrent attack of cerebral disease. This can be determined only by attention to the consecutive phenomena. If the attack be short, and soon followed by complete restoration to consciousness, it is in all probability sympathetic. If, on the contrary, the convulsive crisis be long and severe, if the recovery from it be slow and imperfect, if it be followed by violent agitation, somnolence, or coma, or by some persistent lesion of motility, there is every reason to fear an attack of disease of the brain.

Sympathetic convulsions, occurring at the invasion of different local or general diseases, are to be distinguished only by observation of the symptoms that follow the crisis, which will be those belonging to the particular malady whose approach has caused the attack of eclampsia.

Symptomatic eclampsia is characterized by various signs of encephalic disorder, which soon follow the convulsive attack. The most important of these are severe and continued headache; diminution or exaltation of general or special sensibility; dilatation or contraction of the pupils; irregular movements of the eyes; flexion or stiffness of some of the limbs, or of the fingers or thumbs; disordered intelligence; or the symptoms which have already been described in the articles upon the diseases of the brain.

Prognosis.—The prognosis of essential convulsions must depend on the nature of the cause and the violence of the attack. When the cause has been slight, or one which soon ceases to act, or can be readily removed, the prognosis is much more favorable than under opposite conditions. If the convulsive crisis is short and of moderate severity, if the pulse and respiration are but slightly disturbed, if there be but little congestion of the face, and no stertor, there is every reason to hope a successful issue in the case. Of the three cases of this class that we have seen, two recovered and one died.

Sympathetic is more dangerous than essential eclampsia, but much less so than symptomatic. The prognosis will depend chiefly on the nature of the disease which it complicates, and on the stage of that disease at which it occurs. Thus, in scarlatina, convulsions, especially when they occur in the first few days of the disease, are almost always fatal, in measles much less so, and in other diseases in various proportions. They are very apt to terminate unfavorably when they occur after the malady which they complicate has been in progress for several days. This is a remark made by various authors, and we have already stated that of 46 cases of this form in which we carefully ascertained the period of their occurrence, 25 appeared at the invasion, of which all but 7 ended favorably; 3 at the

middle period, which all recovered; 3 both at the invasion and at a later period, 2 of which were fatal; and 15 after the cases had been progressing for a considerable time, all of which proved fatal. In addition to these important elements for making the prognosis, we must consider, also, the duration and degree of violence of the paroxysm, the state of the patient after the fit as to its cerebro-spinal functions, and lastly the age and constitution of the child.

The prognosis of symptomatic convulsions must depend very much upon that of the disease of which they are the symptom. It may be stated, as a general rule, that, like those of the sympathetic class, they are less dangerous when they occur at the beginning than at a later period of the disease. They are always, however, very dangerous. Of 22 cases that we have seen, 19 were fatal.

It frequently happens, however, that although life is not destroyed by the convulsions, certain grave sequelæ remain, among which the most frequent are paralysis, disorders of the mind, and defects of speech or vision. These symptoms are, it is true, far most frequent in cases of symptomatic convulsions, where they depend upon the same lesion of the brain which occasioned the fit. They may, however, succeed convulsions which we are still obliged to call essential, although there very possibly is some minute alteration or defect in a part of the nervous centres, which our means of observation do not suffice to detect. In such cases these sequelæ probably depend upon some lesion of the brain, such as cerebral hæmorrhage, which has occurred as a result of the convulsion.

Hemiplegia, which is the form of paralysis which most frequently follows eclampsia, is most apt to occur when the fit has been limited to one side of the body; it is often temporary, and passes away in a few days, though it may remain persistently. Dr. J. Hughlings Jackson suggests that, in the absence of evident disease in such cases of unilateral convulsion and palsy in children, the symptoms may depend upon the plugging of very small vessels in the brain.

Treatment.—We shall confine our remarks upon the treatment of eclampsia to the essential and sympathetic forms of the disease, having already treated of that of the symptomatic form in the articles upon the cerebral diseases which give rise to it.

We think that the treatment of eclampsia in children may be simplified if we pay attention to two distinct conditions of disorder, which appear to exist in every case. These are the condition of morbid irritation or derangement of the excito-motory system of nerves, and the cause which occasions that derangement. The condition of irritation or disease of the cerebro-spinal axis exists in all cases, and is always the same, differing only in degree and extent; whilst the morbid cause of that irritation differs in each case, being in one dentition, in another pain, in another constipation, in others pneumonia or indigestion, pleurisy, catarrh, or angina, scarlet fever, measles, fright, or other violent emotions. If this view of the subject be correct, it is clear that in treating a case of convulsions we have to attend to the two morbid conditions referred to, and we shall be careful, therefore, in the course of our remarks, to treat of the remedies most

proper for the removal of the cause, whatever it may be, which acts as the irritant to the nervous centres; and of those calculated to subdue or allay the deranged condition of those centres and the effects of that derangement.

There are some general rules to be followed in the treatment of convulsions which apply to all cases, and of these we shall first speak. They are, to place the child in a large *well-ventilated* room, if such can be procured; if it have been seized in a little close room, where the atmosphere is dense and impure, removal to another room, or exposure to fresh air before an open window, has sometimes sufficed to terminate the crisis. At the same time the clothes of the child should be loosened, in order to prevent all constriction, and, if necessary, taken off, to allow of a careful examination of the whole body. We believe it is a good rule always to place the child, no matter what be the cause of the convulsion, if it be a severe one, in a *warm-bath* (96° or 97° F.). This has frequently proved an efficient remedy, according to our experience. It is easily procured in most cases, and we are quite confident that we have never known it to do harm, though we have used it in almost every case. The patient should be kept in the bath some ten, fifteen, or twenty minutes, or until the convulsive movements cease; when taken out it is most convenient, and at the same time useful, to envelop it in a small, light blanket, or flannel, for a short time, before the clothes are readjusted.

In cases where the attack of eclampsia is limited to a single convulsive seizure, we rarely have an opportunity of instituting any treatment for the paroxysm itself, since it is usually over before we reach the patient. In such instances, bloodletting is unnecessary. If, however, the opportunity offers, and if the convulsion occur in a strong and vigorous subject; if it be violent, and accompanied by a deep red, or yet more by a livid flush of the face, and distension of the veins of the head and neck; if it last more than a few minutes, or is repeated after short intervals of quiet, we would, without hesitation, recommend the use of *bloodletting*. The detraction of blood is called for, in our opinion, for the same reasons as in puerperal convulsions, and indeed in every violent convulsive attack, — to save the nervous centres from the effects of the paroxysm, which are, in all severe cases, excessive congestion, and, in some, fatal effusions. There are, however, many cases, in which we would not advise depletion; as, for instance, those in which the convulsion depends upon an anæmic condition, and in which it is contraindicated by a naturally feeble, or by a debilitated state of the constitution; those in which it is clearly unnecessary, from the slight severity or short duration of the attack; or those which occur in the course of other diseases, and particularly at their termination, and in which a resort to it is rendered evidently improper by the circumstances of the concomitant affection. The quantity of blood to be taken, and the method, must depend on the circumstances of the case. We must be guided as to the quantity by the age and constitution of the patient, the violence and duration of the paroxysm, and the cause of the attack. In a strong, hearty child, two or three years of age, in whom the attack is violent, and produced by some cause not likely to continue long

in action and thereby exhaust the strength, we may take from two to four ounces at the first bleeding; and should this fail to exert an influence upon the paroxysm, a rather smaller quantity may be taken in one or two hours afterwards. In younger children, and those who are somewhat feeble or delicate, the amount drawn ought to be less. Usually speaking, venesection is to be preferred; but when a general bleeding cannot, from any cause, be employed, we may resort to cups and leeches to the temples or back of the neck, or, as advised by some of the French writers, to more distant parts.

We believe it is useful in all cases of essential and sympathetic convulsions, which resist the employment of a warm bath and bleeding, and also when bleeding is not resorted to, to make use of an *emetic* of some kind. The act of vomiting alone is often sufficient to break up a paroxysm of convulsions which has resisted various other means. This we learned first from the advice of an old and experienced practitioner, who was in the habit of employing emetics in all cases of eclampsia of children, and we have since seen it tested on numerous occasions. Dr. Hall recommends the induction of vomiting in the treatment of the paroxysm of the croup-like convulsion or laryngismus stridulus, and as a means of prevention in epilepsy. In the former he employs irritation of the fauces by tickling with a feather; in the latter, ipecacuanha. He says that a new mode of action is induced in the true spinal system by the act of vomiting, so that the disposition to closure of the larynx, and expiratory efforts, is exchanged for sudden acts of inspiration. The emetic which we employ is ipecacuanha. The employment of emetics is generally advisable, even when there is no evidence that the attack is due to the presence of undigested or irritating substances in the stomach, since in cases of sudden eclampsia the cause is so frequently some gastric irritation. Of course, when there is special reason to suspect the presence of such a condition, the indication for the administration of an emetic is even more positive.

In addition to warm baths, bleeding, and emetics, *cold applications* to the head will be found proper and useful in nearly all cases which are of any considerable violence. Their use would be improper, however, when the surface is pale, the features contracted, and the pulse small and feeble; but whenever the skin, especially that of the head, is deeply colored and turgid, and the pulse full and strong, they ought to be employed from the beginning. While the child is in the bath, its head may be wrapped in a cloth wet with ice-water; or, after it has been removed, cold water may be poured from pitchers or a tea kettle upon the same part. If the latter is done, enough should be employed to prevent the sudden reaction which inevitably takes place when but a small quantity is used. During the after-treatment of the case, the cold applications ought to be continued so long as the head remains unnaturally heated.

The administration of a *purgative* dose is proper and useful in most cases of convulsions; particularly when it is found upon inquiry that the child has been constipated prior to the attack; when it is suspected that the bowels may contain crude food or some foreign body; when it is desirable to produce an evacuant effect in a strong plethoric child, or a

derivative action from the brain, and when the attack is attended with violent determination of blood towards that organ. The best purgative in severe cases occurring in hearty children is *calomel*. It is advantageous because of its easy administration, its speedy operation, and the powerful sedative influence which it exerts upon the whole economy. The dose should be from three to six grains, according to the age. It ought to be followed in one or two hours by some other cathartic, which may be either castor oil, rhubarb, jalap, or salts. The best of all is castor oil if it can be given. When the attack is slight or the patient weak and delicate, castor oil is particularly applicable, as it operates with so little irritation to the intestine, or we may employ a mixture of castor oil and spiced syrup of rhubarb. Whatever the remedy may be, it should be given only in such quantity as to produce complete evacuation of the bowels and a moderate derivation upon those organs, without the risk of occasioning a degree of irritation sufficient to increase the disturbance of the nervous system already existing.

In many, indeed, in most cases of eclampsia it will be found that purgative *enemata* are of great service. They may be administered immediately before or after the bath, and not unfrequently have the effect of stopping the paroxysm. They may consist of water holding in suspension or solution castile soap, common salt, molasses, castor oil, sweet oil, or spirit of turpentine. If the first fails to operate in ten or fifteen minutes, another or even a third ought to be given.

Revulsives are of the utmost importance in the treatment of convulsions. They should be employed from the very first, or immediately after the use of the bath. In slight attacks, they alone are often sufficient to suspend the paroxysm, or at least the fit often ceases under their use. Mustard is the most useful and convenient form of application in the great majority of cases. It may be used either in the form of sinapisms, which are to be shifted from place to place, or in that of the foot-bath. When sinapisms are used, they should always be covered with gauze or fine muslin, to avoid the danger of leaving any of the mustard upon the skin after they are taken off. We once saw very bad ulcerations upon the feet of a child from the neglect of this precaution. In the hurry and bustle of the moment, the feet were not washed when the plasters were removed, and the mustard that remained produced vesications which ulcerated. In obstinate attacks, the revulsives ought to be reapplied from time to time, taking care to shift their position in order to avoid vesication.

Antispasmodics are very valuable remedies in eclampsia, but as they are somewhat slow in acting, we should first resort to the means already detailed. We should then give full doses of one of the antispasmodics recommended below, and should continue its use so long as may be thought desirable after the attack has passed over. They should also be used as a means of prevention in children threatened with eclampsia.

The bromides of potassium and of sodium are the most powerful and reliable remedies of this class in the treatment of almost all forms of convulsion in children. They may be given in the dose of three to five

grains, three or four times a day, from the age of six months to one year, with an additional grain for every year.

Next to the bromides, the ones most highly recommended are valerian, oxide of zinc, assafœtida, and camphor. Of these, valerian or assafœtida are the ones we have usually employed. Valerian is best given in the form of the fluid extract, of which from ten to twenty drops may be administered in water, to a child two years old, every half hour or hour, until several doses have been exhibited, after which it ought to be suspended for awhile or given in smaller quantity. Assafœtida is best given in the form of emulsion, half a teaspoonful being administered by the mouth, or one or two teaspoonfuls mixed with a little warm water may be thrown from time to time into the rectum. M. Brachet (*Traité Prat. des Convulsions dans l'Enfance*, 2ème éd., pp. 102–3) highly recommends the oxide of zinc in combination with extract of hyoscyamus, to the amount of at least two grains of the former and four of the latter in twenty-four hours, divided into four, eight, or twelve doses. A dose was given every two or three hours, and when the symptoms were very violent, the first two or three were repeated at much shorter intervals.

Opium is a remedy which requires much care and discrimination in its employment, but which, in certain conditions of the disease, is of the greatest service. It should not generally be given while there remains any evidences of considerable determination of blood to the brain, but when this condition does not exist, or after it has been removed by bloodletting and revulsives, opium proves very useful in allaying irritability and restlessness, which themselves seem to keep up a disposition to a return or continuance of the convulsive phenomena. Somnolence also, and still more, coma, likewise contraindicate the use of opium. Dr. Eberle thinks he has seen much advantage from frictions over the spinal region with a mixture of equal parts of oil of amber, laudanum, and spirit of camphor, particularly in very young infants.

Chloroform has been highly recommended in the essential convulsions of children, by Sir J. Y. Simpson (*Edin. Med. Jour.*, June, 1858), and is favorably spoken of by both West and Trousseau. It should be used when the fits are violent and recur frequently, and do not yield to any of the remedies previously mentioned. By careful administration, anæsthesia may be prolonged for many hours, though, as Simpson recommends, it should be allowed to partially pass off every two or three hours for the purpose of feeding the child. It has been employed in numerous cases with the effect of arresting the convulsions, and in no instance has any unfavorable result been observed to follow its use.

Ice.—In a case of severe convulsions in a new-born infant recorded by Dr. Ellwood Wilson (*Phila. Med. Times*, Nov. 1, 1873, p. 65), the introduction of a small conical piece of ice into the rectum immediately arrested the paroxysm each time.

We shall here conclude our remarks upon the general treatment of eclampsia, and proceed to make some observations on the conduct to be pursued under particular circumstances.

It is always highly important for the direction of the treatment, to dis-

cover the cause of the attack. This is sometimes very easy, while in other instances it is exceedingly difficult, and not unfrequently impossible. If the attack occur in the course of some acute disease, as pneumonia, catarrh, angina, enteritis, or dysentery, or during the progress of one of the eruptive diseases, the diagnosis of the case is, as a general rule, very easy. If, on the contrary, it occurs at the commencement of one of these affections, the diagnosis will be much more difficult, unless indeed the symptoms of the concomitant disease have already declared themselves, or should do so very soon after the convulsion. The treatment in such cases should be that laid down in our general remarks, modified, however, by the requirements of the particular disease during the course of which the eclampsia occurs.

When the attack occurs suddenly in a child previously in good health, or who had been merely slightly ailing for a few hours, the detection of the cause is still more difficult. The most probable causes under such circumstances are, however, dentition, indigestion, intestinal disorder, or the approach of an acute general or local disease. It is easy to determine by inquiry of the attendants, and by examination of the mouth, whether the child is teething or not. As a general rule, the convulsions which depend solely on the process of dentition, are slight, and last but a short time. In all the instances that we have seen, in which such was the only cause to be detected, the attack was of this nature. The treatment in such instances is to lance the gums, if they are swelled and inflamed over the advancing teeth; to use warm baths, and to administer purgative and then antispasmodic enemata. These simple means will seldom fail when eclampsia depends on the process of dentition alone. But when, on the contrary, there is present indigestion, intestinal accumulations, or enteritis, as often happens during dentition, the case becomes more serious, and requires in addition to the treatment above described, one directed to the particular coexisting morbid condition.

The existence of indigestion as the cause of the attack, can be discovered only by ascertaining with great care the diet of the child during the previous days. If it appear that something of an indigestible nature has been eaten within a short time, and if, at the same time, it be impossible to detect any more evident or probable cause for the attack, we should have a right to conclude that it depends upon indigestion. Under these circumstances the proper treatment is the immediate use of the warm bath, and the earliest possible administration of an emetic of ipecacuanha. The operation of the emetic may often be hastened by tickling the fauces with a quill.

The presence of intestinal accumulations as the cause of the paroxysms may be inferred, when it is found upon inquiry that the patient has been constipated for some days, or that the stools have been scanty and hard, or scanty and very offensive; when the abdomen is distended and hard, and the distension is ascertained by palpation and percussion, not to be merely tympany; and, lastly, when there is no more evident cause for the attack. In such a case the particular treatment is the use of purgatives and enemata, in addition to the other means detailed.

If the child presents the symptoms of dyspepsia and malnutrition, asso-

ciated with anæmia, and the convulsions recur during a long period, the most scrupulous care must be taken to secure a nutritious digestible diet, combined with the use of tonics and iron.

The dependency of the attack on the approach or commencement of some acute general or local disease, can be inferred only from a very careful examination of the antecedent and present phenomena of the case. One of these may be suspected as the cause when we can account for the occurrence of the convulsion on no more reasonable supposition; when neither dentition, indigestion, nor intestinal irritation exist. It is scarcely likely that a convulsion could be occasioned by any of the acute thoracic or abdominal affections, unless the disease had already gone far enough to allow a careful examination of the different rational and physical symptoms, to determine its existence. Perhaps the most difficult cases to diagnosticate, are those which occur at the beginning of the eruptive fevers. Even here, however, a careful search for the prodromic symptoms of the disease, a watchful observance of the condition of the patient in and after the paroxysm, will generally lead to a correct opinion within a few hours, or after a day, and sometimes at the moment of the attack. Of the eruptive diseases, scarlet fever is much the most apt to be accompanied by convulsions at the onset, and in that disease the remarkable rapidity and activity of the pulse, the state of the fauces, the heat of skin, and early appearance of the eruption, will generally enable us to understand the cause of the convulsion at a very early period.

The treatment of sympathetic eclampsia depending on acute thoracic or abdominal disease, should be that which is proper for the particular malady which they complicate, with the addition of warm baths, revulsives, antispasmodics, and, after depletion, of opium, in the form of Dover's powder combined with nitre. The management of the convulsions which complicate the eruptive fevers, will be specially treated of in the articles on those maladies.

ARTICLE VII.

LARYNGISMUS STRIDULUS.

Definition; Synonyms; Frequency.—Laryngismus stridulus belongs to the class of neuroses. It is characterized by crowing inspirations, or by momentary suspensions of the act of respiration; these attacks occur suddenly, and at irregular intervals, are of short duration, cease suddenly, and are unaccompanied by cough, or other signs of irritation of the larynx. If the disease progress, it becomes associated with other convulsive symptoms, as strabismus, distortion of the face, carpopedal spasms, or general convulsions.

It is "the peculiar species of convulsion" of Dr. John Clarke; the inward fits of Underwood; the spasm of the glottis of Marsh, West, and

Vogel; the laryngismus stridulus of Good; the croup-like convulsion of Dr. Marshall Hall; child-crowing; the spasme de la glotte of some of the French writers; one form of the internal convulsion of MM. Trousseau and Pidoux, of MM. Rilliet and Barthez, and of J. L. Smith; and the thymic asthma of some of the German authors. It is described by Eberle under the title of carpopedal spasms.

The frequency of the disease seems to vary in different countries. In France it would appear to be somewhat rare. MM. Rilliet and Barthez (2ème édit.) speak of having seen nine cases. At the time of publication of their first edition, they had met with only one case, and then stated that they were acquainted with only one other, published by M. Constant in the *Bulletin de Thérapeutique*. M. Blache (article Névrose du Larynx, *Dict. de Méd.*, t. xvii, p. 590) adverts very cursorily to one case. M. Valleix (*Guide du Méd. Prat.*, art. Asthme Thymique) doubts its existence as a distinct disease. In Germany, on the contrary, it would seem to be a rather frequent disease. In England it cannot be very infrequent, since Merriman says it is by no means uncommon. Copland (*Stridulous Laryngic Suffocation in Children, Dict. of Prac. Med.*) speaks of numerous cases that he has seen, and states that he has had as many as three under treatment at the same time. Ley speaks of having met with considerably above twenty cases. Dr. Marshall Hall remarks that "within the short space of one month, I have seen five cases of croup-like convulsion." Dr. Charles West (4th edit., p. 162) mentions thirty-seven cases of which he has preserved some record. The statements of more recent English writers indicate that it continues to be of quite frequent occurrence.

We do not think it is a common disease in Philadelphia, though it is certainly not extremely rare, since we have either seen ourselves or heard of the occurrence of a comparatively large number of cases.

Predisposing Causes.—*Age.*—It is generally acknowledged that the disease occurs most frequently during the period of the first dentition, though it has been known to occur as late as six or seven years of age. Of 30 cases selected indifferently from our practice and from authors in which the age is given, 13 were six months or less of age, 11 between six months and one year, 4 between one and two years of age, 1 of two, and 1 of four years of age; so that of the 30, 24 were under one year. It is evident, therefore, so far as these cases go, that the majority occur within the first, and very few after the second year.

Of the 37 cases mentioned by Dr. West, 31 occurred in children between six months and two years of age. All the cases seen by MM. Rilliet and Barthez were in children under two years old. Those authors state that the seven subjects observed by M. Hérard were more than two years of age, and that two of them were between three and four years old. From the statements made by authors in general, it would seem to be most frequent between the ages of three weeks and eighteen months. It has been known, however, in one very rare instance, to occur as late as seven years of age.

Sex.—It is most frequent in the male sex. Of 50 cases (45 from authors, and 5 by ourselves), 39 occurred in boys, and 11 in girls. MM. Rilliet

and Barthez state that of 16 cases observed by themselves and by M. Hérard, 12 occurred in boys, and 4 in girls; of 183 cases collected by M. Lorent, in which the sex was noted, 125 occurred in boys, and 58 in girls.

Constitution.—It seems established that it sometimes occurs in the most healthy and vigorous subjects, being then probably dependent upon reflex nervous irritation. It is, however, far most frequently met with in children who are delicate and feeble, and especially in those of scrofulous or rickety constitutions. The very frequent association of rachitis with laryngismus has been more and more prominently developed during the past few years. Some high authorities, since the publication of Elsässer's researches, in 1843, have even asserted that this connection is a constant one, and that laryngismus is essentially dependent upon craniotabes or rachitic disease of the skull. There are certain cases in our own experience, and others which are reported by careful observers, which do not allow us at present to admit that this connection is an invariable one, but there can be no doubt that in the great majority of cases laryngismus occurs in rachitic children, and particularly in those who have craniotabes, or "soft spots" in the occiput. It not unfreqently attacks several children in a family. Ley quotes four instances from other writers, in which three children in each family had the disease, and in one all three died. He states that his own experience fully confirms this fact.

MM. Rilliet and Barthez (2ème édit., note, t. ii, p. 527) state that Davies and Henrich have met with four, and Torgord five children of the same family affected with the disease. They quote from Reid the curious fact that Powell saw one family of thirteen children, not one of which escaped the disease.

Amongst the causes of the disease, in addition to those already mentioned, must not be forgotten *dentition* and *improper food*. These two are, indeed, probably the most influential of all in the production of the complaint. The age at which it occurs most frequently, the last half of the first, and the first half of the second year, the very period during which the process of dentition is most active, would alone go far to show that this must constitute one of its most powerful predisposing, if not exciting, causes. The opinions of writers on this point are also conclusive as to the great influence of this vital process. Improper food, and especially early weaning, and the attempt to bring the child up by hand, is clearly a potent predisposing cause of the disease. This has been clearly shown in the cases that have come under our own observation, and especially in one in which contraction with rigidity followed the symptoms of laryngismus. The details of this case will be found appended to the article on contracture. Dr. James Reid, in an excellent work on the disease (see *Brit. and For. Med.-Chirurg. Rev.*, July, 1849, p. 163), gives the following conclusions as to its etiology: "1. That for the occurrence of this complaint, the cerebro-spinal system is required to be in a peculiarly excitable state, which then acts as a predisposing cause. The period of teething is the most likely to produce this condition. 2. That during this irritable state of the nervous centres, the two most frequent (and in the majority of instances the combined) causes are the improper description of food which is

administered to the infant, and the impure and irritating atmosphere which it breathes." It must not be forgotten that while in some cases these causes act in producing laryngismus by reflex irritation from the gums or mucous membrane of the alimentary canal upon a weak and over-sensitive nervous system; in other cases, the laryngismus is essentially connected with rickets, which has been induced by improper feeding.

Nature and Exciting Causes; Forms.—Much difference of opinion has prevailed in regard to the nature and exciting causes of laryngismus stridulus since the disease has attracted the particular notice of the profession. Kopp and other German authors ascribe it to compression of the respiratory organs by an enlarged thymus gland, while others of that nation, and some of the English and French writers, class it amongst the neuroses. Dr. Hugh Ley supposed it to depend on compression of the par vagum nerves by enlarged cervical and bronchial glands. Dr. Marshall Hall considers it to be a disease of the reflex system of nerves. Amongst the French writers, MM. Rilliet and Barthez regard it as a neurosis; Valleix and Trousseau treat of it as one form of convulsions in children; Blache (*Dict. de Méd.*, t. xvii, p. 584) speaks of it as a neurosis of the larynx, which may be either symptomatic or idiopathic. Many recent authors, as already stated, are disposed to regard it as dependent upon the irritation of the brain due to the existence of craniotabes.

Before examining in detail the different opinions quoted above, which we propose doing, we will refer to the anatomical appearances of the malady.

The mucous membrane of the air-passages, as a general rule, is found perfectly healthy, presenting neither redness, inflammatory swelling, œdema, nor accidental products of any kind. The lungs are usually of the natural color and density, and crepitant. M. Hérard (*Bib. du Méd. Prat.*, v, pp. 319, 320) observed that in several autopsies made by himself, they always presented one marked change from their natural condition, however, which was a very high degree of emphysema, more general and strongly marked than in any other disease. This alteration is believed to depend, as it does in hooping-cough, upon the impediment to respiration which exists during the disease. MM. Rilliet and Barthez state, however, that emphysema was not present in any of their autopsies.

The heart and great vessels of the thorax often, but not always, contained more blood than usual, as in asphyxia.

M. Hérard states that he has made very minute researches in regard to the condition of the nervous system, examining the brain and spinal marrow, the pneumogastric, recurrent, and diaphragmatic nerves, and those of the extremities even, to their terminations, without, however, finding important lesions in any case. He excepts only serous effusion in small quantity, and evidently consecutive, in the ventricles and particularly in the membranes of the brain, and slight venous congestion of the same kind. The tissues of the brain and spinal marrow retained their ordinary consistence, and presented neither redness nor softening.

The condition of the pneumogastric nerves has, however, been variously

reported by different authors, some having found them softened, others indurated.

In some cases tuberculosis of the lungs or bronchial glands has been observed. But as these, as well as all the other lesions mentioned, are not constant, they cannot be regarded as characteristic. In many instances more or less marked evidences of rickets are discovered upon the bones of the cranium, the ribs, or the long bones of the extremities.

We will now examine as succinctly as possible the different opinions which have been advocated in regard to the causes of laryngismus stridulus. These may be classed, it seems to us, under four heads. 1. Enlargement of the thymus gland. 2. Enlargement of the cervical and bronchial glands. 3. Organic disease of the cerebro-spinal axis. 4. That which regards it as a simple neurosis, without appreciable anatomical alterations.

1. *Enlargement of the Thymus Gland.*—That the disease is in some cases coincident with, if not dependent upon, this condition, is proved by the observations of Kopp, Hirsch, Haugsted, Kyll, and others. Hasse (*Pathol. Anat.*, Syden. Soc. Ed., p. 384) says there can be little doubt that it sometimes depends upon this cause.

It appears to us, however, that it has been clearly shown by M. Hérard (*loc. cit.*, pp. 320, 321), that the disease is entirely independent of any alteration of the thymus. That observer found that in six children between two and four years old, dying of the affection, the gland weighed between half a drachm and a drachm in five, and four drachms and two scruples in the sixth. These cases alone show that the size of the gland varies greatly in different subjects attacked with the disease. M. Hérard has examined the gland, with a view to the elucidation of this point, in sixty children dying with various diseases, between two and four years of age (the age of those who had died of the disease under consideration). In fifty he found that it presented the same arrangement, color, density, and weight, as in those who had perished with laryngismus stridulus.

All of these subjects exhibited the same aspect; they were pale, thin, and most of them exhausted by diarrhœa. In ten of the sixty the gland was much more voluminous, weighing from two to two and a half or five drachms, and in one instance an ounce and a quarter. The ten subjects upon which these observations were made, died of different diseases, croup, acute laryngitis, asthma, meningitis, and varioloid. All exhibited the appearances of strong and vigorous health; the one which presented the largest gland was very fat, and so robust, that, though only twenty-two months old, he looked to be three or four years. It appears to result therefore from these researches, that the gland is liable to great variations of size, and that its size bears a very exact proportion to the force of the child, being small in those who are slightly developed, or emaciated by chronic disease, and voluminous in those who are vigorously constituted, or who have died of acute diseases.

That the disease does not depend, at least in all cases, on this cause, is shown also by Haugsted (*Arch. de Méd.*, t. xxxiii, 1833, p. 111), who reports the case of a girl, seven years old, in whom the gland weighed five ounces, and measured four inches long, and one and a half in thickness,

without its occasioning the least difficulty of breathing of any kind. That it occurs in children in whom the gland is very small, is shown also by Caspari and Pagenstecher (quoted by Hasse, *loc. cit.*).

2. *Enlargement of the Cervical and Bronchial Glands.*—This condition as a cause of the disease, so strongly advocated by Dr. Ley, and adopted upon his authority by Kyll and Hasse, would seem from certain facts and arguments to be of doubtful agency.

Thus, Mr. Wakely (quoted by Kerr) states that "he possesses more than one case of tubercular affection in children, where the pneumogastric nerve has been completely flattened by the pressure of tubercles, without giving rise to any remarkable disturbance of the function of respiration." Dr. Hall doubts the correctness of this explanation of the phenomena of the disease, and says that if the contiguity of enlarged glands with the pneumogastric nerve have any effect, it is by their action upon it as an incident excitor, and not as a motor or muscular nerve.

3. *Organic Disease of the Cerebro-spinal Axis.*—That it may depend on this cause is proved by a case mentioned by Dr. Coley (*On Infants and Children*, Bell's edition, p. 226), who states that in a fatal instance which occurred in his own family, the only morbid appearance found on dissection was a large exostosis growing on the inner surface of the occiput, which compressed the cerebellum and produced chronic inflammation of the dura mater. No disease was discoverable either in the cervical or thoracic glands. Dr. Kyll (*Arch. Gén. de Méd.*, t. xiv, 1837, p. 94) quotes a case from Dr. Corrigan, of Dublin, which had lasted three months, in spite of calomel, emetics, and antispasmodics. Attention was called by chance to the spinal column, when it was discovered that pressure over the third and fourth cervical vertebræ was very painful, and produced loud cries from the child. Two applications of four leeches, at an interval of two days, to that point, removed all the symptoms, and the child recovered perfectly.

Dr. M. Hall (*Diseases and Derangements of the Nervous System*, 1841, p. 9) states that the crowing inspiration may arise from affections of the centre of the excito-motory system. He quotes a case related to him by Dr. Evans, of Hampstead, of spina bifida, in which "there was a croup-like convulsion whenever the little patient turned so as to press upon the tumor." He states, moreover, that he found induration of the medulla oblongata in one case of the disease.

Dr. West has also noticed occasional attacks of laryngismus stridulus in chronic hydrocephalus, occurring even before much enlargement of the head had appeared.

4. *That it is a Neurosis.*—We have seen that in very few cases of laryngismus there is actual organic disease of the brain or spinal cord. It is necessary, therefore, to regard it as most frequently a purely spasmodic nervous affection dependent upon irritation of certain parts of the nervous system which are directly or indirectly connected with the muscles of the glottis. Almost all recent authorities concur in the main with this opinion. That it is not always, however, a neurosis, is also shown by the cases quoted under the first head from Drs. Hall and Coley, and by those in

which the disease is accompanied from the first by symptoms of inflammation or congestion of the brain.

It has now been shown that the causes of the disease are exceedingly variable and uncertain, and that any opinion which asserts its dependence on one invariable and constant cause is untenable. We must, therefore, seek some explanation which shall reconcile, as far as possible, the facts related above, and harmonize the various opinions expressed by the authors quoted.

It seems to us that the explanation given by Dr. Hall (*loc. cit.*), is the only one which accounts satisfactorily for the phenomena of the disease, and reconciles the contradictory accounts of its nature and causes brought forward. Dr. Hall regards it as an affection of the excito-motory or true spinal system of nerves, producing in mild cases partial closure of the glottis, and difficult inspirations, while in more severe cases the spasmodic disposition extends to other parts of the body,—to the eyeballs, and to the flexors of the fingers and toes. We have already alluded to his theory that in very violent attacks of laryngismus, where the glottis is entirely shut, the suspension of respiration produces congestion of the nervous centres and general convulsions. As already stated, however, this theory has not been accepted, and we regard the occasional occurrence of general convulsions in connection with laryngismus stridulus, as one proof that this latter affection is merely a partial and imperfectly developed convulsion.

The causes may be either centric, seated in the nervous centres, or centripetal, in the excitor or incident nerves. In the great majority of cases, the causes are centripetal, consisting of various morbid conditions situated at the peripheral extremities of the nerves, which become causes in consequence of the irritation they establish in the nerve-extremities: this irritation is transmitted to the nervous centres, and thence reflected through the various efferent or motor nerves to the different portions of the muscular apparatus affected in the disease, the larynx, face, extremities, and lastly, in severe cases, the whole body. The principal causes of this class are dental irritation occurring during dentition; gastric irritation, arising from excessive or improper food; intestinal irritation from constipation, intestinal disorder or catharsis; and perhaps the pressure of an enlarged thymus or of enlarged cervical or bronchial glands.

The centric class of causes includes such as are seated in the nervous centres. These are much less common than the former class, and give rise to a vastly more dangerous and intractable form of the disease. Foremost among them, according to recent observations, must be placed the development of "soft spots" in the occipital bone in connection with rickets, which allows pressure upon the back of the head to induce irritation of the brain. Indeed, the more this subject is investigated the closer and more frequent does the connection appear to be between laryngismus and rickets. There are also different morbid conditions of the brain and spinal marrow, as inflammation, congestion, and effusion, which appear to have occasionally proved the cause of laryngismus. That such causes sometimes produce the disease is shown by the cases of exostosis already quoted

from Coley, that of spinal irritation from Kyll, that of Dr. Hall, in which he found induration of the medulla oblongata, and the one of spina bifida reported to Dr. Hall by Mr. Evans. In the latter case the tumor was seated on the loins. Mr. E. proposed to treat it by compression, but on making the attempt found that it was followed immediately "by the affection described by Dr. J. Clarke" (*Hall, loc. cit.*, p. 144). Other centric causes, which have been ascribed in some rare instances, are passion, vexation, fright, contradiction, etc., etc.

This theory of the nature of the disease likewise accounts for the varying character of the convulsive symptoms. The laryngeal spasm, from which the disease derives its name, does not constitute the whole malady; it is only one of the symptoms, though the principal one, and that by which it is particularly characterized. The other convulsive phenomena, which generally occur only in severe attacks, or after the disease has continued for some time, are distortion of the face, strabismus, carpopedal spasms, and general convulsions. The hydrocephalic symptoms which occur towards the termination of such cases, and the serous effusion within the cranium found after death, are, it ought to be recollected, often the consequences of the congestion of the brain and asphyxia, which take place during the more or less complete closure of the larynx.

Symptoms; Course; Duration.—Laryngismus stridulus begins suddenly with a paroxysm of difficult respiration. The larynx is contracted spasmodically, and the entrance of air into the lungs is either prevented or impeded. In most cases the closure of the larynx is only partial, and the respiratory movement continues, but is accompanied by prolonged and difficult inspirations, which give rise to the crowing or stridulous sound, whence the disease derives its name. The crowing sound is generally heard several times in each paroxysm, owing to the repeated but only partially successful attempts at inspiration; while in very violent cases it occurs only at the beginning and end of the accession, the respiration being entirely suspended in the middle period. At the same time the child presents an appearance of great distress. The body is thrown forcibly backwards, the eyes are fixed and staring, the nostrils dilated, and the whole countenance indicative of great anxiety. If the paroxysm continues many seconds, the face becomes bluish, the extremities cold, and the fingers and toes contracted. After a few seconds, or a minute, or even longer, the spasm of the larynx ceases; a loud, full inspiration takes place; a fit of crying generally follows, and the child either very soon regains its usual spirits, or, if the paroxysm have been very severe, seems weak, languid, and drowsy, and returns more slowly to its ordinary condition. Between the paroxysms the child may seem perfectly well so far as concerns the character of the respiration, but it almost always exhibits the symptoms of some derangement of the general health, or, in other words, of the morbid condition which is the ultimate cause of the laryngeal spasm.

The paroxysms are most apt to occur during sleep, or as the child is waking. They occur spontaneously, and are brought on by fretting or crying, coughing, fright, contrarieties, deglutition, by the sudden applica-

tion of cold, and other sudden impressions. At the commencement of the disease they recur at rare intervals, and often attract little notice; but, as the case progresses, they become more frequent, and may amount to twenty or thirty in the day, according to Kerr. They sometimes cease entirely for some weeks, or even months, and then recommence. In a case attended by one of ourselves (reported in the *Am. Jour. Med. Sci.*, April, 1847, p. 287), the attacks lasted eighteen days, occurring sometimes two or three times in an hour, and sometimes much less frequently. The child then recovered entirely for a period of seven months, when the disease returned, and after continuing for five days, caused the death of the child in one of the paroxysms.

If the disease continues to progress, it almost always becomes associated with other spasmodic symptoms. The thumbs are drawn tightly into the palms of the hands, and the fingers clasped over them, which gives to the back of the hands a swelled and tumid look. At the same time the toes are strongly flexed under the feet, and the insteps look swelled like the backs of the hands. Sometimes the hands are bent on the forearms, and the forearms on the arms. There is often distortion of the face. In severe cases, or when the disease has continued for a considerable period, epileptiform convulsions make their appearance, and generally prove fatal.

The disease is apyretic in a large majority of cases. When fever arises it almost always depends on the condition which has occasioned the disordered action of the excito-motory system, or on some accidental complication. The pulse during the paroxysm is small, corded, rapid, and sometimes imperceptible. In the intervals it is natural or nearly so.

Death may occur very early in the disease, or after some weeks, months, or according to Kyll, years. Vogel states (*op. cit.*, p. 272) that "sometimes even the very first attack terminates in death, and a seemingly perfectly healthy child may be carried off in a few seconds." In a case quoted by MM. Rilliet and Barthez, death took place at the end of three weeks, and in another, in twenty months.

The *duration* is very uncertain. It generally, however, lasts several months. In one of our own cases it lasted eighteen days, then ceased for seven months, returned, and proved fatal in five days. In another case, the attacks of spasms returned from time to time, during a period of three weeks. In another case, the notes of which were obligingly furnished us by our friend Dr. Benedict, and which we shall append to this article, it lasted, in connection with contracture, four months and a half, and was followed by perfect recovery.

Other Forms of Internal Convulsions.—We have, for the sake of clearness, limited ourselves so far in the present article, to cases where the spasm is confined to the muscles of the larynx, when the attack might be called one of *laryngeal convulsion.*

In other cases, however, the spasm may affect, either solely, or in conjunction with the larynx, the diaphragm, and the respiratory muscles of the abdomen and chest, constituting what is termed by some authors "*internal convulsions.*" The most common form of internal convulsion as

described by Trousseau, "is characterized by rolling upwards of the eyeballs, by an almost complete loss of consciousness, by extreme difficulty or impossibility of deglutition, by irregular respiration, at times barely perceptible, or free, deep, and blowing, indicating that the diaphragm and the respiratory muscles of the abdomen and chest are especially affected."

These internal convulsions may be associated with partial or even general convulsions of the face and extremities; more frequently, however, they are accompanied by more or less general *tonic* muscular contraction.

In most cases, as indicated in the passage quoted from Trousseau, the muscles of the pharynx are involved, and there is marked dysphagia or utter inability to swallow.

In some instances, also, the frequency, irregularity, and smallness of the pulse, and the irregular and tumultuous character of the action of the heart, indicate, as pointed out by Rilliet and Barthez (*op. cit.*, t. i, p. 510), that the organs of circulation probably share in the convulsion.

The degree in which the larynx participates in the attack varies much in different cases; at times there is no obstacle whatever to the entrance or exit of air through its cavity, at others, the spasm of its muscles is so extreme that the passage of air is entirely obstructed; whilst in still other cases, of which the one communicated to us by the late Prof. Pepper, and quoted at the end of this article, is an example, respiration is difficult and accompanied by a stridulous noise.

The above description applies to those cases of internal convulsions where the convulsion is complete, and presents both the primary tonic contraction and the subsequent clonic spasms of the respiratory muscles.

But in other cases, the attack consists merely of a sudden tonic spasm of the diaphragm and respiratory muscles of the abdomen and chest, followed by a sudden and complete relaxation. The entire suspension of the respiration during the spasm would of course rapidly induce fatal asphyxia, but fortunately the attacks, as we have met with them, have usually been so brief as not to cause any dangerous symptoms.

These attacks are popularly known in this country, and were described in the earlier editions of this work, under the title of "*Holding-breath spells.*"

We have met with a considerable number of well-marked cases of the affection, and believe it to be of quite common occurrence. It seldom happens that the physician is consulted in regard to it, as those who have charge of children in whom it occurs, almost always ascribe it to temper, and think it of but little moment. It appears to be the result of a sudden spasm of all the respiratory muscles, so that the child ceases for the time to breathe, from which circumstance, no doubt, it has received its name of "holding-breath spell." There is no stridulous sound, nor hoarseness of the cry, nor indeed sound of any kind. The face is contracted and bluish, the base of the thorax retracted and immovable, and the limbs violently agitated at first, and then stiff; after a few seconds, or perhaps a minute in severe cases, the spasm yields, the child instantly makes a full inspiration, unattended with stridulous sound, and generally bursts into a loud fit of crying, which lasts for a few moments, after which the child seems per-

fectly well, or else the attack is followed by excessive paleness, with languor or prostration, lasting half an hour or even longer. The attacks recur with variable frequency; there may be several in a day, or but one, or they may occur only at intervals of several days. The most frequent cause of the paroxysms is contradiction. They are determined also by fright, pain, and crying. They never occur spontaneously, and never during sleep, so far as we know. It is to be distinguished from laryngismus stridulus by the absence of the crowing sound, by its not occurring spontaneously or during sleep, and by the absence of carpopedal or other spasmodic symptoms. It is, we believe, a spasmodic affection of respiration, analogous to though not exactly similar to laryngismus stridulus. We have never met with it except during the period of the first dentition, and always in children of nervous temperament. The cases that we have met with all recovered, and in one only did the life of the child seem to be at all endangered. In this instance the paroxysms had recurred very frequently for eleven months, and on two occasions were terminated by slight spasmodic movements of the limbs, lasting only for a few instants, and unaccompanied by insensibility or other dangerous symptoms. After these attacks the child was removed to the country, where he recovered perfectly.

Diagnosis.—The only disease with which laryngismus stridulus is likely to be confounded is spasmodic laryngitis, or false croup. From this it may readily be distinguished by the absence of catarrhal symptoms, or fever; by the fact that the paroxysms occur indifferently in the day or night, and that they are much more frequent; by the duration of the paroxysms, which last only a few seconds, or more rarely a minute; by the absence of cough or hoarseness of the voice, even during the height of the paroxysm; by the occurrence of tonic muscular spasms, and convulsions; and, finally, by the chronic course of the malady: the converse of all of which symptoms exist in spasmodic croup.

Prognosis.—The prognosis of laryngismus stridulus is always serious, since even the mildest cases may terminate fatally in any one of the paroxysms. It is, however, far from being so dangerous a disease as has been supposed by some writers, and amongst others M. Valleix, who states that it is almost always fatal (*Guide du Méd. Prat.*, t. i, p. 564). Of 56 cases collected from Pagenstecher, Hachman, Ley, Kopp, Hall, Constant, Rilliet and Barthez, Kyll, and 5 from our own observation, making 61 in all, 4 died of intercurrent or consecutive diseases, while of the remaining 57, 32 were cured, and 25, or about 43 per cent., died of the malady itself.

MM. Rilliet and Barthez quote from M. Lorent, the translator of Dr. Reid's work, the statement, that of 289 cases collected from various writers, 115, or rather more than 39 per cent., proved fatal.

The prognosis given by the physician ought to depend in great measure upon the cause of the malady. When it depends on difficult dentition, improper diet, or gastro-intestinal disease, whether or not connected, as they very frequently are under these circumstances, with rickets, the case will in all probability terminate favorably if the proper treatment can be, and is, brought to bear against those morbid conditions; while if it occur

under the influence of a centric cause, or of enlargement of the cervical or bronchial glands, the prognosis becomes much more unpromising.

TREATMENT.—If the views taken of the nature of the disease in the above remarks be correct, it must be evident that for the treatment to offer any considerable chance of success, it must be directed not merely to the removal of the spasm of the larynx, which is only a symptom and not the whole disease, but to the remedying of the deeper-seated cause of the disordered functional action of the excito-motory system of nerves. In this connection it is especially important to search for the symptoms of rickets, which we have seen to be so often the primary underlying cause of the attacks.

When the disease seems to immediately depend upon difficult dentition, the gums ought to be carefully watched, and freely scarified, so soon as there is the least heat or swelling over the advancing teeth. Dr. Marshall Hall deems the use of the gum-lancet one of the most important means of treatment we are possessed of, and recommends that the gums should be fully divided, "not once, or occasionally, but *twice* or even *thrice* daily." In another place, he says: "We should lance the gums *freely* and *deeply*, over a great part of their extent, *daily*, or *even twice a day*, and apply a sponge with warm water, so as to encourage the flow of blood." He even recommends that, in very urgent cases, the *lateral* as well as the more prominent portions of the gum, should be scarified. Lancing of the gums is undoubtedly a most important point in the treatment of this and other diseases of childhood, connected with dentition. We have long been convinced, however, from personal observation, that a resort to this operation, merely because the child is passing through the period of dentition, is at least useless. We have never found it to do any good, unless the teeth are near enough to the surface to produce manifest swelling, attended with heat and soreness of the gums. So long as the gum is hard, insensible, not turgid, and of its natural color, and the mouth not hot, cutting has done no good.

When the disease depends on gastric irritation, the result of an unhealthy milk or of artificial diet, or when there are evidences that these morbid influences have induced rickets, our attention must be directed principally to the removal of these conditions. A wet-nurse ought to be procured at once if one can be obtained, and if the child will nurse. If this cannot be done, the diet must be carefully regulated by the physician. Ass's milk or goat's milk ought to be used if they can be procured; if not, we would recommend the gelatin diet, prepared as recommended at page 332. The proportion of the ingredients must be regulated by the condition of the stomach. If the digestive power be very weak, the proportion of milk must be only a fourth or even a sixth for a few days, while the amount of cream must bear its usual ratio to the milk.

When the child is thin and pale, and the stomach evidently weak and dyspeptic, it is well to resort to small quantities of stimulants, and to tonics in proper doses. The best stimulant is fine old brandy, of which from ten to twenty drops may be given three or four times a day, or every two or three hours. Or we may administer the aromatic spirit of harts-

horn in connection with, or without the brandy; of this about ten or fifteen drops should be given four or five times a day, or alternately with the brandy. Of tonics, the most suitable, it seems to us, are quinine, in the dose of a quarter to half of a grain three or four times a day, or the citrate of iron and quinine, in the dose of half a grain, given in the same way. Another very excellent stimulant and tonic is the Huxham's tincture of bark, of which about five to fifteen drops may be prescribed in the place of brandy. This kind of treatment will scarcely fail to stimulate the digestive power of the stomach to greater activity after a few days, and of course to improve the nutritive functions and the strength of the patient. In addition to this we would recommend the persistent use of the remedies which, as cod-liver oil and the compound syrup of the phosphates, are most beneficial in the treatment of rickets. The reader is referred to the article on the latter subject for more detailed discussion of this point.

When the disease is associated with marked intestinal irritation, we must inquire carefully into its nature and causes. It may be connected with constipation, diarrhœa, or with an unhealthy state of the contents of the bowels. It is often dependent on the presence of crude or imperfectly digested food in the alimentary canal, and when this is the case, the only proper method of treatment is to attend to the state of the digestive function, and to discover and employ a proper diet. The bowels are quite frequently very torpid, and the stools, when obtained by medicine, are often found to be very offensive, light-colored, and pasty, conditions generally resulting from imperfect action of the liver. Under these circumstances small doses of mercurials, or taraxacum, should be resorted to in combination with or followed by mild aperients, as castor oil or rhubarb. One of the very best cathartic remedies, when this combination of symptoms is present, is Chaussier's mixture of castor oil and aromatic syrup of rhubarb, consisting of three parts of the former rubbed up with five parts of the latter. The dose is a teaspoonful every two or three hours, until the bowels are well evacuated. It is gentle in its action, and yet very efficient, gives no pain, and is easily taken. If a mercurial be desired, about two or three grains of blue mass, one or two grains of calomel, or four grains of the mercury with chalk, may be incorporated into an ounce of the mixture. When diarrhœa is present, it must be treated according to its causes, as recommended in the articles on simple diarrhœa and entero-colitis. When on the contrary, constipation is a marked symptom, this is to be treated by regulation of the diet, by the daily use of warm-water enemata (particularly recommended by Dr. M. Hall), or, if these do not answer, by the exhibition of small doses of the mildest aperients.

Dr. Hall states that by strict attention to the dentition process, and to gastric and intestinal irritation in the *dawn* of the disease, he has succeeded in curing all the cases he has seen but one, and in that he found induration of the medulla oblongata.

By those who suppose the disease to depend on enlargement of the thymic, cervical, or bronchial glands, it has been proposed to endeavor to procure a reduction of the hypertrophy of those glands by frequent appli-

cations of leeches, by the use of exutories upon the thorax, by the employment of strong purgative medicines, and by the administration of mercury, digitalis, and iodine. In a case apparently connected with enlargement of the bronchial or cervical glands, we should prefer to direct our treatment to the invigoration of the general health by attention to diet, by the use of tonics, and by proper exposure to fresh air, whilst we should employ internally, cod-liver oil, iron, iodide of potassium, the preparations of iodine, and antispasmodics.

When the disease depends on a centric cause, this must be treated, if it can be detected, according to its nature.

Antispasmodics.—Whatever be the causes of laryngismus stridulus, it is undoubtedly proper, whilst our chief efforts are directed towards their removal or mitigation, to make use of antispasmodics in order to moderate the spasmodic symptoms which are but the expression of those causes. The remedies of this class most highly recommended are bromides of potassium and ammonium, belladonna, valerian, musk, assafœtida, oxide of zinc, and small doses of ipecacuanha. One of the bromide salts mentioned should be given in full doses, and may be combined with any of the other antispasmodics. As stated in our remarks on the use of remedies of this class in hooping-cough, there is reason to believe that the bromide of ammonium possesses greater power than the other bromide salts in relieving the spasmodic affections of the larynx. The oxide of zinc which, as stated in the article on eclampsia, is so highly recommended by Brachet and others, may be given alone or combined with extract of hyoscyamus. M. Brachet always combines the oxide of zinc with extract of hyoscyamus, and gives at least two grains of the former with four of the latter, in divided doses, in the twenty-four hours. He states that he has never given more than ten grains of each in the period mentioned. Of the fluid extract of valerian, about a teaspoonful, or even more, might be given in the twenty-four hours, to a child one or two years old. It should be mixed with water, of course.

It must never be forgotten, however, that remedies of this class are to be employed only as palliatives and adjuvants, and not as curative agents.

Iron.—Of all the remedies to be employed, after attending in the strict manner to the removal of the exciting causes of the disease, there is one of such almost universal applicability as iron or its preparations. The patient is almost invariably, owing to the faulty state of the digestive and nutritive functions, more or less anæmical, a condition imperatively demanding iron; and as this remedy rarely conflicts with the other means indicated, it should be given probably in all, or nearly all the cases. The metallic iron in powder or in lozenges, in doses of half a grain or a grain three times a day, or the iodide of iron in doses of from two to four drops three times a day, in a mixture of syrup and cinnamon-water, are the best preparations, and they should be continued, as a general rule, throughout the treatment of the case.

We have already referred to the great value of the prolonged use of remedies which improve the general nutrition, and particularly coun-

teract the rachitic diathesis so often present in cases of laryngismus. Among these may be mentioned cod-liver oil, arsenic, and the alkaline phosphates.

Treatment during the Paroxysm.—When the child is attacked with a paroxysm of difficult breathing, it should be lifted at once into a sitting posture, if it be reclining, and fanned, or carried to an open window, if the weather be not too cold. At the same time cold water should be sprinkled upon the face, and if the attack be violent, we may resort to what is recommended by Dr. Hugh Ley and Dr. Hall, tickling of the fauces to produce nausea or vomiting, or irritation of the nostrils with a feather, so as to occasion gasping respiration. In a case which occurred to the late Dr. C. D. Meigs, accompanied with severe general convulsions, he found that the suspension of the respiration could very generally be broken in upon, and the paroxysm sometimes averted, by the application of a piece of ice, wrapped in a cloth, to the epigastrium and lower part of the sternum.

Dr. Edmunds (*Med. Times and Gaz.*, March 12, 1864) also found that the application of one of Chapman's ice-bags to the spine, did more than anything else to keep off the paroxysms in an obstinate case of laryngismus.

To prevent congestion of the brain and effusion, which sometimes takes place as the effects of the attacks, Dr. Hall recommended a few leeches or cups to the head, the application of an alcoholic lotion over the whole head, or the use of the ice-cap. At the same time the bowels ought to be speedily moved by large enemata either of simple water or of water containing salt.

In cases, especially of the more general form of internal convulsions, where the attacks are so frequently repeated and severe as to threaten life, we would recommend the induction of partial anæsthesia by either ether or chloroform, as advised in the article on eclampsia.

Removal to the Country.—When the disease persists in spite of the means above recommended, and especially when it depends on dentition or digestive irritation, change of air will often produce a wonderful effect, and should always be tried.

The following cases are reported in full, as illustrating the peculiarities and treatment of this curious affection:

Case.—"The subject of this case was a boy, born in July. He was a large, hearty child, and remained well until January of the following year, when his mother's milk failed, and he was placed upon artificial diet. From this time to May following, his diet was cream and water, barley-water, oatmeal, arrowroot, pounded crackers boiled with water, and gum-water, all of which were tried in turn, being prepared and administered with the greatest caution as to time and quantity. A wet-nurse was tried, but the child refused the breast entirely.

"On the 27th January, he was attacked with diarrhœa, which lasted one week. This was followed by constipation, the stools being white, firm, tenacious, and offensive. The constipation continued up to July, when it was replaced by diarrhœa.

"February 4th. On this day, the child being seven months old, was first observed a spasm of the larynx, producing a shrill, croupal whistle, or *ooh*, *och*, during two or three successive respirations, and followed by a cessation of breathing for

some seconds, long enough to dash water in his face, carry him to the window, pat him on the back, etc. These spells occurred during the sleeping and waking state, and especially during crying or laughing, and continued almost daily and often many times a day and night until June, when he was taken into the country.

"Simultaneously with the laryngeal spasm, appeared contractions of the upper extremities, the thumbs being drawn tightly into the palms of the hands, the fingers flexed over the thumbs, and the hands bent on the forearms. The backs of the hands were swollen, and the skin looked tight and polished.

"For a few days in the middle of February, there was a subsidence of all the symptoms, with decided improvement in every respect.

"On the 25th of the same month occurred a return of all the symptoms, with extension of the spasm to the feet, the toes being bent under the feet, the insteps much swelled and having a polished appearance. At the same time there were occasional spasmodic movements of the muscles of the face, arms, and body, resembling those of chorea. This condition continued with occasional relaxations up to the 11th of June.

"The stomach was exceedingly delicate, rejecting the most carefully selected nourishment, and at times refusing all food. The child became pale, thin, and vermid; was disturbed by the slightest noise, and shunned the light as painful.

"He was removed to the country on the 11th of June. There his health was gradually restored. The appetite improved, the spasm of the larynx and contractions of the extremities gradually relaxed, and the thumbs were at last liberated, the skin under them having taken on the appearance of mucous membrane. There was no return of the disease after the middle of June, although the child had a severe attack of diarrhœa in July, after which he got perfectly well, and has remained so up to the present time (twelve months subsequently). The first tooth made its appearance in September, and he now has fourteen, and has cut them all without the least accident. During the last eight months he has been remarkably fat and hearty.

"I am not aware that any medicine had any effect in removing the disease. Calomel, in large and small doses, antispasmodics of all kinds, frictions over the spine, blisters to the back of the head, alteratives, laxatives, etc., were persevered in without benefit. On removing him to the country, and feeding him on milk warm from the cow, at first diluted, and afterwards pure, an improvement was speedily observed."

The above case, which was communicated to us by Dr. Benedict, was probably associated with rachitis: unfortunately no record is made of the condition of the occiput. The result illustrates most strikingly the good effects of removal from the city to the country, and the adoption of a more healthy diet.

CASE.—The following case is one that occurred to one of us. We extract the account of it from a paper on croup by Dr. J. F. Meigs (*Am. Journ. Med. Sci.*, April, 1847).

The patient was a girl, five months of age. I saw the child on the 28th of March, 1844. The first attack occurred the day before I was called, but as the mother supposed it to be a matter of little consequence, she did not send for me until the next day. The child was well grown, and except a rather too great paleness, looked strong and healthy. It was playful and good-humored, nursed freely, had no fever, and between the paroxysms presented the appearances of perfect health. The crowing fits occurred frequently in the course of the day and night, sometimes two or three times in an hour, or not so often. They often waked the little thing suddenly from tranquil sleep. They consisted of a succession of long and difficult inspirations, accompanied by a peculiar whistling or crowing sound,

such as might be supposed to depend on the passage of air through a narrow aperture. During the attack the face assumed an expression of great anxiety, the respiratory muscles contracted with violence, and there seemed to be for the time imminent danger of suffocation. After several seconds or a minute the shrillness of the sound diminished, the struggling subsided, and soon the respiration became perfectly natural, and the child seemed well. The paroxysms were usually followed by fits of crying, which, however, were easily pacified.

The paroxysms gradually diminished in frequency and violence, and ceased entirely after the 13th of April. The treatment consisted simply in careful attention to the general health, and in the frequent use of warm baths and mild nauseants.

The child remained perfectly well, with the exception of a slight attack of cholera infantum, until the following November, seven months after, when the disorder recurred. Several paroxysms occurred between the 12th and 17th of the month; but as they were slight and unattended by other symptoms of illness, the mother was not alarmed, and paid but little attention to them. On the 17th of the same month, the child was sitting on the floor amusing itself with some playthings. There were no persons in the room except young children. They saw the little thing stoop forward suddenly, as though in play, and did not therefore regard it immediately. As it remained in that position, however, they went to it, took it up, and found it dead. It had perished suddenly, no doubt in one of the paroxysms of laryngismus.

An autopsy was made, in which the larynx and thoracic organs were examined, but nothing was found to explain the cause of the disease or the sudden death.

In the following interesting case, communicated to us by the late Prof. William Pepper, the attack consisted of persistent laryngismus stridulus, accompanied by frequently recurring internal convulsions affecting the diaphragm and other respiratory muscles, and by tonic contraction of the muscles of the arms.

Case.—A boy, aged four months, remarkably healthy and well developed, after suffering a few days with slight catarrhal symptoms, was suddenly seized with a peculiar stridulous crowing respiration.

I saw the child about half an hour from the commencement of the attack, and found it with a pulse of 140, pale face, and livid lips. The pupils were contracted, and the hands firmly clenched; the crowing sound was very loud, and attended every act of inspiration. At times the respiration and circulation would be entirely suspended for many seconds, followed by great lividity of the surface and coldness of the extremities.

Eight or ten leeches were applied behind the ears, the feet placed in warm water, and a dose of castor oil administered, to be followed by saline enemata.

Four hours from the commencement of the attack, all the symptoms were greatly aggravated; the wrists and fingers were firmly flexed, these spasms coinciding with the arrest of the circulation and respiration; there was now perfect insensibility. The child was placed in a warm bath, cold water was applied to the head, and a sinapism along the spine, without, however, affording any relief to the crowing inspiration, or other spasmodic symptoms.

At the suggestion of Dr. C. D. Meigs, the child was now placed on its right side, with the shoulders elevated; this position to be maintained at least six hours. At the end of that time the child was in no respect improved, and accordingly, at the suggestion of Dr. M., six leeches were applied over the cardiac region; ʒj of lac. assafœtid. was thrown into the rectum, and a blister applied to the back of the neck.

The child expired at midnight, about ten hours from the commencement of the

attack, the crowing respiration, with more or less asphyxia, having persisted throughout.

Autopsy, thirty-six hours after Death.—Mucous membrane of the larynx injected, but in other respects natural. Thymus gland three and a half inches long, two and a half wide, and at its upper part three-quarters of an inch thick; its weight was 620 grains, or 10 drachms and 1 scruple. Lower lobes of both lungs greatly congested. Heart natural. The brain, unfortunately, could not be examined.

It will be observed that, in the above case, the laryngismus and other spasmodic symptoms appeared after slight catarrhal symptoms had existed for a few days; and it may be possible that the irritation of the mucous membrane acted as the exciting cause of the convulsive attack. A recent author[1] has, however, alluded to the case in such a connection and manner, as to at least suggest that he may have mistaken it for one of spasmodic laryngitis. A careful consideration of the symptoms and course of the case will, however, sufficiently show its essential difference from this latter affection.

ARTICLE VIII.

CONTRACTION WITH RIGIDITY.

This is the disease called by the French *contracture*. We shall treat of it as idiopatic contraction with rigidity. It has been little studied until of recent years, since then a number of cases have been placed on record, especially by French writers. We have ourselves met with but one well-marked example of it in an independent form. This case, of which we shall give a sketch at the end of this article, and the one of laryngismus stridulus communicated to us by Dr. Benedict, and appended to the article on that disease, furnish very good examples of contraction coexisting with the former affection. We have seen also two other cases in which the contraction was decided, but in which it lasted but a short time.

The disease is evidently one of the forms of excito-motor disturbance, which present themselves under such a variety of shapes during infancy and childhood. Though it generally exists as an idiopathic and distinct malady, it is in other cases associated with, or follows laryngismus stridulus or spasm of the glottis, and in others again is combined with attacks of general convulsions.

Definition.—By idiopathic contraction with rigidity (*contracture* of the French writers), is meant the involuntary tonic contraction of different flexor muscles of the extremities, particularly those of the fingers and toes, but sometimes of the forearms and arms also, existing independently of any appreciable organic disease of the cerebro-spinal axis. It has

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[1] Dr. J. Lewis Smith (*op. cit.*, p. 199).

been described by different English writers in connection with laryngismus stridulus, under the title of "carpopedal spasms," "cerebral spasmodic croup," "croup-like convulsions," etc., etc. We believe, however, that it will be useful to describe it separately from that disorder, for though of the same nature, and sometimes associated with it, it often exists as an independent affection.

Causes.—It is most common between the ages of one and three years. It is much oftener sympathetic than essential, and its most frequent causes are dentition, disordered states of the digestive function dependent upon improper alimentation, anæmia and its accompanying nervous excitability, brought about by digestive and nutritive derangements, pneumonia, bronchitis, masturbation and other forms of irritation of the genitals, and unfavorable hygienic conditions. In some few cases, the disease is truly essential, since no pathological cause for it whatever can be detected. It is merely necessary to say that it is also often symptomatic of disease of the brain, but of that form of the affection nothing will be said in the present article.

Nature of the Disease.—It appears to consist in a functional derangement of the motor tract of the cerebro-spinal axis, occurring without any cause that can be detected, or determined by the existence of some irritation affecting incident excitor nerves. We once saw a child two years of age, who, after a restless, uneasy night, presented in the morning tonic contraction of the flexors of all the toes of both feet, so that the insteps were swelled, and looked smooth and polished. There was no other sign of sickness except peevishness. Learning on inquiry that the bowels had been somewhat constipated for several days, and that the materials of the scanty stools which had been discharged were dark-colored and very offensive, we ordered a dose of castor oil containing two grains of calomel. The contraction continued unyielding until six o'clock in the afternoon, when a very copious, dark-colored, viscid, and offensive stool occurred, and the contraction immediately ceased. Here the cause of the contraction was evidently an accumulation of unhealthy fecal matter in the intestine, which, by irritating certain sensitive fibres of the excito-motory system, caused a reflex motor action that gave rise to permanent muscular contractions. In other cases the disturbance of the excito-motory system depends on the reflex irritation occasioned by the process of dentition, by indigestion, by diarrhœa, pneumonia, pleurisy, etc. In other instances, again, to which the term essential must be applied, it seems to depend simply on general debility and anæmia, which are well known to be productive of functional disease of the nervous system.

Symptoms; Course; Duration.—The disease rarely attacks children previously in good health, but generally those already suffering from some disorder of the general health, or a severe local affection. When sympathetic, the first symptom noted is the contraction which constitutes the disease. When essential, on the contrary, the onset is sometimes marked by various nervous symptoms, such as giddiness, headache, or somnolence, which soon pass off, leaving the simple contraction with rigidity as the only morbid condition. In most cases, however, the attack begins with the mus-

cular contraction, which generally affects the superior extremities first, and gradually extends to the inferior.

When the disease is fully developed, the thumbs are drawn down into the palms of the hands, and the fingers, strongly flexed at the metacarpo-phalangeal articulations, cover and conceal the thumbs. At the same time that the metacarpo-phalangeal articulations are flexed, the phalanges themselves remain extended and the fingers are separated from each other. The contraction generally affects the wrist-joints also, so that the hands are strongly flexed upon the forearms, and in some rare cases the latter upon the arms. The disorder usually affects the inferior extremities likewise, the toes being in a state of tonic flexion or extension, the foot rigidly extended upon the leg, and its point sometimes drawn inwards. The spasm very rarely extends to the knees.

Children old enough to describe their sensations generally complain of stiffness in the affected parts, with more or less severe pains darting along the course of the nerves. The contracted muscles are hard and rigid to the touch, and sometimes enlarged so as to appear in strong relief under the skin. In slight cases the contractions can be overcome by very moderate force and without pain, whilst in those which are more severe, the attempt to overcome the contraction is productive of acute pain in the rigid parts. The backs of the hands and the insteps present a swollen appearance, and the skin over these points is smooth and polished. In the case communicated by Dr. Benedict, appended to the article on laryngismus stridulus, and likewise in our own case, the skin under the thumbs had assumed the appearance of mucous membrane, from the long and close confinement of the member.

In addition to the symptoms already enumerated as characteristic of the malady, there are others which require attention. The child is of course unable to walk or perform any prehensile movement. The intelligence and senses always remain perfect in simple, uncomplicated cases. The nervous system shows signs of disorder in the form of restlessness or languor, and irritability, with crying and peevishness. In the great majority of instances, these are the only nervous symptoms, though in some there are general or partial convulsions, strabismus, and diminution of sensibility. Of these the most frequent are convulsions, which generally come on a few days after the attack, or precede the fatal termination. In the case of Dr. Benedict, referred to above, there were occasional choreic movements of the face, arms, and body. The simple disease is unaccompanied by any febrile movement, and the organic functions go on naturally. In the sympathetic form, on the contrary, we have the various symptoms of the disease which acts as the cause of the contraction, whether that be abdominal or thoracic. The most common train of symptoms, in young children, is the same as that which accompanies gastric or intestinal derangement, morbid dentition, etc. The *course* and *duration* of the disease are very irregular and uncertain. When once developed it may last from weeks to months, either slowly increasing in severity, or remaining stationary for a length of time. As a general rule, after it has lasted for some time, it becomes intermittent, sometimes diminishing or even disappearing

entirely for a period, then reappearing or increasing, to subside or cease again, and so changing without regularity or evident cause, until at last recovery gradually takes place, or death occurs from the concomitant disease, or in a paroxysm of convulsions.

Diagnosis.—The only difficulty in the diagnosis of idiopathic contraction is to distinguish it from symptomatic contraction, or that which depends upon cerebral or spinal disease. The kinds of cerebral disease which most frequently occasion contraction are tubercle of the brain, and meningeal hæmorrhage. The distinction can generally be made with considerable facility, however, by attention to the various disorders of intelligence and sensibility, to the fever, constipation, vomiting, and different modes of invasion and progress which characterize the symptomatic form. The following table, taken from MM. Rilliet and Barthez, will assist in the diagnosis.

SYMPTOMATIC CONTRACTION.	ESSENTIAL CONTRACTION.
Cerebral symptoms, special functional disorders (convulsions, strabismus, dilatation of the pupils, etc.), preceding or accompanying the contraction.	Similar cerebral symptoms, but only in exceptional cases, sometimes accompanying, but never scarcely preceding the contraction.
In many cases irregularity of the pulse.	No irregularity of the pulse.
Generally partial, and commencing usually in the elbows and knees, and in a single extremity.	Binary, commencing in the fingers and toes.
Almost always permanent.	Remarkably intermittent.

Prognosis.—The prognosis must depend on the cause of the malady. The contraction itself has no influence whatever on the termination. The fatal termination has always resulted from the anterior or concomitant disease. Six cases observed by M. Barrier all recovered. The case communicated to us by Dr. Benedict, which was connected with laryngismus stridulus, and one very severe one that occurred in our own practice, also terminated favorably. The prognosis is favorable, therefore, when the attack occurs in a child of naturally good constitution, and when the cause of the disease is not a permanent or incurable one. The possibility of the occurrence of fatal convulsions should always lead us to make a guarded prognosis.

Treatment.—The treatment must depend on the circumstances under which the disease has made its appearance. When it occurs in the course of an acute local affection, the treatment must of course be that which is proper for the concomitant disorder. When it depends on dentition, or on gastric or intestinal derangement induced by improper diet, the treatment is the same precisely as that recommended for laryngismus stridulus dependent on the same causes.

It may be stated that, as a general rule, all violent remedies, as bleeding, calomel, except in very minute doses as an alterative, drastic cathartics, and blisters, can scarcely fail to be injurious, unless manifestly necessary in the treatment of the concomitant affection.

It is proper in almost all cases to combine with the treatment already

recommended, the employment of antispasmodic remedies, particularly when the contractions persist after the removal of the primary disease.

The best remedies of this class are the warm bath, used every day; belladonna; conium; bromide of potassium; the fluid extract of valerian; assafœtida, and camphor. We would further recommend the use of remedies calculated to improve and invigorate the nutrition, and particularly cod-liver oil and iron. The diet ought generally to be nutritious and strengthening, particularly when the patient is weak and delicate.

In conclusion we may state that the treatment should be very much the same as that proposed for laryngismus stridulus, and we therefore refer the reader to that subject for more detailed information.

CASE BY DR. J. F. MEIGS.

Case.—The subject of this case was a girl nine months old. The parents were healthy persons, but the mother, owing to some idiosyncrasy, had made but a poor nurse for the preceding child, and I had strongly advised her, therefore, at the birth of this one, to give it a wet-nurse. This was not done, however, and it was found necessary to feed the infant a great deal from its birth. During the early months of its life it had some slight attacks of disorder of the digestive system, but being taken to the country for several months in the summer, it there improved very much. On being brought back to town I saw it, and found it pretty well developed, but very pale, and, on the whole, delicate-looking. It was still nursed by the mother, but not to any very considerable extent, as it was obliged to be fed several times each day. The food consisted of different farinaceous substances made with cow's milk.

On the left forearm of the child there was situated a congenital aneurism by anastomosis, which had grown, by the age of nine months, to be as large as a five-cent piece. It was deemed necessary to remove this tumor, and, accordingly, on the 11th of January, 1852, a surgeon tied it with a needle and double ligature. The child bore the operation very well, was soon quieted, and was cheerful and ate well until the evening of the 15th, when it was attacked with fever, which lasted all night, and was accompanied with a good deal of cough and some gurgling in the fauces. On the following morning, at about 7½ o'clock, it had a slight convulsive seizure, lasting a few moments, and marked by stiffening of the body, and a staring expression of the eyes. In the middle of the day, it was seized again, and during that and the next day (17th), up to 10 P.M., it had twenty-four convulsions. These lasted from three to eight minutes each; they were general, and consisted of flexions of the limbs, working of the face, and were attended with unconsciousness. There was no opisthotonos during the attacks, no extensions of the limbs, and no contraction of the jaw. Between the seizures, the child nursed perfectly well, sucked the finger, had no stiffness of the lower jaw, and was perfectly conscious. There was, during these two days, some fever, as the skin was too warm, and the pulse between 161 and 180. The respiration was more frequent than natural, there was a good deal of cough, some catarrhal râles in the chest, and also some gurgling in the fauces. The stools were scanty, pasty, and white. There was a well-marked but rather faint rash on the limbs and trunk, like erythema or mild scarlet fever, and the lymphatic glands on both sides of the lower jaw were somewhat swelled, and quite hard. The treatment directed was one-sixth of a grain of calomel every two hours; two drops of solution of morphia with five of fluid extract of valerian, to be given also every two hours; warm immersion baths, and mustard foot-baths. On the second day, blisters were applied behind the ears.

On the 19th, the child was better. There was no convulsion; she noticed well, smiled a little, nursed heartily, and took some arrowroot-water.

During all this time the tumor in the arm was not at all inflamed. It was neither red, sore to the touch, nor swelled. It was suppurating slightly. Under the idea that the convulsions might depend in part on the operation, and in order to promote suppuration, a warm poultice was kept constantly applied over the tumor.

The child continued better, with the exception of slight angina and severe cough, until the morning of the 22d, when it waked early, crying violently as though in severe pain, and I found the fingers of both hands strongly flexed at the metacarpal articulations over the thumbs, which were themselves drawn into the palms of the hands. The phalanges, though bent, as just stated, at the metacarpal articulations, were stiffly extended at the phalangeal articulations, and at the same time separated from each other. The hands were flexed at the wrists. The toes were flexed, and the feet stiffly cramped at the ankles, and the insteps, as also the backs of the hands, looked swelled and cushiony. Any attempt to open the hands was painful and caused crying. The pulse was frequent and small, the skin pale, and very slightly too warm; the intelligence was perfect. The jaw was open, and the act of sucking was performed, but with some difficulty. On the previous day the bowels had been opened three times, and on this day once; the stools were scanty, pasty, and white. At 9 A.M. I ordered two drops of solution of morphia, five of the fluid extract of valerian, and twenty of milk of assafœtida, to be given every two hours.

4 P.M.—Same state, except that the contraction is stronger. There is more heat of skin, much crying, and a restless, distressed motion of the head. At 4½ o'clock, two drops of laudanum were given with assafœtida. A teaspoonful of the following mixture was ordered every hour:

℞.—Mass. Hydrarg., ... gr. iij.
Ol. Ricini, ... ʒiij.
Syr. Rhei. Aromat., ... ʒv.—M.

10 P M.—Has taken three doses of the mixture and had one large, whitish, pasty stool. Much easier. Has slept a good deal. Contractions not so strong, as the hands can be opened more easily, and with very little pain. Skin soft, of natural temperature, and moist. Ordered one or two more doses of the mixture, and a repetition of the laudanum and assafœtida, in case of restlessness. During all this time the tumor has not separated. A process of ulceration is going on around the ligatures, but there is no inflammation of any consequence; the arm is not swelled, and there is neither redness nor soreness to the touch.

January 30th.—The contracture diminished very much for two days, and then returned, so that during the 27th, and 28th, and 29th, it was very marked, the forearms being flexed on the arms, and the hands strongly flexed on the forearms. The feet also were very stiff, and strongly flexed. The head was occasionally but not constantly retracted upon the trunk. The child evidently suffered very much, as it cried constantly and was very restless, except when under the influence of anodynes or antispasmodics. The bowels are sluggish, but have been kept open by the oil and rhubarb mixture. The dejections were generally whitish and pasty, but occasionally there was a healthy yellow stool. On the 28th the following mixture was ordered:

℞.—Ext. Valerian. Fluid, ... ʒj.
Sp. Ætheris Comp., ... ʒss.
Liq. Morph. Sulph., ... gtt. lx.
Syr. Tolutan., ... ʒvj.
Aquæ, ... ʒij.—M.

A teaspoonful to be given every hour or two, when there is much suffering or restlessness.

On the evening of the 29th the ligatures were removed, as they had become entirely loose, though without cutting off the tumor. The diseased point was not much inflamed, nor was it very tender.

The child is still nursed and fed. Since the 29th it has had goat's instead of cow's milk. On the evening of the 30th the patient was more tranquil, the expression was more placid and open, and the contracture not quite so strong.

Up to February 7th, there was no decided change in the symptoms. They continued quite as severe as before. The dyspeptic symptoms, the torpid state of the bowels, the want of appetite, and the white, pasty state of the evacuations were never relieved, except momentarily, by means of cathartics. On the 7th a wet-nurse was procured, but only after the most persevering and urgent solicitation and argument on our part, I having long been convinced that the cause of the contracture lay in the disordered state of the digestive functions, produced and kept up by artificial diet, and perhaps by an unhealthy state of the mother's milk. The parents, however, had always thought that the operation had been the cause of the convulsive disease, and for a length of time would not consent to a wet-nurse.

After the child had been suckled by the wet-nurse for two days, the stools, which, since the beginning of the sickness, now twenty-three days, and to a greater or less extent since birth, had been very unhealthy, became yellow, homogeneous, and natural in character; while the bowels, instead of being obstinately constipated, so as to require large doses of cathartic medicine, were moved spontaneously two or three times a day.

On the 10th we noticed strong divergent strabismus, and the child looked very badly. The left leg was drawn up, whilst the right was stiffened. The left arm was more used than the right, the left hand being carried often to the mouth, while this was never done with the right. It was difficult to measure the degree of the intelligence, but the child occasionally looked at and evidently noticed objects, but during most of the time it was dull and inattentive.

On the 13th there was an evident improvement, the previous night having been very good. The face was improved in color and expression, and was not quite so thin. The contraction was about the same.

14th.—Some diminution of the contraction, the forearm being a little extended upon the arm, and the wrists, though still very rigid, not quite so much drawn. The child looks better; she nurses a great deal, taking all that the mother, and most also of what the wet-nurse, a hearty woman, has.

February 20th.—Doing very well up to last night, when she became more restless, cried a great deal, rolled the head on the pillow, and had slight retractions of the whole trunk of the body. Occasionally she ceased to cry, scarcely breathed, and the eyes were rolled upwards and fixed for several seconds. She looked pale and pinched again, and refused to nurse. Had one whitish, curdy stool.

21st.—Better; more quiet; nurses well. The boring with the head has ceased, and also the retractions of the trunk. One healthy stool.

22d.—Much better; nurses well; one healthy stool. The contraction of the right arm is yielding, and that of the forearm on the arm is gone on both sides. The left wrist is straight; the right one is yielding very much, though it is still somewhat bent. The fingers of the right hand, though still bent, have relaxed very much; those of the left hand are still very much bent, but are less rigid than before. The integument of the palms of both hands has become, in the flexures, whitish, soft, moist, mucous-like, and has an offensive odor. To-day and yesterday the child uses the arms, touches and reaches out for articles; she is much more intelligent, and looks at and observes objects; she now holds her head up, and likes to be carried about sitting up in the arms of the nurse, which before she could not bear at all. She is gaining flesh; the color of the surface is improving; the ears have become pink and pretty.

A fresh assafœtida plaster was applied upon the back yesterday.

March 1st.—Continues to do well. The right hand is to-day almost natural,

being opened and shut, and used to grasp with, though it still looks a little stiff. Left hand much better; she opens and shuts the forefinger, and grasps and holds toys with it, but the other fingers are still much contracted. The movements of the arms are quite easy and natural. There is no bending of the hands at the wrists, except, perhaps, very slightly in the left extremity. The feet are natural, except a slight stiffness. She now nurses very well, and is growing fat. She is larger, in fact, than before the sickness. The intelligence is improving rapidly, as she notices, smiles occasionally, and distinguishes, her attendants think, between persons. The bowels are regular without medicine. She has taken no remedy of any kind for three days past.

March 11th.—Almost entirely recovered. There is still a slight but only very slight flexion of the fingers of the left hand. General health excellent.

March 29th.—The patient is now perfectly well, except that she uses the forefinger of either hand rather better than all together, so that in grasping and holding an object, she is more apt to seize it with the forefinger than with all. Still she can and does grasp with all, when the object is large, and no one, unless very observant, would notice the peculiarity just described. Embonpoint very good; complexion clear and healthy; sleeps sound; bowels in excellent condition. Intelligence perfect; smiles and laughs a great deal, and distinguishes between persons; takes a great deal of notice. She is about equal in intelligence to a child of eight months old. Does not attempt to speak.

April 10th, 1852.—I was sent for to-day. The child had not been well for three days, having had three or four thin and greenish stools a day, with whitish specks in them. She was fretful and did not sleep well, and had a good deal of loose catarrhal cough and some acceleration of the breathing. I found her in the morning, after a restless night, quite feverish, hot and dry, with frequent respiration, and with some catarrhal wheezing in the chest. She had coughed a good deal, and her mother had found her hands showing some signs of spasm, the forefingers being extended as though pointing, and separated from the other fingers, which were flexed, with the thumbs also, into the palms of the hands.

There is some degree of laryngismus, as on waking from sleep the breathing is labored, difficult, partially suspended, and accompanied with a slight crowing, or rather choking sound, while at the same time the face becomes pale and the mouth bluish. Bowels open three times yesterday, the stools being mucous, greenish, and containing small lumps of undigested casein.

Ordered a quarter of a grain of mercury with chalk diffused in a teaspoonful of syrup of jalap to be given every two hours.

At 1 P.M. there was a slight general spasm, with stiffening of the limbs and retraction of the head, lasting, however, only a few moments. This occurred again in the afternoon. The dose of the mercury and jalap was reduced one-half in the middle of the day, as the quantity first ordered was found to cause sickness and vomiting.

Evening.—Rather better. No fever; some moisture of the skin; spasm of the hands very much relaxed. The diminished dose of mercury and jalap was well borne.

11th.—Rather better. Some fever still, with cough, gurgling in the throat, and distinct enlargement and hardening of the lymphatic glands at the angles of the jaw on both sides. There is still some contraction of the hands. Bowels open freely twice last night, and the stools better, being of a pale yellow color, and more homogeneous. The jalap and mercury to be suspended.

In the course of the day there were two slight general spasms, with laryngismus. The latter occurred several times during the waking state, but was not severe. Ordered three drops of syrup of ipecac, with four of sweet spirit of nitre, to be given every two hours.

12th.—Much better. Contraction of hands almost gone; very slight feverish-

ness; cough less frequent and looser; respiration easy. No spasm to-day. Stools more healthy, yellow, homogeneous, and of natural quantity.

13th.—Continues better. Contraction slight. Cough diminishing very much.

14th.—Rather pale, dull, and languid. Has had several attacks of laryngismus, one of which was quite severe, being attended with deep blueness about the mouth, and some of the face also. Does not nurse so well as formerly. The hands exhibit decided flexion of the third, fourth, and fifth fingers at the metacarpo-phalangeal articulations, with stiffened extension of the other phalangeal articulations. Thumbs slightly drawn into the palms, and the forefingers rather extended. Bowels natural. Ordered fifteen drops of brandy, and a very small pinch of the Quevenne's metallic iron in powder, three times a day.

15th.—Condition about the same. On the 22d of March, the first wet-nurse, under whose charge the child had improved so rapidly, was changed, on account of some objection to her personal appearance, and another one procured in her place. This one was a healthy-looking woman, with milk enough, but she was red-haired, irritable, and excessively high-tempered, and the child has been losing ground ever since her arrival. Under the idea that her milk did not suit the child, a third nurse was by my advice obtained to-day (15th), a calm, placid, fat, and comfortable-looking woman, with an abundant supply of milk of ten months old.

17th.—The child has improved very much She is fatter already, has a contented, tranquil expression, takes more than she did from the previous nurse, and rejects much less of the milk. The stools are now regular, occurring twice daily without aid, and of a natural appearance. The sleep of the child is better now than it has been at any time since the first wet-nurse was dismissed. The attacks of laryngismus are already much less frequent, and less severe. The hands are very nearly in a natural condition. The child is less nervous, not starting now as formerly at sounds.

To continue the brandy and iron.

From this period the child continued to improve regularly in health. She was removed to the country during the summer months, and when brought back in the autumn, was entirely well, with the exception that she was less forward in talking than most children, but not more so than might have been expected in one who had been dangerously ill for so long a time. Her intelligence was good in all respects.

February 5th, 1853.—We have seen this child to-day, and find her in very good health, except that she is rather smaller in size than is usual at her present age. She has been weaned now for about six weeks, and eats heartily and digests well most ordinary food, as milk, meat, potatoes, etc. The weaning was borne very well, except that the appetite was rather deficient and capricious, for about a week after the departure of the nurse. She can stand up when placed in the erect position, and can walk feebly when well supported, but not alone, nor can she rise up from a sitting posture. Her intelligence is, in all respects, perfect, but she does not talk as yet. There is no vestige of her former spasmodic symptoms, when she is in good health; but any little turn of sickness reproduces some contraction of one leg, and a slight flexion of the hands.

Some months after this, the child was unfortunately seized with hooping-cough. She did well for several weeks, but one day, being seized with a fit of coughing while seated upon the floor playing, died instantly, doubtless from asphyxia, caused by complete closure of the glottis by spasm. This is the only case of hooping-cough that we have ever known to prove suddenly fatal in this way. There is every reason to suppose that the fatal suspension of respiration was caused by the unnatural excitability of the sphincter muscle of the glottis, left by the previous attack of laryngismus stridulus.

ARTICLE IX.

TETANUS NASCENTIUM.

Definition; Synonyms; Period of Occurrence; Frequency.—Tetanus nascentium is a most fatal affection, occurring principally during the first two weeks after birth, usually running an acute course, and characterized by a more or less general tonic contraction of the voluntary muscles, with paroxysmal exacerbations, and usually without any period of complete relaxation until the close of the malady.

From this definition it will be seen that the affection does not differ in its essential nature from tetanus as it occurs in adults; though there are so many peculiarities in its causes and symptoms as to demand a special discussion. This disease has also been described under the names of trismus nascentium or neonatorum, in accordance with the prominence and frequency of contraction of the muscles of the lower jaw; but as the spasm is rarely limited to these muscles, but usually involves the other muscles of the face and those of the extremities, the more comprehensive name of tetanus seems more appropriate. It most frequently makes its appearance between the third and tenth days after birth, although there are cases on record in which it set in fifteen hours after birth (West), and others where it did not manifest itself until the twelfth or fifteenth day.

Causes.—The causes which have been assigned for the production of tetanus nascentium are very numerous; they may, however, be generally divided into the groups of *general* and *local*. Among the local causes, the various morbid conditions of the umbilicus and umbilical vessels hold the most prominent place. These are, however, far from being constantly present, and yet the weight of evidence is at present in favor of regarding diseases of the umbilicus, and more especially of the umbilical arteries, as occasional causes of tetanus nascentium.

In other cases, the disease has been attributed to some blow or accidental injury which the infant had received. It is, however, still a vexed question as to how much influence should be ascribed to those purely mechanical impressions in the production of this affection. One of the most powerful efforts yet made to establish their importance was by Dr. Marion Sims,[1] who published a series of articles to prove that "trismus nascentium is a disease of centric origin depending on a mechanical pressure exerted on the medulla oblongata, and its nerves; and that this pressure is the result, most generally, of an inward displacement of the occipital bone." This displacement is physiological during the parturient state, but its persistence after birth is dependent, according to his theory, chiefly upon the improper position in which infants are allowed to lie, resting upon their occiput for days together.

[1] Amer. Jour. of Med. Sci., April, 1846, p. 363; July, 1848, p. 59; and October, 1848, p. 355.

Further experience, however, has not confirmed this view, nor justified ne admission of injury to the cranial bones into the list of common auses; and yet there are a few cases on record in which tetanus undoubtedly appears to have been developed from this source.

General Causes.—Vicissitudes of temperature appear to favor the evelopment of tetanus, since it is frequent in many countries where a gh temperature during the day is succeeded by great cold during the ght. In the same way, exposure of the infant to wet and cold, as by tting damp clothes upon it, may be productive of the disease. The ost frequent and well-established cause of tetanus nascentium, however, a vitiated state of the atmosphere; whether engendered by a filthy conion of the bedding or house, or by imperfect ventilation; and it is to is that we must attribute the frequency of the affection in such dissimilar calities as the Western Hebrides, Iceland and the neighboring islands, inorca (see Cleghorn, *Observ. on Epidemical Diseases of Minorca*, London, 68, p. 81), and some of the Southern States of America, where it was rmerly not at all unusual for 50 per cent. of all infants born to perish ring the first two weeks from this cause alone. It was formerly supsed that certain localities, pre-eminent among which are those just mened, were peculiarly favorable to the development of this disease, but is probable that no predisposition exists excepting the fluctuations of climate and the filthy habits of the people.

The very great importance of filth and deficient ventilation as a cause tetanus nascentium is, however, most forcibly shown by the great reducn in the frequency of this disease in large lying-in asylums, effected by introduction of more thorough ventilation and a greater regard to nliness. This was conclusively demonstrated in the Dublin Lying-in lum towards the close of the last century. Previously to the year 1782, 7,650 infants born alive in the asylum, 2944, or almost one-sixth, had l within the first fortnight, and in almost every one of these the cause eath was tetanus nascentium. During the next seven years, after Dr. rke had simply introduced a much more complete system of ventilation he wards, of 8033 children born, only 419 in all died, or about 1 in 19, $\frac{1}{5}$th per cent.

ur comparative immunity in this part of America, even among the in our cities, is probably due to the greater degree of cleanliness in houses, and to the improved construction of our hospitals and ums. In New York, however, according to Dr. Smith,[1] there are more hs from tetanus during the first year of life than at all other ages ther.

e mortality returns of this city indicate that tetanus, although comtively frequent among infants, is much less so than in New York. us during the 9 years from 1860 to 1868 inclusive, the returns show al mortality (less still-born), at all ages, of 127,563, and under 1 year 5,765. During this period there were 233 deaths from tetanus at all ; 61 of which were during the first year of life, and 157 after that

[1] Amer. Jour. of Med. Sci., July and October, 1865; and op. cit., p. 168.

age. Thus the proportion of deaths from tetanus to those from all causes was, after the age of one year, as 1 to 598, and during the first year of life, as 1 to 602.

During this same period, the number of births in Philadelphia amounted to 146,895.

Pathological Appearances.—We have already alluded to the morbid conditions of the umbilical vessels or umbilicus occasionally found in tetanus nascentium; it is evident, however, that if these lesions have any connection with the disease, they merely act as exciting causes.

The only characteristic lesions of this affection are presented by the nervous system.

The brain and its meninges are frequently found intensely congested, though this is not so uniformly present as a similar condition of the spinal cord; according to numerous observers, however, it is more frequently present than absent. In some cases, this congestion has led to an actual effusion of blood, either between the skull and dura mater, into the arachnoid cavity, or into the ventricles. In some cases, instead of hæmorrhage, there has been found serous effusion into the ventricles or into the subarachnoid space, accompanied with a diminution of consistence of the cerebral substance, as reported by Matuszynski.

The morbid appearances found in connection with the spinal cord are the same in character as the above, but more constant and even more marked. The vessels of the spinal meninges and of the substance of the cord are intensely congested, and there is frequently effusion of blood into the cavity of the arachnoid.

The value of these appearances was formerly underestimated from a suspicion that they might be partly, at least, due to the mere gravitation of the blood after death. This suspicion has, however, been entirely removed by the observations of Weber of Kiel, and Finckh of Stuttgardt, who placed the bodies of infants dying with tetanus in various positions before examining them, and yet invariably found the above-mentioned conditions.

There is, however, a further source of doubt as to the significance of these lesions. We have already seen, in speaking of eclampsia, an affection in which no appreciable material lesion has as yet been detected, that, in a certain proportion of cases, congestion, serous effusion, or actual hæmorrhage might be present not as causes but as effects, and due merely to the intense venous engorgement caused by the embarrassment of the respiration and venous circulation during the convulsion. It is, indeed, it seems to us, highly probable that a similar interpretation may be placed, in many cases at least, upon the morbid appearances above mentioned as being found after death from tetanus nascentium.

We have thus enumerated the lesions of the nervous system which are readily discoverable in many fatal cases of tetanus; and yet these lesions are, it will be observed, almost without exception concerned merely with the vascular supply of the brain and spinal cord, and we are as yet without any accurate investigations into the condition of the nervous tissue itself. Within the past few years, the wonderful advances of microscopi

al science, as applied to pathological anatomy, have revealed structural hanges in the nervous system in connection with more than one disease, hose pathology has heretofore been utterly obscure, and it is not too much hope that at no distant period the question of the presence of any definite structural change in the brain or spinal cord in cases of tetanus nascentium will be positively settled. In connection with this suggestion, pecially in consideration of the analogy between this disease and tetanus the adult, we append the results of the investigations of Rokitansky and emme upon the microscopical appearances in the spinal cord in fatal ses of this latter affection.[1]

1. The constant anatomical character of tetanus appears to be proliferion of the connective tissue (of the cord); the most striking peculiarity this lesion is the extent over which it is found.

2. The product is a viscous mass, abounding in nuclei; it remains at this ge of development in both acute and chronic cases, never progressing to e formation of fibres.

3. This change is found almost exclusively in the white medullary subnce; the gray matter seems to suffer only secondarily, and then from mpression rather than interstitial deposit.

4. The proliferation is not always followed by corresponding swelling of white matter; it can often be recognized only by means of the micrope.

5. It was principally found in the medulla oblongata, the crura cerebri, inferior peduncles of the cerebellum, and in the greater part of the nal cord.

6. This lesion of the connective tissue appears to be due to long-contin- or repeated congestions.

7. The period at which it occurs probably varies in different cases.

These observations, which were originally published about 1860, have n confirmed in all essential particulars by Wagner (*Syd. Soc. Year-Book*, 2, p. 219); and still more lately by J. Lockhart Clarke, who published he *Med.-Chir. Trans.*, vol. xlviii, the results of the microscopic examin- n of the spinal cord in six cases of tetanus, in all of which structural ons were discovered; and by Dr. Dickinson (*Med.-Chir. Trans.*, vol. li, 65).

YMPTOMS.—There are rarely any premonitory symptoms of the attack, the onset and development of the disease are usually gradual. The iest symptom noticed is, in most cases, difficulty in nursing; the infant earing anxious to nurse and eagerly pressing its mouth against the nip- but being unable to fully take it into the mouth or to suck, from a l condition of the masseter muscles. At the same time it utters a npering, whining, unnatural cry.

he tonic muscular contraction very rarely remains limited to the mas- s, but soon invades the other muscles of the face, and those of the k and extremities.

ie expression of the face thus produced is indicative of great suffering;

[1] Schmidt's Jahrb., vol. iii (in New Syd. Soc. Year-Book, 1864, p. 232).

though it is impossible to say how truly this represents the sensations of the patient.

The face is drawn into wrinkles and furrows, and has a strange appearance of age. The condition of the mouth, however, is most characteristic; the jaws are firmly fixed, the lips slightly separated and pressed firmly against the gums, and the angles of the mouth drawn backwards and downwards in the well-known risus sardonicus.

During this time, the other voluntary muscles gradually become rigid. At first, their contraction can be overcome by the use of a moderate degree of force, but in the course of twelve or twenty-four hours the period of maximum rigidity is attained. The head is drawn backwards, and firmly fixed; the arms are flexed, and the hands clenched, with the thumbs drawn across the palms. The thighs may be flexed upon the pelvis, or the legs crossed; the great toes are usually adducted and separated from the rest, which are flexed.

The contraction of the dorsal muscles frequently produces opisthotonos; and the entire body is at times rendered so rigid that it can be raised, without bending, by placing a hand under the heels and head. This extreme degree of spasm of all the voluntary muscles may never be developed in some cases; or, when present, it often is not so persistent. When the infant is quiet or sleeping, there is usually a certain degree of relaxation. It is a marked peculiarity of the affection, however, that exacerbations of the tonic spasm are produced by the slightest exciting causes, as an effort at deglutition, a sudden noise, a puff of air, the most delicate touch, or even the alighting of a fly upon the surface. During these paroxysms or clonic spasms, the muscular rigidity and contraction attain their greatest height, and produce the most painful distortion of the face and limbs. The fit, according to West, may be ushered in by a screech. During its continuance, there is serious interruption of respiration and circulation; the surface becomes livid, and epistaxis may occur. It is during this condition, too, that hæmorrhages into the brain or spinal cord, or their meninges, may result.

These paroxysms recur at irregular intervals, but usually, in fatal cases, occur with increasing frequency until either the child expires suddenly during one of the fits, or passes into a state of coma.

The pulse does not present any characteristic change; in some cases it has been found accelerated, but in others has continued normal, or has even fallen below the healthy rate.

The condition of the bowels is not uniform. Diarrhœa is frequently present, but is probably due to irritation of the bowels from the irritating nature of the ingesta, or to some accidental cause; particularly as the bowels are occasionally constipated in well-marked cases.

The appetite generally appears to continue, but we have already alluded to the fact that any attempts to feed the child bring on violent spasms, which expel the greater part of the food taken into the mouth. Owing principally to this obstacle to the nourishment of the infant, the emaciation is more rapid and marked in this than in almost any other affection of infancy.

The state of the pupils in tetanus nascentium has not been noted with sufficient frequency or accuracy to allow any deductions to be drawn with regard to it. Smith has seen the pupils contracted in the last stage of the disease.

Prognosis.—The majority of authors state that they have never met with a case of recovery from fully established tetanus nascentium.

Dr. Smith has, however, collected 8 cases of recovery, in the histories of which he calls attention to two important peculiarities; that the children were all about a week old when the initiatory symptoms appeared, and that there were fluctuations in the symptoms of the disease. The only circumstances, then, which would lead us to form a less gloomy prognosis than usual, are the late appearance of the disease, and the mildness and intermitting character of the symptoms.

Dr. Hüttenbrenner (quoted in *Boston Med. and Surg. Jour.*, Feb. 12th, 1874) has lately published the results of more recent clinical experience in regard to this disease, from which it appears that although the prognosis is very unfavorable, it must not be considered absolutely fatal.

The *diagnosis* of this affection presents no difficulties, being readily made by attention to the persistent muscular contraction, the inability to suck or to take food, and the exacerbations which are produced by the slightest causes.

Duration.—In fatal cases, the duration rarely exceeds forty-eight or seventy-two hours, and death frequently occurs during the first day. There are instances, however, in which its course has been prolonged to the sixth, or even the ninth day; and Smith refers to two remarkable fatal cases, recorded by Underwood and Elsässer, in one of which the duration was six weeks, and in the other thirty-one days.

Dr. Wells has reported (*Brit. Med. Jour.*, Dec. 21st, 1861) the following case of chronic trismus: The child died at the age of one year—having been, from its birth, in a state of tonic spasm or trismus; it was always restless, and appeared ill nourished, though there was no reason for this. All treatment was unavailing. It was suggested that the child's state might proceed from irritation due to the mother's milk; and the child was weaned, but without benefit. At the post-mortem examination, there was found a considerable opalescent effusion over the surface of the brain; the cerebellum was harder than usual, and on being cut into presented a homogeneous appearance. The arbor vitæ was entirely wanting.

In favorable cases, the duration varies from a few days to one month, or even more.

In the 8 favorable cases collected by Smith, the duration was, in 1 case, two days; in 1, a few days; in 1, fourteen days; in 2, fifteen days; in 1, twenty-eight days; in 1, thirty-one days; and in the remaining case, about five weeks.

Prevention and Treatment.—It is fortunate that we can by wise hygienic measures do much to prevent the occurrence of a disease of such fatality, and in which, when once fully developed, treatment is so unavailing. We have already alluded to the vast diminution in the number of deaths from this disease, which followed the introduction of free ventilation

and cleanliness into the wards of the Dublin Lying-in Hospital. Nor are the good effects of this practice limited to public institutions, but it has been found that wherever the disease has prevailed to any extent, as on the Southern plantations, its progress can be arrested by insisting upon the observance of cleanliness in bedding and clothing, of mother and child; by cleaning, disinfecting, and freely ventilating the houses; by care in dressing the umbilical cord; and, finally, by attention to the food of the infant, and the condition of its bowels.

Even when the disease has made its appearance, these same measures should be carried out with equal care, since by removing all possible causes, so far as we are acquainted with them, we may mitigate the severity of the attack.

In addition to the removal of the causes, the strictest quiet should be enjoined, and all care employed to avoid exciting the violent paroxysms, which are so readily induced.

It would be well, in addition, to examine the occipital region, to discover if the occipital bone be unnaturally depressed, since in one or two cases this has appeared to act as the exciting cause of the attack. If such depression be found, the position of the child should be varied by placing it on its side, in accordance with the recommendation of Dr. Sims.

The application of leeches to the nape of the neck or along the spine, appears indicated in the early stage of the disease. Dr. West advises the practice, though he has had no experience in its use. Collins, however, states he has tried frequent leeching along the spinal column, without the least benefit.

Purgatives are only useful to the extent of maintaining regular action of the bowels.

The remedies which have been most highly recommended as directly curative, are ether and chloroform, and various narcotics and antispasmodics, as opium, hydrate of chloral, belladonna, aconite, cannabis Indica, conium, woorara, tobacco, and assafœtida.

Anæsthetics have been employed frequently in tetanus of the adult, and occasionally in the affection under discussion. Despite, however, the great expectations which were entertained in regard to their utility, their action cannot be considered directly curative. They relieve suffering, however, and by temporarily allaying the spasmodic contraction of the muscles, enable us to administer food or remedies, and thus prolong life, and give time for other agents to act. "So long, therefore, as the patient is able to take food and to obtain periods of comparative quiet, the use of anæsthetic inhalations is not desirable. Great advantages may, however, be obtained from them if he be unable to open the jaw sufficiently to permit of taking food, or if the tetanic spasms are without remission. Ether appears to have stronger facts in its recommendation than chloroform." (J. Hughlings Jackson, and Hutchinson's Report on Tetanus, *Med. Times and Gaz.*, April 6th, 1861.)

The evidence in regard to the superior efficacy of any particular narcotic, is highly conflicting. Opium has, until recently, been the one usually relied upon, and several recoveries have occurred under its use.

Of late years, however, various other narcotics have been employed, especially in traumatic tetanus in the adult. Thus belladonna and its alkaloid atropia have been used, the latter hypodermically, with occasional good results. If the sulphate of atropia is used hypodermically in infants, the first dose should not exceed the $\frac{1}{200}$th or $\frac{1}{150}$th of a grain, so that its effects may be tested carefully. One-half grain of the salt may be dissolved in a fluid ounce of water, and four to six drops injected under the skin along the spine.

The various preparations of cannabis Indica have also been extensively used. Dr. Gaillard reports two cases of recovery from tetanus nascentium under this treatment; in one of which the infant, aged eight days, took as much as f℥ss. of tincture of cannabis Indica in a single day—being equivalent to about eleven grains of the pure extract. This quantity, however, appears excessive.

Woorara has been given in twenty-two cases, according to Demme, with eight cures. It has been recommended by Harley, Spencer Wells, Broca, Vella, Chassaignac, and others. The dose in which this poisonous substance has been given, is from one-eighth to one-half a grain to an *adult*. The great objection, however, to both this remedy and cannabis Indica, is the great want of uniformity in the strength of their preparations, which necessitates the utmost caution in their use.

More recently still, numerous cases of tetanus in the adult have been treated with the various preparations of conium, and with its alkaloid conia, and also with hydrate of chloral, and the results have been of a decidedly encouraging character. Hüttenbrenner (*loc. cit.*) especially recommends hydrate of chloral, which, according to his observations, is preferable to all other remedies in this disease.

Among the antispasmodics most frequently used, are assafœtida and tobacco, either given internally or by enema, or added to a warm bath. There is no very positive evidence, however, of their efficiency in this disease.

Baths, either of warm water or vapor, should be repeatedly given; they tend to act favorably as sedatives, by relaxing the muscular spasm, and, in addition, excite the action of the skin.

The free use of large doses of quinine, usually in combination with one of the narcotics above mentioned, appears to be serviceable in traumatic tetanus, by reducing the frequency of the pulse and mitigating the tendency to spasm, so that the induction of cinchonism in tetanus nascentium is a measure worthy of a fair trial.

The application of ice to the spine has been highly recommended in tetanus in adults, and is reported to have been used with success in several cases. The condition of the bloodvessels of the cord and its membranes, in fatal cases of tetanus nascentium, would certainly appear to indicate its use in this affection also.

Whichever of the above plans of treatment may be adopted, it must never be forgotten that one of the principal dangers and most frequent causes of death in this disease, is the obstacle offered to the nourishment of the infant. We must pay attention, therefore, to the administration of

milk, meat-broths, and alcoholic stimuli in small quantities, but frequently repeated; and if the rigidity of the jaw and the occurrence of spasms upon every attempt at deglutition, prevent the child from taking food, we should have recourse to anæsthetics to relax the spasmodic muscular contraction, and enable us to get nourishment into the stomach.

ARTICLE X.

CHOREA.

DEFINITION; SYNONYMS; FREQUENCY.—Chorea is a non-febrile, convulsive disease, characterized by irregular and imperfectly co-ordinated, but not completely involuntary contractions, of different parts of the muscular system, and particularly of the muscles of the face and of the extremities.

It is called also St. Vitus's dance, chorea sancti viti, choreomania, epilepsia saltatoria, and by various other titles.

It is evidently impossible at present to determine the frequency of chorea, as it rarely proves fatal, and consequently scarcely figures in the mortality reports. It must, however, be quite frequent, since it rarely happens to us not to have several cases under treatment at any one time, either in private practice or in some public institution. M. Rufz states (*Dict. de. Méd.*, t. vii, p. 544), that of 32,976 children admitted into the Children's Hospital of Paris in ten years, only 189 were affected with chorea, or 1 in 377.

PREDISPOSING CAUSES.—*Age.*—Chorea very rarely occurs during infancy. According to M. Rufz, it is seldom met with between one and six years of age, since of 189 cases, in only ten did it occur within that period; while between six and ten years of age it is much more common (61 in 189 cases); and between ten and fifteen years still more so (118 in 189).

M. Sée, in a valuable essay on chorea (*Mém. de l'Acad. Nat. de Médécine*, t. xv, p. 373), and the relations of rheumatism and diseases of the heart with nervous and convulsive diseases, states (page 448), that of 531 cases of chorea treated in the Children's Hospital at Paris, during a period of twenty-two years, 28 were under six years, 218 between six and ten years, and 235 between six and fifteen years of age. M. Sée concludes, after carefully sifting the facts, that the true maximum of frequency is comprised between six and eleven years of age, and that it corresponds especially to the tenth year. Under six years of age it becomes more and more rare as we approach the moment of birth. MM. Simon and Constant, however, met with it in nursing children of twelve, six, and four months of age.

The statistics furnished by Hillier[1] confirm these statements in every detail. Thus, of 422 cases treated as out-patients at the Children's Hos-

[1] Diseases of Children (Amer. ed., 1868, p. 234).

pital in London (where no patients over twelve years are received), the numbers at different ages were as follows:

From 3 months to 6 months,			3	From 6 years to 7 years,			48
" 6 "	12 "		5	" 7 "	8 "		51
" 12 "	18 "		2	" 8 "	9 "		58
" 18 "	2 years,		4	" 9 "	10 "		80
" 2 years	3 "		6	" 10 "	12 "		104
" 3 "	4 "		11				422
" 4 "	5 "		20				
" 5 "	6 "		30				

Of 1984 cases of all kinds treated in the wards of the Children's Hospital of this city during the period of twenty years ending with the close of 1875, there were 65 cases of chorea. The ages of these were as follows:

Under 5 years,			2	At 11 years,			8
At 6 years,			7	" 12 "			9
" 7 "			5	" 13 "			4
" 8 "			6	" 14 "			2
" 9 "			7	" 15 "			1
" 10 "			14				

Sex.—It is much more frequent in girls than boys. Of the 531 cases cited by M. Sée, 393 occurred in girls, and only 138 in boys. This is the same result as that attained, M. Sée remarks, by Reeves, Good, etc.,—131 girls in 186 cases. This accords entirely with our own experience, and in a very interesting statistical report by Dr. George S. Gerhard, based on 80 cases observed in this city (*Amer. Jour. Med. Sciences*, July, 1876, p. 99), the number of female patients just doubles that of the males, 53 to 27. Of the 65 cases occurring in the Children's Hospital, tabulated above, 38 were in girls, 27 in boys.

This excess of females over males obtains in chorea of every grade, from the mildest to the most rapidly fatal cases.

Rapid growth and the *second dentition* probably act, in a considerable degree, as predisposing causes of the disease. Particular attention is drawn to these conditions by MM. Rilliet and Barthez, and the precise age at which it is most frequent (between six and eleven years), would seem to show that they exert a very positive influence. The general deterioration of the health, resulting in anæmia, and the exaggerated nervous susceptibility, so often observed at these periods, are probably the immediate causes of the frequency of the disease at this epoch of life.

Drs. Gerhard (*loc. cit.*) and S. Weir Mitchell report that they have observed that chorea occurs more frequently and in a more severe form in the spring than at any other season; and also that relapses of the disease are most apt to take place at that time. They think this is probably attributable to the condition of weakness of the system which exists in the spring.

An altered and anæmic state of the blood has also been supposed, as by Ogle[1] and Barnes,[2] to be the efficient and exciting cause of the affection.

[1] Brit. and For. Med.-Chir. Rev., Jan. and April, 1868, pp. 208, 465.

[2] Chorea in Pregnancy, Proc. of Obstet. Soc. of London, vol. x, 1868, p. 147.

Rilliet and Barthez,[1] also, when speaking of rheumatism as a cause of chorea, say that, "while admitting the existence of rheumatic chorea, it must not be forgotten that the disease is frequently of a different nature, and that we meet in authors with incontestable examples of chorea consecutive to chronic diseases that have produced a debilitated condition of the economy, . . . as chlorosis, anæmia, and tuberculosis."

Constitution does not seem to exert much influence in its production, though it is generally thought to be most apt to occur in children of delicate, excitable, and nervous temperament. The belief in *hereditary* predisposition seems to be unfounded save in rare cases. The disease appears to commence more frequently in spring and summer than in winter, and yet it is scarcely known in tropical climates.

Rheumatism, however, is unquestionably the condition in connection with which chorea occurs more frequently than with any other. The evidence of all observers of experience is unanimous upon this point. M. Sée (*loc. cit.*) asserts, after much examination of this subject, that one-half the cases of chorea are dependent upon the rheumatic poison. Thus of 109 cases of rheumatism admitted into the Hôpital des Enfants, he found that 61 were complicated with chorea. Trousseau[2] also states that in his experience rheumatism was undoubtedly the most marked cause of chorea. M. Henri Roger[3] asserts their connection even more strongly, and states that "the coincidence of chorea and rheumatism is so common a fact that it ought to be regarded as a pathological law, just as much as the coincidence of heart disease and rheumatism."

In England, also, this connection between rheumatism and chorea, both of the mild and severe or fatal form, is positively stated by numerous authorities. Thus in 104 cases of the list collected by Dr. Hughes,[4] "where special inquiries were made respecting rheumatic and heart affections, there were only 15 in which the patients were both free from cardiac murmur, and had not suffered from a previous attack of rheumatism." Hillier (*op. cit.*, p. 236) "believes there is a very close connection between these diseases." West (*op. cit.*, 4th Am. ed., p. 188) says: "Be the exact relation then what it may, it does seem that rheumatism, or the rheumatic diathesis, is a very powerful predisposing cause of chorea." Dr. H. M. Tuckwell, in a valuable article[5] on the pathology of chorea, strongly upholds their frequent connection, and cites 17 cases of his own, in 11 of which the previous occurrence of rheumatism was allowed, while it was denied only in 6.

Dr. Chambers found that out of 33 cases of chorea in his books, in 6 the affection either began during rheumatic fever, or followed immediately after it, or else rheumatic fever succeeded to the chorea. In 80 cases of non-fatal

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[1] Op. cit., 2ème ed., t. ii, pp. 565–598.

[2] Clin. Med., 2ème ed., t. ii, pp. 160–198.

[3] Arch. Gén. de Méd., 1866, vol. ii, p. 641; and 1867, vol. i, p. 54; and Gaz. Méd. de Paris, March 7, 1868.

[4] Guy's Hospital Rep., 2d series, vol. iv, 1846.

[5] St. Barth. Hosp. Rep., vol. v, 1869, pp. 86–105.

chorea recorded by Ogle,[1] it appears that in 8 cases rheumatic fever had existed.

On the other hand, several German authors of high authority do not attach so much importance to the causative influence of rheumatism in chorea. Thus Romberg[2] states that he has not observed their connection frequently; and Vogel[3] states that, "although it must be acknowledged that chorea may succeed to acute rheumatism, still the frequency of the occurrence has been very much overestimated."

Steiner[4] also states that out of 252 cases of chorea the disease ensued during the decline of acute articular rheumatism in but 4 cases; of 3 fatal cases, however, reported by him, one was complicated with rheumatic heart disease.

We must also allude to the argument of Vogel (*op. cit.*, p. 399), that if there were any actual connection between these diseases, then more girls than boys ought to suffer from rheumatism; for it is well known that the former are predominantly subject to chorea. "Just the reverse happens to be the case in rheumatism, which notoriously attacks more boys than girls." We have already quoted extensive statistics, which prove the truth of the first of Vogel's statements; but we are by no means convinced that the latter is correct, and that rheumatism is more frequent in boys than in girls. On the contrary, the statistics quoted by Tuckwell (*loc. cit.*, p. 102) go to show that the reverse even may be the case. Thus during sixteen years there were admitted to the Children's Hospital in London 478 patients with rheumatism, 252 of whom were females, and 226 males.

We are not aware of the existence of any accurate statistics of the disease in this country in regard to this point, excepting those of Gerhard (*loc. cit.*), in whose 30 cases rheumatism was assigned as the cause in only 4.

The great weight of evidence, however, which has been accumulated in favor of such a connection, together with the decided results of our own observation, appears to us to leave no doubt that in a considerable proportion of cases, chorea is in some way connected with the previous occurrence of rheumatism. We shall have occasion to call attention to the obscurity which frequently attends the manifestations of rheumatism in young children; and it is, therefore, highly probable that in not a few cases of chorea, where, on inquiry, the parents deny the previous occurrence of rheumatism, the truly rheumatic nature of some acute febrile attack, with which the child may have suffered months before, has been entirely overlooked.

We will postpone, until we come to discuss the nature of this affection, the consideration of the manner in which rheumatism disposes to chorea, whether by directly causing centric lesions, as of the spinal meninges; or by inducing a state of anæmia, impaired nutrition, and preternatural mo-

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[1] Brit. and For. Med.-Chir. Rev., April, 1868, p. 490.

[2] Dis. of Nerv. Syst. (Syd. Soc.), 1853, vol. ii, p. 57.

[3] Op. cit., p. 399.

[4] Preg. Vjrschr. xcix (xxv, 3), p. 43, 1868; in Schmidt's Jahrb., Bd. 142, No. 4, 1869, p. 26.

bility of the nervous system; or whether the choreic movements are in some way connected with cardiac disease, which so frequently attends rheumatism in the young.

Exciting Causes.—Of many exciting causes that have been mentioned by different writers, the one most frequent and most clearly proven, is the influence of terror. It was assigned as a cause in 31 out of 56 cases collected by Duffosse and Bird, in 34 out of 100 cases collected by Hughes, in 25 out of 128 by Sée, in 9 out of 31 by Peacock, in 9 out of 38 by Hillier, and in 7 out of 30 by Gerhard. Besides this are cited imitation, blows and falls upon the head, fits of violent anger, contrarieties, prolonged excessive mental effort in young subjects, masturbation, the difficult establishment of the menstrual function in girls, or suppression of that function, the sudden drying up of ulcers or eruptions, and, in females after puberty, pregnancy, which indeed is a well-ascertained and most important cause.

In a very interesting case reported by Packard (*Amer. Jour. Med. Sciences*, April, 1870, p. 347), a child of 11 was attacked with very violent and persistent chorea following severe irritation of the ulnar side of the matrix of the right thumb-nail due to a large splinter of wood. The chorea persisted, despite judicious treatment and a residence at the seashore until the irritated filaments of the ulnar nerve were excised, after which speedy and permanent improvement ensued.

Chorea has also been observed in the course of, or as a sequel to, various acute diseases, as pneumonia, the eruptive, typhoid, and intermittent fevers, and affections of the gastro-intestinal tube.

Dr. Weir Mitchell (*Amer. Jour. Med. Sciences*, Oct. 1874, p. 342) has called attention, under the name of "post paralytic chorea," to the disorderly movements of choreic nature which are frequently seen to follow paralysis either in the adult or in children. He has pointed out that it is not the ordinary infantile palsy, but rather the hemiplegia of cerebral origin, which is apt to be thus followed by chorea; and that the younger the child the more likely are these choreic sequelæ to ensue.

Anatomical Lesions.—It would appear that as yet we are unacquainted with any truly characteristic lesion in chorea. In many of the recorded autopsies, it is stated that no lesion either of the cerebro-spinal axis or any other viscus was present. As, however, most of these autopsies were made before the improved methods of microscopic examination of the nervous system were introduced, they cannot be regarded as conclusive upon this point. In many cases, also, the examination of other viscera has been too superficial to have led to the detection of minute but positive and important lesions. Upon the whole, therefore, it may be fairly said, that it is chiefly the examinations which have been made during the past few years which are of real value, and that there is still need of numerous accurate autopsies before we can consider ourselves justified in speaking of the true lesions in chorea.

It is evident that the determination of this question presents great difficulties, apart from the fact that fatal cases of chorea are comparatively rare, and that it requires an amount of skill and patient labor, rarely at

command, to make the examination with the requisite minuteness. One of these difficulties consists in the fact that, although chorea may exist as a special, individual affection, there are numerous other cases of nervous disease which are of very varied nature, but which are attended with irregular muscular movements truly choreic in character.

We think it highly probable, therefore, that all cases of so-called chorea will never be found to be invariably associated with any one anatomical lesion.

Thus, passing to the actual results of post-mortem examination, we find a number of lesions recorded which evidently refer to cases of organic disease of the nervous centres, which were merely attended with choreoid symptoms.

Among these are enlargement of the odontoid process, effusions into the arachnoid, tumors in the substance of the brain, abscess in the cerebellum, bony plates upon the spinal meninges, and many other entirely disconnected lesions.

On the other hand there are cases on record, in which careful examination has failed entirely to detect any material lesion, either of the nervous centres or of the other viscera, and in which the choreic movements were probably of a reflex character.

Of late years, however, since this question has been subjected to more frequent and critical examination, there are certain lesions which have been found so frequently after death in fatal cases of true chorea, that they must be regarded as possessing some definite connection with the disease. These lesions consist in certain morbid conditions of the heart, and of the nervous centres.

In regard to the lesions of the *heart*, M. Sée (*loc. cit.*, p. 390) states, after a careful examination of eighty-four autopsies, that "in most of the cases, and especially in those most strongly attested, chorea is the result of the rheumatic diathesis, and that it reveals itself by plastic inflammations of the cardiac membranes, of the pleura, and of the peritoneum, with or without articular rheumatism."

Bright, Copland, Todd,[1] Kirkes,[2] Nairne,[3] Begbie,[4] were also among the first to call attention to the frequency of rheumatic endocarditis in connection with chorea. In an interesting article on "Maniacal Chorea,"[5] Tuckwell gives an analysis of the lesions in 34 fatal cases of chorea collected by himself. In 25 of these the endocardium was found diseased, the presence of warty vegetations on the valves being especially alluded to in 20. Of the remaining 9, no mention is made of the heart in 5, and it is reported as healthy only in 4. The pericardium was found diseased only in 8 of the 34 cases.

In Ogle's fatal cases (*loc. cit.*, pp. 208 and 507), there were in 11 out of 17 instances more or less fibrinous deposit or granulations upon the valves or some part of the endocardium. In 2 cases only was the pericardium

[1] Lumleian Lectures, 1849.
[2] Medical Gazette, 1850.
[3] London Jour. of Med., 1851.
[4] Edin. Med. Jour., 1852.
[5] Brit. and For. Med.-Chir. Rev., Oct. 1867.

diseased. In the 14 fatal cases collected by Hughes (*loc. cit.*), vegetations were found on the valves of the heart in not less than 11.

The results of careful auscultation, during life, come to support those of post-mortem examination.

Hillier states (*op. cit.*, p. 236) that, "of 37 cases in my note-books there was probably organic disease of the heart in 25, and in 4 others there was evidence of functional derangement, whilst in 8 only was there no sign of cardiac disturbance."

Jules Simon writes from a large experience, and says: "I have been almost always able to detect well-marked evidence of cardiac affection in chorea, in the shape of organic murmurs, hypertrophy of the heart, etc."[1]

In our own experience, evidences of rheumatic heart disease have very frequently been present in cases of chorea; and also in cases which have come under our care for organic disease of the heart, there has frequently been a history of previous attacks of chorea.

It is sufficiently evident, therefore, that in a large proportion of cases of chorea, some morbid condition of the endocardium is present. The particular lesion which has been usually found, consists of fine bead-like vegetations, which either fringe the border of the mitral valve, or are seated upon the auricular surface of its leaflets.

These vegetations are in most cases readily detached from the valve, by lightly brushing them with the tip of the finger, or with a camel's-hair brush; and it has been supposed by some observers, as Ogle and Barnes, that they consisted merely of the fibrin of the blood, deposited in the agony of dissolution. We believe, however, both from the previous occurrence of valvular murmurs in cases where such vegetations have been found, as well as from a careful study of the anatomical descriptions of their appearances, and the occasional presence of the positive results of embolism, that these vegetations are produced by a process of endocarditis.

We will, however, discuss the question of their connection with chorea, when we come to speak of the nature of that disease.

In regard to the condition of the nervous system in fatal cases of chorea, there is at times no lesion appreciable, even on microscopic examination, while on the other hand there is not unfrequently marked disease, either of the nervous tissue or of the meninges.

Thus, in the 14 fatal cases collected by Hughes, the *brain* was healthy in 4, only congested in 3 cases; there was softening of the brain, with or without opacity of the membranes and serous effusion in 6, and in the seventh with opacity and congestion of the dura mater.

In 11 of the 35 fatal cases collected by Tuckwell, the brain was found softened, and in 9 only is it reported as healthy. In the 16 fatal cases reported by Ogle, the brain was healthy in 6, much congested in 8, softened in but 1, and anæmic in 1 also.

It appears, therefore, that in a notable proportion of the cases upon

[1] Nouv. Dict. de Méd. et de Chir. Prat., Art. Chorée (quoted by Tuckwell, St. Barth. Hosp. Rep., loc. cit., p. 101).

record, positive organic disease of the brain, and especially in the form of softening, has been discovered. In a few instances embolism, or occlusion of the vessels by fibrinous masses, has been observed, either in the carotid artery (Ogle), or in the minute arterial branches leading to patches of softened brain-tissue (Tuckwell). We need, however, a large series of careful observations to determine more positively how frequently lesions of the brain occur, and especially in what proportion of cases embolism is present.

The *spinal cord* has also been found softened with or without opacity and thickening of its membranes, though in a much smaller number of cases, probably in part because it has not been so frequently examined in such cases as the brain.

Of the 16 fatal cases reported by Ogle, its tissue was congested in 5; there was slight softening in 2; in 1 the upper dorsal region of the cord was completely broken down and almost diffluent. In 2 cases the cord was examined by Mr. J. Lockhart Clarke, who found in one (*loc. cit.*, p. 221) that "in the lower part of the dorsal region, at the ninth dorsal nerves, the anterior columns were swollen, and formed a convex protuberance of considerable size. In a transverse section of the cord carried through this part, and examined under the microscope, it was very evident that extensive morbid changes had been going on, the white substance had been softened, ... and in two or three places there were circumscribed effusions of blood, surrounded by granular exudations, which had probably occurred before the effusions." Similar appearances were discovered in the lower dorsal region in the other case (*loc. cit.*, p. 507).

In a case already referred to, observed by Tuckwell, of rapidly fatal maniacal chorea in a lad of seventeen years of age, in addition to several patches of embolic softening of the brain, there was marked softening of the spinal cord in the middle dorsal region.

In 3 fatal cases reported by Steiner (*loc. cit.*), there was increase in the connective tissue of the spinal cord; serous effusion in the spinal canal; and congestion or effusion of blood in the membranes at the exit of the nerves.

Finally, in the cases where embolism of the brain was observed by Tuckwell, there was also minute embolism of the *kidneys*.

In a case of fatal chorea reported by Monckton,[1] embolism of one brachial artery occurred, and, after death, large vegetations were found on the aortic valves.

We will have occasion to refer again to these various anatomical appearances when speaking of the nature of chorea.

Symptoms; Course; Duration.—The disease may be general or partial: in the first case, it affects all the limbs, the face, and some of the muscles of the trunk; in the second it implicates only one side, the upper extremities, a single member, or a certain group of muscles. It happens not rarely that the choreic movements are limited to one side of the body: thus in 80 cases of non-fatal chorea reported by Ogle (*loc. cit.*, p.

[1] Brit. Med Jour., 1866, No. 305.

488), the right side alone was affected in 24, whilst the left alone was affected in 20; and in 25 both sides were affected, though in some instances one or the other side was more involved than the opposite one. Of the 30 cases reported by Gerhard (*loc. cit.*), no less than 15 were strictly unilateral, the choreic movements being confined to the right side in 10 instances, and in 5 to the left. In a large majority of the recorded cases of unilateral chorea, the right side was the affected one. It occasionally happens, as noted by Russell (*Med. Times and Gazette*, 1868 and 1869) and Gerhard (*loc. cit.*), that a chorea, which begins as unilateral, may subsequently invade the opposite side and become general. Of 7 cases that we have seen, in which this point was noted, it was general in 4, and confined entirely to the right side in 1, and to the left in 2. We shall describe first the prodromes of the disease, then the invasion, and afterwards the symptoms as they exist in fully developed cases.

Prodromic Symptoms.—It is doubtful whether there are, as a general rule, any well-marked prodromic symptoms. The only ones that have been mentioned with any authority are irritability and peevishness of the temper, an unusual degree of impressibility, languor, debility, disturbance of the organic functions, exhibited by deranged appetite and an irregular state of the bowels, and, after a time, a certain quickness and irregularity of the movements, which mark the commencement of the characteristic symptoms of the malady.

Invasion.—The onset of the disease is, as already stated, either sudden or gradual, so that there may be several days or more before it reaches any considerable degree of severity, or it may, particularly when the case has been of a sudden and energetic nature, reach its height in a few hours. In most cases, however, it begins with some unusual and singular movements in one of the upper extremities. The choreic movements are often observed first in the fingers, and at the same time, or soon after, in the face. Sooner or later they increase in severity, and extend to the other arm, to the legs, and to the tongue, and the disease is fully developed.

Symptoms of Confirmed General Chorea.—When the disease has become fully confirmed, the movements are exceedingly diversified and irregular. The limbs are agitated by involuntary contractions of the muscles into every attitude possible for them to assume. The fingers are opened and shut, brought together or separated, without any regularity. The hands are flexed and extended upon the forearms, or pronated and supinated, whilst the forearms are flexed or extended upon the arms, and the arms moved at the shoulders into every imaginable position. Such are the irregularity and rapidity of the motions that it is often with great difficulty that the patient can seize anything with the hands, and when once the object is attained, he frequently cannot do with it what he wishes. This imperfect control over the hands and arms sometimes prevents the patient from carrying food and drink to the mouth, excepting with the utmost difficulty, and may make it necessary to feed the child.

The inferior extremities are affected in the same way as the arms. Walking is always more or less difficult, and in some severe cases impracticable. The patient totters from side to side, or walks rapidly a short

distance, and then suddenly stops. Sometimes the progress is accomplished in a zigzag direction, and at others by fits and starts as it were, whilst in others again the walk is rapid and sudden, almost a run. The child often falls while walking or running, either from meeting a slight obstacle, or in consequence of the irregular and imperfect muscular action. In some instances standing is impossible, the knees bending suddenly under the weight of the body. It was no doubt the peculiar irregular and dancing movements of the inferior extremities during the attempts to walk and stand, that gave to the disease its original name of St. Vitus's dance.

The convulsive movements of the face and head are not less singular than those of the limbs. The face is distorted into all kinds of expressions, so that it assumes by turns that of the most opposite emotions,—sadness, terror, joy, or grief. The mouth is opened and shut, or its corners drawn apart, with the greatest irregularity; the tongue is occasionally protruded between the teeth, and sometimes moved rapidly in the mouth, so as to cause a clacking sound; the lower jaw is depressed and elevated, or moved in a lateral direction, and with such violence perhaps as to injure the tongue or teeth. In consequence of the irregular motions of the tongue and mouth, articulation becomes difficult, and the child either stutters, or speaks slowly and badly, or can pronounce only monosyllables. In a case that occurred to one of ourselves, the movements of the mouth and tongue were so violent and uncontrollable that the patient, a boy nine years old, lost for three weeks all power of speech. He was at the same time unable to open or shut the mouth at will, or to swallow at the proper moment, so that in the act of feeding him, which became necessary from his entire want of control over the arms, the food was constantly spilled and spluttered about as though by an idiot. The act of mastication also was quite impossible, so that he could take nothing but fluids for a number of weeks. In another case also that occurred to one of ourselves, in a girl between eight and nine years of age, and which moreover was a relapse, the patient exhibited the same inability to feed herself, and the same difficulty in regard to mastication, so that she had to be nourished for several weeks on soft food. The speech was likewise greatly affected, it being very difficult to understand her muffled, thick, and indistinct utterance.

Whilst the face and limbs are contorted as above described, the head is moved rapidly from side to side, or backwards and forwards, or undergoes constant rotation, and, in some instances, as in two that came under our own notice, all power over the muscles of the back of the neck is lost, and the head falls from side to side, or forwards, as in an infant. In severe cases the choreic movements affect the trunk also, so that the patient cannot lie upon a bed, but rolls and twists about the floor with such violence as to bruise and excoriate the skin. Deglutition is sometimes slightly embarrassed, and the child is obliged to swallow with great rapidity; in some few cases a peculiar loud cry, like that which occurs in hysteria, dependent apparently upon spasm of the larynx, has also been observed. The muscles of the external and internal respiratory apparatus are rarely affected, though Romberg narrates three remarkable instances,

in which dyspnœa, loud whistling respiration, spasmodic contractions of the glottis, or hiccup, were present. Occasionally irregular action and palpitation of the heart are observed, and have been attributed to chorea of its muscular structure.

In some cases, also, the sphincters of the bladder or rectum are partially paralyzed. Retention of urine has been noticed in a few cases; and, on the other hand, the late Prof. William Pepper mentions having known incontinence of urine to alternate with chorea of the external muscles.

The disease is unaccompanied by pain unless it be attended with some complication, and what is very singular and remarkable, the constant and often very violent muscular contractions do not seem to occasion fatigue.

There is, however, frequently evidence of a want of muscular power, which may merely amount to an unusual susceptibility to fatigue on voluntary exertion; or complete paralysis may be present, especially in the form of hemiplegia, in cases of unilateral chorea. This latter is by far the most frequent form of palsy in choreic patients, according to our own observation. It occurred in no less than 17 of Gerhard's 80 cases—in 10 times on the right side, and in 7 upon the left.

The general symptoms require some attention. The choreic movements are almost always increased by emotion, as terror, anger, contrarieties, and by the consciousness of being observed. Sleep generally suspends them entirely. In very bad cases they are said to produce insomnia, or to wake the child frequently in the night. The intelligence is rarely affected, except in very severe and long-continued attacks; though some authors appear to have met with frequent instances of impairment or perversion of the intellectual faculties. It is said that idiocy is apt to occur in cases which last for a number of years, but it is probable that in such cases the choreic movements have been associated with some organic lesion of the nerve-centres. The temper is often irritable and capricious. General and special sensibility commonly remain natural; though in some cases, impairment of general sensibility of the parts most convulsed, even amounting to anæsthesia, is noticed. In simple, uncomplicated attacks, the pulse, as a rule, remains natural: the appetite is preserved; there is no unusual thirst, and the bowels continue regular.

The *urine* has at times been observed to be of unusually high specific gravity, and to contain an excess of urates and oxalates. These conditions do not, however, appear to be at all constant or characteristic.

In a considerable proportion of cases of chorea (see statistics on page 586), a bruit is heard on auscultating the heart, usually of low pitch, and not very great intensity. In some cases this is undoubtedly due to the vegetations so frequently found on the valves of the heart in this disease, but in others it appears to be rather due to the anæmic state of the blood, and in those cases where palpitation exists, it may be due to the irregular contractions of the walls of the heart. It has also been noticed that the murmurs in chorea are often transitory, and even intermitting.

The *course* of the disease is acute or chronic. In a large majority of cases it is acute, the symptoms becoming more and more violent until the

reach their height, when they remain stationary for a time, and then subside and disappear under the influence of treatment, or in the natural course of the malady. It has been frequently noticed that when an acute febrile or inflammatory disease is developed during the course of chorea, the spasmodic movements are very apt to diminish or entirely cease for the time. In fatal cases the symptoms are constantly aggravated; the movements become so violent as to make it necessary to secure the child in bed, or in a strait-jacket; the patients, deprived of sleep, become feeble and emaciated; the respiration becomes difficult; intelligence is abolished; the pupils are contracted; and the child dies.

The *duration* is irregular, varying in acute cases between one and three months. The average duration is probably about six or nine weeks. In very slight attacks it may be much less. The duration of chronic cases is from months to years. In fatal cases the duration is sometimes very short. In one it was only nine, and in another twenty-seven days. The local forms of the disease are often peculiarly intractable, and last many years.

Relapses.—Relapses are quite common and are said by Trousseau to be shorter than the original attack. We have, however, in a few cases, observed that the relapse was much worse than the first attack. In one case in particular, the relapse was one of the most violent and prolonged attacks that we have seen. MM. Rilliet and Barthez state they occurred in six out of nineteen cases seen by them. The relapses in these cases occurred once, twice, and three times. M. Sée (*loc. cit.*, p. 408) says that it is not uncommon, after some weeks of respite, or several months of apparent recovery, to see the disease reappear with renewed intensity, and be thus repeated twice, thrice, and even seven times in succession. Out of four patients, at least one, he states, remains thus under the influence of the disease. Of 158 cases he counted 37 relapses, of which 17 were arrested after the second attack; 13 suffered a third, and 6 a fourth attack; and, lastly, one had seven distinct seizures, each one of which was separated from the following by a well-marked interval. In 46 of Ogle's cases in which this point was noted, previous attacks had occurred in 25; in 5 of which there had been 2 previous attacks, and in 1 no less than 7. According to Gerhard, relapses, like the primary attacks, occur most frequently in spring.

Nature of Chorea.—In considering the essential nature of chorea, it is evident that there are two points of importance to be determined, namely, the precise portion of the nervous system involved, and the nature of the morbid change in this part.

Before alluding to the views which have been entertained in regard to the first of these questions, we would refer to the very great irregularity which exists in different cases in the extent and distribution of the choreic movements. Thus it frequently happens that the disease is strictly confined to one or the other side of the body, or it may be entirely symmetrical. In other cases the muscles of the head and neck may almost or quite escape, while both legs and one or both arms are affected. Or, on the other hand, the choreic movements may first appear and remain most

severe in the muscles of the face, mouth, and tongue. It seems probable to us, therefore, that there is no one special portion of the motor centres which is exclusively the seat of lesion in all cases of chorea. In the great majority of cases, however, the symptoms are so far uniform that the muscles of the face and tongue, as well as those of the extremities, are affected, and the only peculiarity is that the irregular movements may be confined to one or the other side, a circumstance susceptible of ready explanation.

Marshall Hall considered chorea as an affection of the true spinal system, and possibly in some cases where the choreic movements are limited to the extremities and symmetrical, this supposition may be correct.

In the vast majority of cases, however, it is undoubtedly necessary to locate the seat of disturbance in chorea at a higher point in the cerebro-spinal axis, one above the decussation of the anterior pyramids, and probably in or near the corpora striata. Among the arguments which lead to this view, many of which have been advanced by J. Hughlings Jackson[1] and Broadbent,[2] who strongly uphold it, may be stated the following: That the muscles of the face are very frequently affected by the choreic movements; that in the great majority of cases the movements cease during sleep; that the affection is frequently limited to one side of the face and body, and that the spasmodic movements not rarely terminate in complete hemiplegia. In a footnote (*loc. cit.*, p. 93) Tuckwell says: "It is just to Dr. Todd's memory to add, that he long ago (*Lancet*, 1843, vol. ii, p. 463) showed that the choreic phenomena cannot be explained by the hypothesis which refers them to irritation of the spinal cord. He says: 'The hemiplegic tendency is utterly inexplicable according to that view. The affection of one-half the body would alone refer to some point above the decussation of the pyramids as the seat of irritation.'" The supposition of Carpenter and others that the cerebellum is the seat of the disturbance in chorea, was based upon the view that that organ possessed the chief power of co-ordinating muscular movements. Recent researches into the functions of the cerebellum, as well as the arguments which have been adduced above, render this supposition untenable.

The further question now remains as to the condition into which the affected part of the motor centres is brought, in order to produce the phenomena of chorea. And it is especially in regard to this point that the investigations of Jackson and Broadbent, above referred to, are of so much value. These pathologists, and paticularly the latter, have called attention to the fact that the choreic phenomena are symptomatic merely of the seat of the disease, and that the only essential condition of their production is an impairment of vigor and instability of the sensori-motor ganglia, a condition which may probably be induced in different ways.

We are now prepared to consider the manner in which the various causes of chorea may be supposed to act.

We have already seen that in a certain number of cases chorea is inde

[1] Reynolds's Syst. of Med., Art. Chorea, vol ii, p. 127, footnote; and Med. Time and Gaz , March 6th, 1869.

[2] British Med. Jour., 1869.

pendent of any appreciable lesion of the nervous system. In some of these cases it is possible that the impaired nutrition of the motor centre may result from an altered and anæmic state of the blood; and, indeed, it appears to us quite as reasonable to explain a certain class of cases of chorea in this manner, as to apply the same explanation to analogous cases of paralysis.

It is probable, also, that in another group of cases, chorea may be *reflex* in character, and depend upon a different degree of that peculiar action upon the motor centres which produces reflex paralysis, whether by exhausting their excitability or by causing a reflex spasm of their vessels. This view is maintained by Broadbent (*loc. cit.*) as well as by Radcliffe,[1] who states that irregular choreic movements may be produced not only by injury of certain parts of the nervous system, but by injury of certain nerves at a distance from the nervous centres, the portions of the cerebro-spinal axis which are concerned in the development of such movements, being affected by reflex action.

It is probable that if this mode of production be admitted, it will serve to explain a large number of cases of chorea, both where the source of irritation is at a distance (as in cases of pregnancy, or where there are worms in the intestinal canal, or, as in the case already quoted from Packard, where a splinter was lodged in the matrix under a finger-nail) and where it is seated in immediate connection with the nervous centres. As instances of the latter kind, may be suggested such conditions as thickening of the meninges of the brain or spinal cord, and the presence of bony spiculæ developed in the meninges.

Finally, we must admit as a cause of chorea, primary alterations of the tissue of the sensori-motor ganglia and adjacent parts; the degree of disease not being so great as to abolish entirely their function and produce paralysis, but only sufficient (as for instance would be secured by an early stage of softening) to weaken it and render it unstable.

It will be seen from the foregoing remarks that we deem it impossible, at least in the present state of our knowledge upon the subject, to consider the cause and mode of production essentially the same in all cases of chorea, and that we are disposed to admit the existence of cases due to mere anæmia and impaired nutrition, or to an altered state of the blood; of cases due to reflex irritation, in both of which classes of cases, some minute and as yet inappreciable lesion may exist; as well as of cases which are due to primary material alterations of the sensori-motor ganglia.

We have already, in considering the causes and anatomical appearances of chorea, had occasion to dwell upon the connection which exists between it and rheumatism, and before leaving the present subject it is desirable to refer to the various explanations which have been offered of this circumstance. Among these, the most important and interesting is that of Kirkes,[2] who, noticing the frequent presence of vegetations upon the valves of the

[1] Reynolds's Syst. of Med., Art. Chorea, vol. ii, p. 126.

[2] Med. Times and Gaz., 1863, vol. i, pp. 636 and 662.

heart in fatal cases of chorea, was led to suggest that very small fragments of fibrin might be detached from the valves, and entering the circulation cause temporary obstruction of the minute capillaries of the nervous centres, producing irritation and impaired nutrition. This theory, which attributes the production of chorea to embolism, has been accepted by J. Hughlings Jackson (*loc. cit.*), by Savory,[1] by Tuckwell (*loc. cit.*), and, in part at least, by Broadbent (*loc. cit.*).

It is supported strongly by the facts that continued observation of cases of chorea has shown even more clearly the very frequent existence of cardiac murmurs during life, and of vegetations upon the valves after death; that complete paralysis, usually in the form of hemiplegia, frequently follows the choreic movements; that in many fatal cases there is found just such cerebral softening as follows embolism; and, finally, that in a few cases, already referred to, the existence of embolism has been actually demonstrated.

It is also to be borne in mind that recent researches have shown that endocarditis with the production of fine vegetations on the margins of the cardiac valves, is not a complication of rheumatism alone, but occurs in connection with scarlatina, diphtheria, and some other acute specific diseases. If then the theory is finally substantiated which would explain some cases of chorea as the result of minute embolisms, it is possible that it may be found that such is the mode of production of a part of the post-scarlatinal or post-diphtheritic choreas.

There have, however, been numerous objections advanced against this theory, the most powerful of which are urged by Barnes (*loc. cit.*) and Ogle (*loc. cit.*). Thus it has been objected that, on the supposition of numerous minute fragments of fibrin circulating in the blood and becoming impacted in the minute capillaries, it would be difficult to explain the fact that chorea is so frequently unilateral, or even localized in a single group of muscles. It must be remembered, however, in answer to this, not only that in some cases of fatal chorea embolism of single large arterial branches has been found, but that the number of minute fragments of fibrin detached from the heart's valves may be very small, and that it is quite supposable that they should in some instances nearly all pass into the innominate, or the left carotid artery, and thus be chiefly distributed to one side of the brain. It may be mentioned also in this connection, that it is especially in these cases of unilateral chorea that the affection is succeeded by paralysis, such as might readily follow in case of embolism.

Again, it has been objected that if chorea be invariably dependent upon embolism, the results of this accident must be of a very transient and trifling character, since in so great a majority of cases the disease terminates in complete and permanent recovery. The weight of this objection must be admitted, and yet Tuckwell fairly remarks in answer to it, that the "mere fact of recovery is not enough to condemn the notion of embol-

[1] St. Barth. Hosp. Rep., vol. i, 1865, p. 107.

ism. On the other hand, the very frequent presence of a cardiac murmur, even in the milder attacks of chorea which recover, would rather dispose me to look for the same exciting cause in the mild as in the severe cases, viz., embolism." It is evident also that if the supposed embolus were minute, and therefore obstructed only a very small vessel, a collateral circulation might soon be established and restore the nutrition of the area affected.

Another objection advanced by Ogle (*loc. cit.*, p. 232) is, that in other cases of capillary embolism the symptoms produced are not those of chorea, but rather of pyæmia or of gangrene. It is quite evident, however, that these symptoms alluded to (which are met with for instance in ulcerative endocarditis) are due, as remarked by Savory and Tuckwell, not to the mere capillary embolism, but to the concomitant septic condition of the blood. In this connection, reference may be made to the elaborate experiments of Panum as to the results of embolism (*Arch. f. Path. Anat.*, xxv, 308, 433; *Syd. Soc. Year-Book*, 1863, p. 211), in which he demonstrates that embolism of the vessels of the brain and medulla oblongata is followed by tetanic symptoms.

This extremely interesting question cannot be considered as definitely settled; there is still needed a series of careful examinations in regard to the various points under discussion. It appears to us, however, conclusively shown that, in a certain number of cases, the peculiar irritation and impaired nutrition of the sensori-motor ganglia, which leads to the development of the choreic phenomena, are due to embolism of the vessels supplying these parts. We have, however, already expressed our opinion that, at present at least, there must be admitted two other classes of cases of chorea, due primarily to alterations in the blood and to reflex irritation respectively. It is quite possible, therefore, that in some instances rheumatism induces chorea indirectly, either by causing anæmia and impaired nervous vigor, or by causing inflammatory lesions, as of the spinal meninges or sheaths of spinal nerves, which may serve as the foci of reflex irritation.

Diagnosis.—The diagnosis of chorea cannot be attended with any difficulty, and we shall therefore make no remarks upon it.

Prognosis.—Idiopathic simple chorea in young children is rarely a fatal disease. Nevertheless, even under these circumstances, it sometimes terminates fatally, and usually from exhaustion. Thus MM. Rufz, Legendre, and Rilliet and Barthez have each met with an instance. M. Sée (*loc. cit.*, p. 406) states that of 158 cases, 4 passed into the chronic condition, and 9 proved fatal. Dr. Copland states that he has met with 3 or 4 fatal cases, that Dr. Prichard has recorded 4, and that Dr. Brown refers to 3 in his practice; but he does not inform us whether they were idiopathic, complicated, or symptomatic. We have already referred to the list of 14 fatal cases, of which the autopsies were reported by Dr. Hughes (*loc. cit.*); and to the 34 additional fatal cases collected by Tuckwell (*loc. cit.*). Dr. J. W. Ogle has lately (*Brit. and For. Med.-Chir. Rev.*, January and April, 1868) published the details of 19 more fatal cases; and from the same source we

quote the following table as exhibiting the mortality from this disease in Great Britain during 23 years.

	Deaths from Chorea.		Deaths from Chorea.
1839,	54	1855,	69
1840,	25	1856,	59
1841,	28	1857,	44
1842,	19	1858,	53
1847,	39	1859,	55
1848,	38	1860,	66
1849,	34	1861,	71
1850,	60	1862,	52
1851,	77	1863,	63
1852,	73	1864,	73
1853,	67	1865,	88
1854,	48	Total during 23 years, 1255.	

It is quite possible, however, that many cases of organic disease of the nervous system merely attended with irregular choreoid muscular movements have been included in these reports. On the other hand, out of 84,332 deaths at all ages occurring in this city during seven consecutive years, but 3 are attributed to chorea. It must not, however, we think, be positively inferred from this that severe and fatal chorea has been really so rare among us; since, during the same time, there are reported in addition to the deaths from convulsions, 79 deaths from cramps, a vague and most improper term, which, in all probability, includes a certain proportion of cases of chorea.

In regard to any special rules in prognosis to be deduced from a study of the fatal cases, it may be observed that their average age is considerably greater than that of ordinary mild chorea. Thus in 17 out of Ogle's 19 fatal cases, but two were under the age of ten; the average being 15$\frac{4}{5}$ths years.

So too in 32 of Tuckwell's 34 fatal cases, 21 were at or above the age of fourteen, and 6 of this 21 were at or above the age of twenty.

The duration of the case scarcely seems to have a direct bearing upon its fatality. It is true that in cases which have passed into the chronic form and persisted for several months, the prospect of being able to effect an entire cure diminishes, but still such patients may live very many years, and ultimately die only from some intercurrent disease. And, on the other hand, death has been known to occur as early as the end of the first week. Of course the existence of any serious complication, and perhaps especially of marked cardiac disease from previous rheumatic attacks, renders the prognosis unfavorable.

Of 58 cases treated in the Children's Hospital of this city, the average duration of treatment was 39 days. Of this number, 42 were discharged cured, 13 much improved or almost well, and 3 without any improvement.

In conclusion, whenever, in a case of chorea, the convulsive movements become incessant, and the respiration embarrassed, and still more when subsultus tendinum takes the place of the choreic movements, a fatal termination is greatly to be apprehended.

TREATMENT.—Many different plans of treatment, and a great variety of drugs have been proposed for the cure of the disease under consideration. These facts alone may serve to teach us that the effects of treatment are not clearly appreciated, and also, when taken in connection with the circumstance that fatal cases are rare, that the disease tends naturally to recovery in a good proportion of the cases. This feature of the natural history of the disease is shown also by the evidence given by Dr. Bardsley, who mentions, that in the Manchester Infirmary, notwithstanding the variety of treatment adopted by successive practitioners, an incurable case had not presented itself in the course of thirty-three years. (*Tweedie's Lib. Pract. Med.*, Am. ed., vol. ii, p. 46.)

The only rules to be laid down for its treatment are those which apply to all the convulsive affections depending on functional disorder of the nervous system, and on disordered states of the general health, connected with a faulty condition of the functions of digestion and assimilation. These are attention to the general health, and especially a careful regulation of the diet and other hygienic conditions of the patient, the removal of any local derangement or disease that may exert an unhealthy influence upon the nervous system, the use of tonics and iron, and the employment of such remedies as have been found to exert a controlling effect upon spasmodic and convulsive affections generally, and upon this disease in particular.

We shall consider, under different heads, the various means that have been recommended, endeavoring in the course of our remarks to distinguish the cases to which each remedy is best adapted.

Purgatives.—This class of remedies has been extensively employed and often exclusively relied upon by some very high authorities, especially the English. When relied upon exclusively in the treatment, an active cathartic is given every day, or every second or third day; and there can be no doubt that many cases have recovered under this plan. In our own practice we must say that the treatment by cathartics alone has never succeeded well, and we have only used them of late to such an extent as was necessary to secure a soluble and healthful condition of the bowels. When, therefore, the stools are natural and healthful in all respects, we do not think it proper to employ powerful purgatives in the treatment of the disease. We resort to them only when there is constipation, or when the discharges present some unnatural appearances as to color, odor, etc. Under the latter circumstances we may resort to any of the somewhat active cathartics, as cream of tartar and jalap, sulphate of magnesia, rhubarb, aloes, etc. When the discharges from the bowels are clay-colored, or dark and offensive, when the mouth is pasty, the tongue loaded with a thick yellowish fur, and the breath heavy, it is proper to employ a mercurial. Dr. Copland advises that we should commence with the exhibition of a full dose of calomel, either alone or with other purgatives, or followed by them in five or six hours. He adds that the doses of calomel ought not to be frequently repeated in the disease, and thinks that it is not serviceable "to continue purgatives long, without either exhibiting them with

a bitter tonic or antispasmodic remedy, or with both, or alternating them with those remedies."

Antispasmodics are amongst the most important remedies we have to oppose to the disease. The weight of evidence seems to show, indeed, that they, in conjunction with a moderate use of purgatives, of tonics, especially ferruginous tonics, and of certain particular remedies, and with careful regulation of the hygienic conditions of the patient, ought to constitute the treatment in the great majority of cases. Of the various remedies of this class that have been employed, those which have exerted the most beneficial influence are valerian, assafœtida, oxide of zinc, camphor, the root of the cimicifuga or black snakeroot, and the bromide of potassium.

Particular Remedies.—Of the remedies belonging to this class, we shall first mention cimicifuga, which has always been much employed in this city. This was first introduced into use by Dr. Jesse Young, and is now extensively employed and much relied upon. Dr. Wood (*Pract. of Med.*, vol. ii, p. 755), says: "I have in repeated instances found it of itself adequate to the cure of the disease." We have employed it ourselves quite frequently in primary cases, and in two cases of relapse. In several of the former the children recovered entirely under its use; in some, however, it failed to do any good, and recovery took place under the use of iron, arsenic, the sea-bath, and in the course of time. In the two relapsed cases, the patients recovered finally under the use of the cimicifuga, iron, cod-liver oil, and good diet. One of the cases that recovered under its use was among the worst we have ever met with. It was that of a boy of nine years, in whom the disease went so far as to destroy all power of locomotion. The child was unable even to stand. At the same time, the movements of the lips, cheeks, and tongue were so violent and irregular, and so little under the control of the will, that the power of speech was lost entirely for a period of four or five weeks. The choreic spasm appeared to affect even the muscles of deglutition, so that the act of swallowing was often difficult and uncertain. Mastication also was impossible, and the child was unable to carry anything to its mouth, rendering it necessary to feed him, as one would a baby, with soft solids and fluids. During some two months, the muscles at the back of the neck were so weakened that the head could not be lifted from the pillow or held direct, but fell from side to side or forwards like that of an infant. The condition of the child was altogether one of the most complete and distressing helplessness. During the first month of the case, it was treated with active cathartics, chiefly very large doses of cream of tartar and jalap, and with iron, but as the symptoms became worse and worse, the cathartics were abandoned except so far as to maintain by the occasional use of rhubarb and senna, a soluble state of the bowels, which were very much disposed to constipation. The patient was now put upon the use of decoction of cimicifuga, of which he began with four ounces, soon increased to half a pint per day, made in the proportion of half an ounce to the pint. The iron was continued. Under this treatment he very soon began to amend, and in two weeks showed a very decided improvement. Cod-liver oil was now added to the iron and cimicifuga, and in six weeks he was in great measure re-

stored to health, and in the end recovered completely. In another case almost as bad as this, the patient finally recovered under the same treatment.

The cimicifuga is given in powder, tincture, decoction, or fluid extract, and should be continued for several weeks in gradually increasing doses, until some visible effect is produced, as nausea, headache, vertigo, or disordered vision. The usual doses are from half a drachm to a drachm of the powder, from one to two ounces of the officinal decoction, and one or two drachms of a saturated tincture, given three times a day. For our own part we prefer the decoction, of which we give to children of eight or nine years old, from four ounces to half a pint a day, made in the proportion of half an ounce of the root to a pint of boiling water. Prepared in this way, it is not a disagreeable drink, and is usually taken without much objection.

The bromide of potassium in full doses has in some cases in our experience proved of marked benefit. We have used it especially in those cases which were connected with rheumatism as a cause, and have then frequently administered it in combination with the iodide of potassium and the iodide of iron.

Some French authors recommend chiefly valerian, oxide of zinc, and assafœtida. Of these the one which has the highest reputation is valerian, and from the evidence adduced in its favor there can be no doubt that it exerts a very beneficial effect upon the disease. It may be given in the form of powder, infusion, or fluid extract. The dose of the powder is from twelve to eighteen grains in the day, to commence with, to be rapidly increased to several drachms, as the stomach becomes accustomed to it. It may be given in honey or preserve-syrup. We should prefer the fluid extract, of which half a teaspoonful may be given to a child eight or ten years old, three times a day, and the quantity gradually increased. The oil of valerian is employed by some practitioners. Oxide of zinc is given in doses of a grain every three hours to children eight years old, and is much relied upon by some practitioners. Assafœtida is recommended both by English and French writers. It is best given in pill, on account of the nauseous taste of the mixture. Two three-grain pills may be given to a child of four or six years of age, three times a day. Dr. Bardsley gave it by injection, in combination with laudanum, every evening, after using musk and camphor, through the day.

Narcotics have been recommended by some writers. Those which are most employed are opium, belladonna, stramonium, and cannabis Indica. Substances of this class are seldom, however, made the basis of treatment. Opium is useful in some cases in which the agitation is very great, so that the sleep of the child is much disturbed, but it is seldom necessary except as an adjuvant to other means; and the remark applies equally to other remedies of the class.

Arsenic.—There is no remedy in regard to whose curative action in chorea testimony is more unanimous. Bomberg and Begbie speak of it as curing the affection in as short a time and with even greater certainty than any other remedy; and Trousseau also testifies to its good effects, but

adds that it has the disadvantage of being difficult of administration, owing to its irritant properties. Gerhard (*loc. cit.*) also speaks of it as having proved of marked benefit in his hands. Dr. Radcliffe, who has met with the same difficulty in maintaining the use of full doses of this remedy for any length of time, has tried with apparently marked success the hypodermic injection of Fowler's solution. He was first led to employ this in cases of chronic local chorea in adults, where the injection of doses of Fowler's solution, varying from five to fourteen minims, produced a speedy cure. He has also employed it successfully in two cases of general chorea, the duration being twenty-eight and thirty-two days respectively.

The usual manner in which we have administered it is in the form of Fowler's solution, given in the ordinary doses, and immediately after eating, and steadily persisted in until some evidence of its constitutional effects are produced. By carefully watching for these, and immediately reducing the dose until the signs of irritation have passed away, and then again cautiously increasing it, we have usually been able to administer it without serious inconvenience, and with excellent results in a large proportion of cases. This preparation may also be advantageously combined with the bitter wine of iron.

Strychnia.—Trousseau recommends more highly than any other plan of treatment, the use of sulphate of strychnia in gradually increasing doses, until the extreme limit of tolerance is reached. He begins by giving gr. $\frac{1}{28}$th twice or thrice daily, to children between five and ten years old, and cautiously increases this dose until it reaches about gr. $\frac{3}{4}$th in twenty-four hours. The results obtained by this treatment in Trousseau's hands certainly appear good, but the risk attending it and the care demanded to prevent accidents are so great, that we should prefer some of the equally successful and less dangerous methods. It appears, however, that other observers, as West, have obtained good results from its use in doses much smaller than those recommended by Trousseau, not exceeding gr. $\frac{1}{24}$th thrice daily, for children of eight or ten years of age.

Conium maculatum, given in the form of the succus conii, has been highly recommended by Dr. John Harley (*The Old Vegetable Neurotics*, London, 1869), in the treatment of chorea; and a certain number of cases have already been reported of its successful administration. Dr. Harley prescribes the succus in the doses of 20 or 30 drops for a child of six months old; a drachm for one over two years old; and from one to two drachms at ten years of age. In explaining the use of doses so large as these, he insists upon the fact "that hemlock given in doses which fall far short of producing its proper physiological action, is useless for the treatment of the diseases to which it is adapted." We have not had any extended experience ourselves with this drug in chorea, but from our observation of its use in other conditions we should strongly advise beginning with much smaller doses, and gradually increasing as they are found to be tolerated.

Bouchut gives (*Bull. de Ther.*, April 15th, 1875, quoted in *Medical Times and Gazette*, June 5th, 1875) the results of numerous trials of eserin, the active principle of calabar bean, in chorea. It may be given either hypodermically or by the stomach: in the former way it is most energetic,

and must be given in doses of $\frac{1}{25}$th to $\frac{1}{15}$th of a grain (3 to 5 milligrammes) three times a day; by the stomach, one-half as much more may be given. Its action is temporary, lasting two or three hours. It often causes, in the above doses, some uneasiness and restlessness, and occasionally nausea. It arrests the choreic movements during its action, and gradually effects a permanent modification in them, so that, according to Bouchut, the cure is effected in ten days on an average.

Stimuli.—The well-known views of Dr. Radcliffe upon the pathology of spasmodic affections, have led him to recommend the free use of alcoholic drinks, to the point of obtaining their decidedly sedative action on the economy, as the foundation of a rational treatment in chorea.

Without being prepared to adopt this as a regular plan of treatment for ordinary cases of the disease, we should certainly be disposed to administer alcoholic stimuli whenever the symptoms indicated the approach of nervous exhaustion.

Tonics.—Whenever the disease occurs in debilitated and anæmic individuals, remedies of this class are evidently necessary, and prove of great efficacy. The ferruginous preparations are those most clearly indicated under the circumstances; and, indeed, there are many authorities, as Watson, Elliotson, and others, who consider the preparations of iron sufficient, of themselves, to cure almost all cases of chorea. Any of them may be selected. The best are the subcarbonate, Vallet's pills, the syrup of the iodide, and the pure metallic iron (ferrum per hydrogen). Quinine is also recommended when the patient is feeble and weak. It may be given alone or in combination with iron. The citrate of iron and quinine would form a very good prescription under the circumstances mentioned. Cod-liver oil is an admirable remedy when the child is thin and weak, and especially when there is cause to suspect any tubercular predisposition.

A great variety of remedies besides those we have mentioned have been employed, and have more or less evidence in their favor. Amongst them are sulphate and iodide of zinc, nitrate of silver, subnitrate of bismuth, iodine, calabar bean, and a host of others which it is useless to enumerate. The sulphate of zinc has undoubtedly proved efficacious in some instances. About two grains may be given at first three times a day, and gradually increased to six or eight if the stomach bears the remedy well.

External Remedies.—The cold plunge and shower bath as well as cold affusions to the nape of the neck and along the spine have been frequently employed as adjuncts to the internal treatment, and are of unquestionable value in many instances. The cases in which they are used should, however, be selected. They ought not to be employed unless followed by full reaction, nor unless the child is willing to take them. When the use of the bath terrifies or shocks the patient greatly, it cannot be proper. A warm or tepid bath used once a day, or every second day, would always be useful in promoting the general health, when the cold bath is not borne well. Ether spray has been recommended by Lubelski (*Gaz. Hebd.*, April 19th, 1867), as an application along the spine, and a number of cases in which its use was successful have been placed on record.

Sulphurous baths have been recommended and employed with much

success, by M. Baudelocque of Paris. A rapid and definite cure was obtained in 58 out of 65 cases. Thirty drachms of sulphuret of potassium are added to each bath, which is employed for at least one hour daily, at a temperature of 91°. Generally amelioration occurs after the second or third bath, but sometimes not until after twelve or fifteen days, a mean of twenty-two days having served for the cure of fifty out of fifty-seven cases. Where the cure is retarded, it ordinarily depends upon the patient's powers being lowered by other remedies or insufficient diet, upon irritation of the skin induced by the bath, or upon acute irritation of the internal serous membranes,—circumstances contraindicating the baths while they continue. The conjunction of other remedies retards rather than aids the cure. Deducting the cases in which the bath was improperly used under the above circumstances, there remain but nine true failures in eighty-one cases, these being almost all recent or rheumatic choreas. (Sée on Chorea, *Ranking's Abstract*, No. 16, p. 51.)

Counter-irritation to the spine, in all its shapes, from pustulation with tartar emetic, issues, and blisters, down to frictions with coarse towels, has been proposed and employed in the treatment. The use of any but the milder remedies of this class is unnecessarily harsh and cruel, except when the disease is evidently dependent upon an affection of the brain or spinal marrow. The great majority of cases will recover perfectly well without a resort to such violent means, and they ought therefore to be avoided.

Electricity has been resorted to, and apparently with good effects in some instances, and it might therefore be tried when other and simpler means fail, or in conjunction with these means. In cases where the spasmodic movements are constant and persistent despite the use of internal remedies, the inhalation of anæsthetics has been tried, but with uncertain results.

In violent cases, it is of course desirable to confine the patient to bed; and it may be necessary to have padded sides made for it to prevent him from dashing himself out of bed in his uncontrollable and violent movements. In such cases it may even become necessary to employ padded splints, or to envelop the body with bandages carefully applied over layers of wadding, so as to secure the legs together, and to confine the arms by the sides.

Gymnastic Exercises.—M. Sée (*loc. cit.*, p. 481) says that this method is one of the best that has been employed. He states that it was recommended by Darwin, and then by Mason Good, and was first employed by Louvet Lamarre in one case, after which it fell into oblivion until some of the physicians of the Children's Hospital, at Paris, and amongst others, MM. Bouneau, Baudelocque, Guersant, and Blache, "struck, no doubt, like myself, with the good effects of gymnastics in scrofula and other cachectic diseases, and taught especially by the effects of musculation on the general health, conceived the idea of applying this treatment to nervous diseases, and particularly to chorea, which, besides the perturbation of the nervous system, is so often attended with disorders of nutrition and of the functions of organic life. To put a stop to this state of languor, to re-establish at the same time the equilibrium of the movements, which are

rather irregular than convulsive, to endeavor, in fine, by regulating the contractions, to break up their vitiated habit,—this is the triple object sought to be attained by gymnastics. Be it theory or empiricism, success crowned these previsions, and proved the utility of the new treatment, of which we are about to study the methods and its consequences." M. Sée says, that to commence the treatment, we must prescribe first simple and cadenced movements, and exercise at the same time the larynx by means of singing. "To place the child in a vertical position, make it flex and extend the knees, touch the ground, stretch out and bend the arms, harmonizing at the same time these various movements by regulated singing, —such are the first means by which to replace the contractions under the power of the will. This end will be so much the more rapidly attained, as the attention of the patient is the less distracted, its intelligence the less changed, and its temper the less capricious; so also is it often impossible to succeed unless we first obtain control over the patient by kindness and gentleness.

"After reaching this point, we may attempt walking, regulated to a slow or quick step, running, jumping, hanging by the arms, or other more complicated movements, always graduating them to the degree of the disease, watching them most carefully, and repeating them daily without prolonging them beyond fifteen or twenty-five minutes, in order to avoid muscular fatigue and palpitation of the heart, which occur sometimes when the exercises are too long continued.

"With these precautions, and no matter how severe the symptoms, we may, after a few lessons, and sometimes after the first, and at latest after the fifth or sixth, perceive a manifest change in the abnormal mobility, which is usually so rapid that we are generally able to decide, after the first eight days, as to the efficacy of the treatment. When, after this length of time, the patient can neither stand erect, walk in a straight line, nor hang by the arms, there is reason to fear that the method will fail; it is at least certain that it will be tedious and difficult."

In *Ranking's Abstract* (*loc. cit.*, p. 50) may be found the following statements in regard to the treatment by gymnastic exercises:

They were first employed under the guidance of M. Laisné, gymnastic professor of the Polytechnic School, their effects being tried first on scrofulous children. "Commencing with simple movements of the legs and arms, accompanied by appropriate songs, the children's progress was so rapid that they were soon able to employ the orthopedic ladder, the parallel bars, and other machinery, in succession. By the twentieth lesson they were exercised in wrestling, and afterwards in running, special exercises being devised for the lame. From the first lesson the children became fired with emulation, and movements which seemed impossible were soon executed with ease and pleasure. A marked amelioration was speedily observed, their countenances becoming animated, their flesh firm, their voices stronger, their appetite keener and more regular; glandular swellings, which had long resisted all treatment, were resolved, and fistulous sores, that had been open for years, closed up. The lessons, one hour each, were given three times a week; and in the intervals the children

amused themselves by repeating such of them as did not require machinery." This treatment, at first applied to scrofulous children, was, as stated above, extended to those laboring under nervous affections, partial paralysis, rickets, and especially chorea. Since 1847, ninety-five children suffering from chorea, sometimes so obstinate as to have resisted the most various treatment, have been cured by this means alone, or in conjunction with others, and no accident has resulted from the employment of the exercises. The movements are graduated according to the severity of the case, and they are repeated daily, but not for more than from fifteen to twenty-five minutes, so as not to induce fatigue or palpitation. "Improvement is sometimes seen after the first lesson, and at latest after the fifth or sixth; so that at the end of a week we can judge whether the means are likely to prove efficacious, and if manifest improvement has not then taken place, it is doubtful whether the cure will be thus effected, or if it is, it will be so only after a long time. The worst as well as the slightest cases have reaped equal benefit, the cure in the favorable ones only requiring a mean of twenty-nine days, and old or relapsed chorea being more amenable than recent. Dr. Sée has found that when other remedies are conjoined with the gymnastics, the proportion of cures is less, and the period of their attainment later; and he recommends no other adjunct to be employed than good diet." (Dr. Sée on Chorea, *loc. cit.*, No. 16, p. 50.)

Hygienic Treatment.—The management of the hygiene of the patient is quite as important as any other part of the treatment. The diet should be arranged to suit the particular condition of the individual, and with a view to procure and maintain the most healthful possible state of the digestive apparatus. It should always be light and easily digestible, in order that neither the stomach nor bowels may be oppressed and deranged by the products of an imperfect digestion. When the stomach is weak and dyspeptic, the food ought to consist for some days chiefly of preparations of milk and bread, whilst in the meantime, a tonic remedy is administered internally, in order to invigorate the power of that organ. As the digestive function becomes stronger, the child ought, as a general rule, to be put upon the kind of diet most likely to promote the general health and vigor of body. It ought to consist of bread, milk, plain wholesome meats, and simple vegetables. Coffee and tea, and all other nervous stimulants, had better be avoided. The meats ought to be mutton, beef, or poultry. There are few vegetables, besides rice, potatoes, and tomatoes, which are suitable under the circumstances. All candies, preserves, unripe, coarse, or dried fruit, hot bread and cakes, except the very simplest, ought to be withheld.

Of dress we need merely say that it must be suited to the season. Exercise, or at least, exposure to fresh air and insolation, are of the utmost consequence. When the disease is so violent as to prevent the child from walking, it ought to be taken to drive as often as possible. In cases which seem connected with a debilitated and anæmic condition of the constitution, removal to the country, and particularly to the seaside, will often effect a cure with great rapidity. Whenever, indeed, a patient inhabiting

a large city or town can be conveniently taken to the seaside in the summer, it ought to be done, for the change is useful not only at the time, but it lessens, also, by strengthening and invigorating the constitution for the future, the danger of a relapse.

ARTICLE XI.

ATROPHIC INFANTILE PARALYSIS.

Paralysis occurs in the young child in almost, if not quite, all the forms observed in the adult. Many of these are however rare in childhood: whilst, on the other hand, there is one form which, although it is occasionally observed in the adult, occurs with such peculiar frequency in young children as to have received the name of infantile palsy. It is characterized by total or partial loss of power over one or several groups of muscles, usually without impairment of sensation, occurring suddenly as a rule, and often followed by atrophy of the palsied muscles, and consequent deformities.

History and Synonyms.—Occasional allusions to infantile paralysis may be met with in medical writings even as far back as the latter part of the last century, but of such a vague and indefinite nature that the full recognition and accurate description of this peculiar affection cannot be said to date further back than the writings of Kennedy and Heine, in 1836 and 1840 respectively. Since the publication of Heine's classical memoir, however, a number of observers have studied the disease with much attention and success. We have subjoined a list of the principal writings upon this subject to which we have been able to obtain access.[1]

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It will be observed that the vague and discordant views which have been held in regard to its cause and nature, have led to the employment of

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many names by which to designate it. Thus it has been called by Heine infantile spinal paralysis, and Meyer follows him in the use of this term; by Gull it was called paralysis during dentition; by Rilliet and Barthez, Vogt, Eulenberg, Valleix, Brunniche, Laborde, and Niemeyer, essential paralysis of children; by Duchenne, who is followed by Echeverria, fatty atrophic paralysis of infancy; by Reynolds, paralysis with wasting of the muscles; by Bouchut, myogenic paralysis; by Hammond, organic infantile paralysis; and it has also been called idiopathic and congestive infantile paralysis.

We have been led to select the name which heads this article, because those above enumerated appear to us to be either vague and inaccurate, as the terms essential and idiopathic; or to neglect one of the most striking features of the disease, the muscular atrophy, as the term infantile spinal paralysis does; or to convey a partial or even erroneous theory of the pathology of the disease, as the names congestive and myogenic respectively do. The terms organic and fatty atrophic paralysis also seem to us defective, since the first is equally applicable to cases of palsy due to organic disease of the brain, while the second is based upon the fatty degeneration of the affected muscles, which, however, occurs only in a portion of the cases of infantile paralysis.

It is evident, however, that a term might be introduced which would embody our present accurate knowledge of the seat and character of this form of paralysis, and which should supplant all those above mentioned.

Causes.—The etiology of this affection is very obscure, doubtless partly owing to the fact that, as the paralysis occurs when the spinal system is extremely impressible, the causes which induce it are trivial and usually entirely overlooked. Age is the only influence which can be said to have a positive action in its production, since the great majority of cases occur between the ages of six months and two years, during the period of primary dentition. By several of the early observers especially, the disease was on this account attributed solely to dental irritation, but more careful observation shows that in most cases no such direct connection can be traced; and it is probable that early age and dentition only act indirectly by inducing a remarkably susceptible condition of the entire spinal system.

Sex appears to have no influence whatever upon its production; and the disease is almost as frequent among the children of the wealthy as among the ill-fed and ill-tended children of the poor. In some few cases, where the loss of power is sudden, the exciting cause seems to be the direct exposure to the local action of cold, as from sitting upon a stone step (West), or lying on the damp ground (Hammond).

Atrophic infantile paralysis is usually primary, and occurs in the midst of good health; but it has also been observed in a secondary form, appearing during the convalescence from measles, scarlatina, or typhoid fever, or during rheumatism and chorea.

In one of the cases following chorea, which are recorded by Kennedy (*loc. cit.*), it is positively stated that there was a distinct cardiac murmur,

due to organic valvular disease; and it may be suggested that the essential cause of the parylysis was embolism of some of the spinal arteries, as observed by Panum.[1]

Mode of Attack; Initiatory Symptoms.—There is considerable variety in the mode in which this disease makes its appearance. In some cases the paralysis is the first symptom observed, and is found to have almost immediately attained its full extent, without any recognizable cause or premonitory symptom. Thus the child may have appeared perfectly well when put to bed in the evening, and yet on the following morning, there may be more or less complete loss of power over the lower extremities. But in the great majority of cases, especially the more severe ones, the attack is preceded by quite marked constitutional disturbance. This may consist merely of fever, appearing without evident cause and lasting from a few hours to a week or more, unattended by any gastro-intestinal disturbance. Or, during this period, the child may also complain of pain in the back, or there may be tenderness on pressure, especially in the lumbar region; there is frequently slight dulness of the mind, or finally, in comparatively rare cases, one or more convulsion may occur. It is the rule, however, for no marked symptoms of cerebral disturbance to be present at any period of the disease. There are rarely any symptoms connected with the parts about to become paralyzed, though in an interesting case recorded by Kennedy (*loc. cit.*), there was spasm of the muscles subsequently affected.

The disease usually makes its appearance during health, but it is probable that many of the cases of paralysis occurring during convalescence from the various exanthemata properly belong to this variety.

Whether preceded by initiatory symptoms or not, the development of the paralysis is generally sudden, and it is only in rare cases that it is partial at first and increases gradually. Indeed it usually happens that when first observed the paralysis is at its maximum, both as regards the number of muscles affected and the degree of the loss of power, and that there soon occurs a diminution in its extent, so that only some of the parts first affected remain palsied.

The form of the paralysis clearly indicates its spinal origin. Complete hemiplegia is scarcely ever observed, though in a few cases the arm and leg of the same side, or even all four extremities, have been palsied.[2]

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[1] Ueber den Tod durch Embolie (Bibliothek für Läger, 1856), quoted by Jaccoud (op. cit., p. 297), and Arch. f. Path. Anat., xxv, 308, 443, 1863, in Yearbook of N. Syd. Soc., 1863, p. 210.

[2] With reference to the parts affected, in 43 cases observed and analyzed by West, in only 2 was the arm alone palsied, though in 19 instances the paralysis was limited to one or both legs. In 8 cases the right leg, and in 5 the left, was paralyzed; and in one of the former instances paralysis of the right portio dura was also present. In 6 instances, the right arm and leg, and in 8 the left arm and leg, were affected, with which ptosis of the left eyelid was once associated, and once paralysis of the left portio dura. Paraplegia existed in 8 instances, combined in one case with paralysis of the right arm, and in another with loss of power over

Most frequently the disease takes the form of incomplete paraplegia; though occasionally the paralysis affects single groups of muscles or even individual muscles.

According to Mr. Adams, the groups of muscles most frequently affected are: 1. The muscles of the anterior parts of the leg, forming the extensors of the toes and the flexors of the foot; 2. The extensors and supinators of the hand, these muscles being always affected together; and 3. The extensors of the leg, and with them generally the muscles of the foot, as in the first group. When single muscles are affected, the most likely to suffer are these: 1. The extensor longus digitorum of the toes; 2. The tibialis anticus; 3. The deltoid; and 4. The sterno-mastoid.

The bladder and rectum are very rarely involved.

The degree of the paralysis varies as much as its extent; usually complete at first, in some cases it soon becomes partial or even slight; while in others the loss of power remains absolutely complete. The paralyzed muscles are perfectly relaxed, so that the affected parts can have all their normal movements impressed upon them without difficulty, and fall in a lifeless manner if left unsupported. The special senses are unimpaired; and general sensibility is usually only blunted for a time. Occasionally it is not affected at all, or, as stated by West, there may even be hyperæsthesia for a variable time.

The paralyzed muscles are rarely the seat either of painful subjective sensations or of tenderness on pressure; though in some cases severe pain may be present in the affected parts.

Reflex movements are, as a rule, abolished in those parts where there is complete loss of voluntary motion; though Laborde (*loc. cit.*) has shown that they may occasionally be preserved even in the first stage of the paralysis.

During the early stage we are at present considering, the electro-muscular contractility usually remains intact, and the muscles respond both to the induced and direct current.

The constitutional disturbances which we have described as preceding the paralysis may persist for a variable time after its development, or disappear quickly, leaving no other symptoms present but those connected with the paralyzed parts.

The following case, seen by one of ourselves with Dr. James Tyson, may be quoted as an illustration of this form of paralysis.

A male child, æt. thirteen months, was brought to Dr. Tyson for treatment by its mother, an intelligent woman, with several healthy children. The following history of the case was obtained: The little boy had walked at the age of nine months, and always seemed a vigorous, intelligent child; he had also cut eight teeth, without much irritation. About Sept. 10th, 1868, after no particular exposure, he became fretful and feverish, with occasional vomiting; and after three days it was noticed that right-sided hemiplegia had developed itself. The paralysis

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both deltoid muscles, and over the flexor muscles of both thumbs. Six times none of the limbs were palsied, but the affection was confined once to the portio dura of the left, and five times to the portio dura of the right side; but in one of these instances, though there was no actual paralysis, the patient's gait was feeble and tottering.

of the arm was never complete, while the leg had entirely lost all power of motion. This loss of power had not become complete suddenly, but, at first partial, had gradually increased. There was no tendency to coma and no evidence of any acute pain. The febrile symptoms soon disappeared; the arm regained the power of motion in a few days, but the leg remained palsied. It also soon grew remarkably cold, and when seen on October 1st, three weeks after the attack, the temperature was decidedly lower than that of its fellow. Sensation was impaired, but had never been abolished. There had been no paralysis of either bladder or rectum. At the time of the examination the child seemed bright and lively, though rather pale. There was no tenderness along the spine, nor in the leg. No reflex movements were developed in the paralyzed leg by tickling the sole of the foot. Neither atrophy nor deformity had as yet occurred.

The subsequent course of the disease varies greatly in different instances. In one set of cases, though the paralysis may be quite extensive and complete at first, the symptoms gradually subside, the paralysis disappears, and complete recovery ensues in from four to six weeks. These cases correspond exactly to the form of paralysis originally described by Kennedy (*loc. cit.*) under the name of "Temporary Infantile Paralysis," and, as we shall see hereafter, in all probability depend upon mere congestion of the spinal cord.

In the other set of cases, on the contrary, the loss of power persists, and after it has continued for a time, varying from one to several months, is followed by marked and more or less rapid atrophy of the affected muscles. The circulation in the paralyzed parts becomes feeble, the subcutaneous veins are smaller, and Heine, and Rilliet and Barthez each cite a case of paralysis of the arm in which it was almost impossible to detect the radial pulse. The temperature of the affected part becomes perceptibly lower, the fall amounting, according to Hammond, to from 5 to 8 or even 10 degrees, as tested by a galvanometer. The muscles themselves undergo marked atrophy, frequently accompanied by fatty degeneration; and their reflex motility and electro-muscular contractility disappear. It is important to notice, however, that long after muscular contractions fail to be produced by the induced current, they may frequently be excited by the use of a direct current of low tension, slowly interrupted.

The mere wasting of the muscles is not, however, the only cause of the great difference in size between the healthy and paralyzed members. The nutrition of the whole limb is affected, and the growth and development of all its tissues arrested, so that the paralyzed member becomes smaller in all its dimensions than its fellow. Rilliet and Barthez cite an example which they observed, to show to how remarkable a degree this conjoined atrophy and arrest of development may progress. The patient was a young girl who was seized with instantaneous paralysis of the right lower extremity; and the following measurements show the degree of inequality which was produced by four years' continuance of the paralysis and arrest of development.

	Right leg.	Left leg.
1. From the great trochanter to the external malleolus,	49 cent.	54 cent. 5 mill.
2. From the patella to the malleolus,	29 "	32 "
3. Length of foot from heel to great toe,	14 " 3 mill.	18 "

Five months previously, the following diminution in thickness of the limbs was noticed: at three fingers' breadth above the patella, on left side, 20 centimetres, 16 on right; at the middle of the thigh, on left side, 29 centimetres, and 22 on right. The height of the child was 116 centimetres.

This wasting and palsy of the muscles is associated with relaxation of the ligaments, and the combination of these causes induces many of the deformities observed in childhood. When the paralysis affects one side of the body chiefly, it indirectly leads to various lateral curvatures in the spinal column, probably from a want of symmetrical action in the muscles of the two sides.

In cases of paralysis of the arms, the relaxation of the ligaments about the shoulder-joint and the atrophy of the deltoid allow the head of the humerus to drop out of the glenoid cavity, so as to produce even complete dislocation, with apparent elongation of the paralyzed limb to the extent of three-fourths of an inch (West).

As the muscles of the lower extremities are far most frequently affected in this form of paralysis, we usually find the resulting deformities involving the feet and legs, where they constitute the greater proportion of all cases of club-foot. According to Adams (*loc. cit.*), "these deformities occur in the following order of frequency: 1. Talipes equinus; 2, equino-varus; 3, equino-valgus; 4, calcaneus, or calcaneo-valgus; and 5, talipes varus. When both feet are affected, equino-varus of one foot is generally found with equino-valgus of the other."

In addition to the influence which the actual wasting of the limb and the arrest of its development exert, Adams believes that the great cause of such deformities is the "adapted atrophy" of Paget, the changes which ensue in consequence of the mechanical relations of the foot to the leg. Although, however, it is true that paralysis of a group of muscles does not excite active contraction in their opponents, it appears that in the efforts of the child to move the part, the non-paralyzed muscles must gain control over the limb, and aid at least in producing the various characteristic distortions.

During the development of this atrophic stage, the general sensibility of the affected parts is usually normal, and the general health, intelligence, and nutrition of the patient unimpaired.

Duration.—As will be inferred from our description of the course of this affection, the entire duration and that of its different stages varies greatly in different cases. In some, which have hence had the name "temporary" infantile paralysis bestowed upon them, the loss of power rapidly diminishes, and complete recovery follows in from a few days to a few weeks; while, in other cases, the paralysis persists until atrophy ensues, and the limb may remain crippled and useless throughout life. The period which elapses before atrophy commences, and the rapidity with which it advances, also vary extremely, even in apparently similar cases. Thus the palsied muscles may begin to atrophy within four or five weeks, though more frequently this change cannot be noticed for several months. Different muscles also atrophy with very different rapidity, the deltoid and

tibialis anticus appearing to waste more rapidly than any other muscles of the body; and, in different cases, the same groups of muscles show equal variety in this respect, a few weeks serving in some instances for as much wasting to occur as would require months to produce in other cases.

Prognosis.—The great uncertainty of the progress and duration of atrophic infantile paralysis render it highly desirable to ascertain, if possible, the conditions which determine its result. Of itself, it is never fatal; but, unfortunately, our prognosis is limited, in the early stage of the disease, to this assertion, for the duration and course of the case are not influenced, in any constant and reliable way, either by the age of the patient, the extent of the paralysis or the parts affected, or the initiatory symptoms. It may perhaps be stated that, in general, cases which are ushered in by high fever, especially if associated with convulsions, and in which the paralysis is extensive, will prove severe and tedious. But there are too many exceptions to every particular of this statement for it to be regarded as a general rule of much positive value in prognosis.

When paralysis has lasted three or four weeks, we are able to determine with much accuracy the approach of atrophy by the condition of the electro-muscular contractility; for it has been frequently observed that those muscles which lose their power of responding to the interrupted current, soon begin to waste.

After the occurrence of atrophy, also, much valuable aid in prognosis is gained from the use of electricity.

We may here mention the interesting and highly important observation, first made in connection with this disease by Hammond (*loc. cit.*) and J. Netten Radcliffe,[1] that in many cases where the atrophied muscles have lost entirely their power of reacting to the most powerful induced electrical currents, they will still react vigorously to a direct (galvanic) current of low tension and slowly interrupted. The importance of this discovery, in the treatment of the disease, can scarcely be overrated; and it has also enabled this point to be established in the prognosis, that whenever muscular contractions can be excited by either induced or direct currents, no matter how far advanced the atrophy of the muscles, the restoration of their power can certainly be accomplished; though it would appear from a case successfully treated by Hammond, that even when such contractions are not at first produced, the prognosis is not absolutely unfavorable. The still more curious, and as yet inexplicable observation has also been frequently made, that as the muscles regain their power of voluntary motion, their susceptibility to the direct galvanic current is apt to diminish, but, on the other hand, their normal reaction to the induced current returns.

The prognosis will also be materially influenced, especially when the atrophic stage has begun, by the condition in which the tissue of the palsied muscles is found, as in cases where advanced fatty degeneration is present, it is far more unlikely that they will ever regain their power. In order to ascertain this point, Duchenne has devised a small trocar,[2] called by him

[1] See footnote to page 665, vol. ii, Reynolds's System of Medicine.

[2] These trocars are manufactured by Tiemann, of New York. Dr. Hammond has published (Jour. of Psych. Med., July, 1867) a description of their form and mode of use, illustrated by a woodcut.

"emporte-pièce," by which small pieces of muscle can be extracted, and subsequently submitted to microscopic examination.

It is evident, finally, that the duration and result will depend, to a great extent, upon the period at which treatment is instituted. In those cases where the paralysis has been allowed to continue until marked atrophy has ensued, and the electro-muscular contractility is almost lost, although the prognosis may still be favorable as regards the ultimate cure, it must be carefully guarded as to the duration, since the treatment will probably require to be steadily pursued for many weeks, or even months.

MORBID ANATOMY AND PATHOLOGY.—It appears desirable to introduce the consideration of the anatomical appearances at this point, in order to facilitate the subsequent discussion of the pathology and diagnosis of the disease.

In regard to the changes which take place in the atrophied muscles, the brief yet complete summary given by Hillier, may be quoted (*op. cit.*, page 268):

"1. The transverse striæ become less apparent and separated by wider spaces, which are filled with opaque granules, which are not dissolved by ether, but are sensibly acted on by acetic acid.

"2. The transverse striæ disappear, and there is an abundant appearance of granular substance.

"3. There remain but slight traces of longitudinal fibres, filled with granules, with a larger quantity of connective tissue between the bundles.

"4. The granules have disappeared, and emply transparent tubes of myolemma with a few scanty granules on their walls remain, with more connective tissue and some elastic fibres.

"5. In some cases, fat-globules take the place of the granular matter in the muscular fibres, and in the cellular tissue between the bundles of muscular fibre. This change is not universally present in cases even when atrophy has proceeded to an extreme degree."

The last conclusion stated here, which has been confirmed by other observers, shows that perhaps the most frequent change which occurs, is a simple atrophy of the muscles, with a granular but non-fatty degeneration, and conclusively shows the inaccuracy of the name proposed by Duchenne for the disease (namely, fatty atrophic paralysis of infants).

In approaching the question of the lesions of the nervous centres in this affection, which have now been definitely determined, it is necessary to refer to the general question of the existence of so-called essential, purely neurotic paralyses. In one form of paralysis, the reflex, it is true that as yet no material lesion has been detected, and that the most plausible explanation of the loss of power in such cases is simply the exhaustion of the functional activity of the spinal cord, owing to the prolonged irritation of some of the peripheral nerves. And it must be borne in mind that the form of infantile paralysis under consideration was formerly by some regarded as a reflex paralysis depending on dental irritation. Apart, however, from the fact, that the symptoms much more closely resemble those due to spinal congestion than those seen in reflex paralysis, it is to be remembered that the disease is by no means limited to the period of denti-

tion, and that all local signs of dental irritation are frequently absent at the time of the appearance of the paralysis. With the exception, then, of reflex paralysis, it may be asserted with confidence that all other forms of spinal paralysis are associated with some material lesion of this nervous trunk. It is to be remembered that it is only a few years since the beautiful researches of J. Lockhart Clarke have shown that positive structural changes, in both nerve-cells and nerve-fibrils, may be detected by microscopic examination in spinal cords, which present no alteration apparent to the naked eye. In rejecting the evidence of all post-mortem examinations of the spinal cord, made before the introduction of Clarke's method, as incomplete and inconclusive, we find that in all those diseases formerly classed as pure neuroses (such as tetanus and chorea), which have been subjected to this latter mode of examination, positive demonstrable lesions have at least occasionally been detected.

Among this class of diseases, so long considered as purely functional neuroses, atrophic infantile paralysis has always, until lately, occupied a prominent position, as is evinced by the large number of authors who have described it under the terms "essential," or "idiopathic."

It is indeed difficult to secure opportunities of examining the state of the spinal cord in this affection, owing to the fact that the disease is scarcely ever, if at all, fatal of itself; so that the arguments in opposition to the view of its functional nature, will be in part drawn from the close analogy of its symptoms to those of certain spinal diseases, which are well known to be attended with positive lesions of the nervous tissue. Thus, in its mode of appearance, and in the character of the paralysis, there is so perfect a resemblance to the onset and symptoms of congestion of the spinal cord, as to leave little room for doubt that this is the condition at first present in many cases of atrophic infantile paralysis. In both this affection and spinal congestion, the paralysis may appear quite abruptly, or be preceded by pains in the back and fever; in both, the paralysis is usually paraplegic, the loss of power only partial, and the affected muscles are relaxed; in both, general sensibility is but slightly impaired, the bladder and rectum are not involved, and there are no disturbances of the cerebrum or special senses; in both, finally, recovery usually follows, if proper treatment be promptly instituted.

In those cases where the paralysis disappears within a few days or weeks, it has been supposed by various authors that the nature of the disease is entirely different from that of atrophic infantile paralysis; but it appears to us highly unnecessary to complicate the question by such a supposition, since the temporary character of the paralysis is readily accounted for by supposing that the spinal congestion which produced it was slight and transient.

It is quite possible also that in other cases the loss of power caused by more severe spinal congestion should persist until atrophy of the affected muscles ensued, and rendered the case more protracted.

Indeed, some of the authors who most forcibly support the view of the pathology of this affection which we have given above, as Dr. C. B. Radcliffe (*loc. cit.*), hold that the lesion of the cord does not advance beyond

is stage of congestion. The evidence in support of this opinion is prin-
pally found in the result of post-mortem examinations, as those reported
y Rilliet and Barthez, Fliess and Adams, where no lesions of the cord
ere detected. But in none of these cases does it appear that the careful
nd skilful microscopic examination, which is now recognized as necessary
detect some lesions of the nervous tissue, was performed; so that we
ay feel at liberty to doubt the complete accuracy of these autopsies. On
e other hand, it certainly seems entirely consistent to suppose that in cer-
in cases, where the congestion is unusually marked and prolonged, or
here it is repeated, that a process of subacute inflammation should be ex-
ted, resulting in the permanent structural change.

The usual change which takes place in the spinal cord, under such cir-
mstances, is that described under the name "sclerosis," in which there
marked proliferation of the connective-tissue elements of the cord, with
elling and consequent pressure upon the nerve-tubules. In the subse-
ent development of the new-formed connective tissue, it undergoes con-
action, and induces atrophy of the compressed nerve-tubules. The por-
ns of the spinal cord where this lesion exists, may either be atrophied
retain their normal size, shape, and external appearance, but on trans-
rse section, though the tissue is firm, certain parts of the white substance
e seen to present a grayish, translucent appearance, differing noticeably,
well-marked cases of the lesion, from the opaque whiteness of the sur-
nding healthy tissue. In other instances, however, the change in color
nnot be detected, and it is only by microscopic examination that we can
cover the increase in the connective tissue of the cord, and the atrophy
the nerve-tubules.

This view of the nature of the lesions in atrophic infantile paralysis,
s forcibly urged by Heine, in the last edition of his classical monograph
this subject (*op. cit.*), who based it merely upon an analysis of the symp-
ns, and it has since been adopted by Jaccoud (*loc. cit.*). It does not
t, however, solely upon such reasoning, for there have been a limited
t rapidly increasing number of autopsies made in which the above-de-
ibed lesions of sclerosis have been actually observed.

Heine quotes three post-mortem examinations in support of this theory.
e of these, quoted from Longet, was of a girl of eight years, with club-
t on the right side, following an attack of paralysis, who died of variola;
l at the autopsy the muscles and nerves of the right leg were atrophied,
l the anterior roots of the spinal nerves which make up the right sciatic
ve, were scarcely one-quarter the size of the corresponding roots on the
side.

In the second case, quoted from Hutin, the subject was forty-five years
, had been paraplegic from the age of seven years, and had considerable
ormity of the lower members; at the autopsy, after death from dysen-
y, there was atrophy of the lower part of the spinal cord.

The third observation quoted by Heine, has been quoted more fully from
original source (*Trans. de la Soc. Méd. de Berlin*, Dec. 7th, 1862), by
coud (*op. cit.*, p. 450). It was the autopsy of a child with paralytic
b-foot, reported by Berend and Remak, where the "spinal arachnoid

was found thickened by inflammatory product, and exercising such pressure upon the cord, that when the false membranes were cut, the nervous tissue immediately protruded through the incision."

Berend also reported (*id. loc.*) another observation upon a child four years old, who died paraplegic with contraction of the legs and feet. The autopsy was performed by Recklinghausen, who found tubercles in the cord.

Hammond reports (*Jour. of Psych. Med.*, vol. i, p. 51) a case where the paralysis affected the left leg, and had lasted four years, in which he found, upon post-mortem examination, a cicatrix, partly filled with clot, in the lower part of the dorsal region, in the left anterior column. Recently, however, the opportunities for careful study of the lesions in atrophic infantile paralysis have multiplied, and have been seized by numerous able observers, especially in France, where the first demonstration of the true characteristic morbid changes in this disease was effected. The earliest cases placed upon record in which this lesion was accurately described were by Cornil (*loc. cit.*) in 1863; by Laborde (*loc. cit.*), in 1864; by Prevost (*loc. cit.*), in 1866; J. Lockhart Clarke (*loc. cit.*), in 1868; Charcot and Joffroy (*loc. cit.*), in 1870; Parrot and Joffroy,[1] in 1870; Roger and Damaschino,[2] in 1871; Dujardin-Beaumetz,[3] in 1872; Petitfils,[4] in 1873; and numerous other observers have followed in confirmation, so that the morbid anatomy of atrophic infantile palsy may be regarded as clearly and fully determined.

The lesions occupy the antero-lateral columns, and especially the anterior horns of gray matter. There is atrophy of the nerve-fibres in the anterior and lateral columns, which varies in amount in different cases, and is associated with a varying degree of hypertrophy of the interstitial connective tissue (sclerotic). These parts are more translucent than natural, and often present a very appreciable grayish rose tint to the naked eye. The consistence of the affected tracts is diminished, and upon microscopical examination there may be observed a marked proliferation of the elements of the connective tissue, the cells and nuclei being dispersed in the midst of a finely granular substance, in which there are fibrils of extreme tenuity. In the parts which are most affected the nervous tubules are either lost altogether, or they present a varicose appearance, while the other portions of the spinal column preserve a perfect integrity.

But the most characteristic changes are found in the anterior horns of gray matter, where there is invariably atrophy of the ganglion nerve-cells and of their processes, so that in some instances the anterior group of cells has entirely disappeared from atrophy. In other cases the remains of the cells are found atrophied, misshapen, and with granular degeneration of their contents. The other elements of the gray tissue are usually changed also; there is proliferation of the nuclei of the neuroglia, and occasionally

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[1] Arch. de Physiologie, tom. iii, 1870, p. 135.

[2] Gaz. Méd. de Paris, 1871.

[3] De la myelite aigue, Paris, 1872.

[4] Considérations sur l'atrophie des cellules motrices, Paris, 1873.

ncrease in the delicate fibrils of this connective tissue. In some cases he walls of the vessels in the affected parts are found thickened, with roliferation of their nuclei. These changes have been so prominent in ome cases as to have led to the opinion (Damaschino, Duchenne) that hey constituted the primary and essential lesion. This, however, does ot seem probable.

It is thus seen that the progress of anatomical investigation has at last eveloped the true pathology of this affection. It is possible that in some ases the lesion of the antero-lateral columns may be the result of hæmor- hage into the substance of the cord, or of pressure from thickening of he meninges; but in the vast majority of cases the morbid process is one f slow subacute inflammatory, sclerotic change, with atrophy of the nerve- ubules in the antero-lateral columns and anterior horns of gray matter, nd especially with atrophy and destruction of the anterior groups of gan- lion nerve-cells.

Diagnosis.—There is but little danger of overlooking the nature of ose cases where the paralysis appears quite suddenly in the midst of ap- arent good health, excepting in cases occurring in young children who ave not yet learned to walk, and where the loss of power is limited to e lower extremities. In such instances the paralysis may be entirely verlooked by the parents or nurse for some time. So also in cases pre- ded by constitutional disturbance, as there is nothing whatever charac- ristic in these premonitory symptoms, it is quite possible to fail to rec- nize the presence of paralysis. It is well, therefore, whenever a child tween six months and three years of age presents feverish symptoms for hich no apparent cause exists, to ascertain carefully whether there is y loss of power of its extremities.

The diseases with which atrophic infantile paralysis is most likely to be nfounded, are other forms of paralysis of cerebral or spinal origin, and rogressive muscular atrophy.

In paralysis due to hæmorrhage into the substance of the brain (see ge 520), the case is more apt to be ushered in by delirium or convul- ns, followed by more or less marked coma, while in atrophic infantile ralysis there is either entire absence of cerebral symptoms, or at most a gle convulsion occurs. Cerebral paralysis is usually hemiplegic, while the form of spinal paralysis we are considering, paraplegia is more mmon, or the loss of power may be limited to one leg or to a single oup of muscles. In those comparatively rare cases where the paralysis at first hemiplegic, the arm usually soon regains its power of motion, ving the leg paralyzed; while the reverse of this occurs in cerebral miplegia, where the leg usually improves much more rapidly than the m. In cerebral paralysis, also, the affected muscles are frequently id instead of being relaxed; and there is not the tendency to atrophy d deformity, the loss of electro-muscular contractility, nor the lowering the temperature of the affected part, which are observed in atrophic antile paralysis.

In cases of meningeal apoplexy where the hæmorrhage has occurred *on* the surface of the brain, the symptoms are still more distinct. Thus

(see page 520) there are usually repeated convulsive seizures, with somnolence during the intervals; paralysis is rare and partial, while strabismus and tonic contraction of the hands and feet are very common.

In acute inflammation of the spinal cord, or myelitis, the loss of power is complete, and there is also more marked loss of sensation, and paralysis of the rectum and bladder, with alkaline urine; though there is here as well as in atrophic infantile paralysis, diminution of reflex excitability and electro-muscular contractility, and wasting of the paralyzed muscles. The symptoms first mentioned, the more grave character of the case, and the tendency of the paralysis to increase rather than decrease, suffice to distinguish myelitis from the affection under consideration.

Progressive muscular atrophy, of very rare occurrence in children, may be distinguished by its gradually progressive course; and by the preservation of the temperature of the affected parts, of the power of motion, and of electro-muscular contractility, until atrophy has far advanced. There is usually a quivering of the atrophied muscles in this disease, due to fibrillar contraction, which is entirely wanting in atrophic infantile paralysis.

We have already expressed our belief that some of the cases where the loss of power is very temporary, are really instances of reflex paralysis, and in such some source of peripheral irritation can usually be detected.

West alludes to the fact that in those cases where the affection is limited to one leg, and attended by hyperæsthesia and painful sensations, the disease may be mistaken for coxalgia, though the diagnosis may readily be made by attending to the slow course, the absence of paralysis, the fixed pain in the knee-joint, and the marked increase of suffering caused by forcing the head of the femur against the acetabulum, which characterize hip-disease.

Treatment.—The treatment of atrophic infantile paralysis may be divided into that adapted to the early stage and that directed against the second stage or period of atrophy.

In the first instance we must endeavor to discover and remove any exciting cause of the paralysis that may exist. If symptoms of morbid dentition have preceded, and the appearance of the gums indicate it, they should be lanced; or if gastro-intestinal disturbance is present, or the presence of worms is suspected, laxatives should be administered. Tepid baths are also recommended, as tending to allay irritation and reduce feverishness.

When, however, no local irritation can be detected to render it possible that the case is one of reflex paralysis, we should direct our remedies towards relieving the spinal congestion, which we believe to exist in cases of true atrophic infantile paralysis. Counter-irritation should be applied along the spine, and may be effected by producing a narrow blister, or preferably by the use of sinapisms or stimulating liniments, containing croton oil, ammonia, or turpentine.

Local abstraction of blood by means of cups or leeches applied along the spine has been recommended by Fliess; and we should certainly advise its employment, especially in those cases where there is considerable febrile disturbance and pain in the back.

There are also certain remedies from which we have obtained excellent results in the treatment of spinal congestion in the adult, and should, therefore, recommend their employment in the early stage of this affection.

These are ergot, which may be given in the form of fluid extract, beginning with doses of 5 to 10 minims for a child of two years old; and belladonna, which may be given either in the form of tincture, or an aqueous solution of the extract. Iodide of potassium may also be given in combination with one or the other of these, in doses of gr. j or ij for a child of two years old, in the hope of preventing the development of any inflammatory changes in the cord.

In addition to these remedial measures, the child should be absolutely confined to bed.

If, despite the use of these agents, the paralysis persists, the temperature begins to fall, and the muscles to atrophy, every means must be adopted to promote the general nutrition of the child so as to favorably influence indirectly the changes in the spinal cord; and, at the same time, local treatment must be instituted to promote the circulation and nutrition of the paralyzed parts.

Among the internal remedies, iron is one of the most suitable, and may be given in any eligible form. The pyrophosphate is perhaps especially indicated on account of the phosphoric acid with which the iron is combined.

The various preparations of nux vomica or its alkaloid strychnia are also very valuable after the acute stage has passed. Heine advises the use of tr. nucis vomicæ in combination with camphor and pyrethrum; while West recommends the alcoholic extract of nux vomica. Strychnia, which is more frequently employed than the preparations of nux vomica itself, is usually given in the form of solution. Hiller has also used it hypodermically, but without marked benefit.

The doses of these powerful drugs, which are recommended by some authors, especially Heine, appear to us too large to be safely administered. We should recommend beginning with a dose of at most gtt. ij of the tincture, or gr. $\frac{1}{20}$th of the alcoholic extract of nux vomica, or gr. $\frac{1}{80}$th of sulphate of strychnia, for a child of two years old; the amount being increased steadily but cautiously so long as no unpleasant symptoms are produced by it.

Local means must also be employed for inducing increased circulation in the affected parts. For this purpose, the stimulating liniments already mentioned, or moist heat, may be applied. Passive motion, and kneading the muscles, also aid in improving their nutrition and contractile power.

Electricity, however, certainly ranks first among the local means for restoring the contractile power of the paralyzed muscles. It is true that several authorities have asserted that they derived no good results from its employment, but since the introduction of localized electricity (faradization), as developed by the researches of Duchenne, and of the use of the constant current, the most marked benefit has been obtained at all stages of this form of paralysis.

If the induced current be used, it must be carefully isolated and limited to the affected muscles, by means of wet sponges fastened to the electrodes.

In those cases where the muscles refuse to respond to an induced current even of considerable power, the direct current, slowly interrupted (the labile current of Remak), will be found to induce contractions, excepting where the muscular tissue is far advanced in fatty degeneration. In all such cases then, this direct current should be employed. We have already alluded to the curious observation which has been made by several authors, that as the palsied muscles regain their power under the use of the direct current, they respond to it less and less strongly, while the induced current is found to again have the power of exciting muscular contractions. When this period in the treatment of the case arrives it is properly desirable to substitute the use of the induced current.

In order that the use of electricity, in either form, may be productive of the excellent results it is capable of yielding, it must be applied thoroughly to each of the paralyzed muscles three or four times weekly, and this treatment pursued for months, until the muscles regain both their size and contractile power.[1]

One of the earliest symptoms of improving nutrition is an elevation in the temperature of the part, which may readily be detected by the galvanometer, as before mentioned. The value of this mode of treatment is, indeed, so great "that so long as muscular contraction can be induced, recovery is merely a matter of time, but if no action of the paralyzed muscles can be brought about, the prognosis must be unfavorable, though even here there is some hope." (Hammond, Radcliffe.)

In addition, however, to the local and general measures above recommended, there is another kind of treatment scarcely less important, which should be employed in conjunction with them.

This consists in the use of such mechanical apparatus and gymnastic exercise as shall tend to bring the affected muscles into play, and to obviate the deformities of the atrophic period. The greater part of our knowledge upon this subject is due to the admirable and extensive observations of Heine, who has the superintendence of a large orthopedic institute, and has most carefully studied the effects of these agents upon cases of paralysis which have progressed to the stage of atrophy and deformity. But it is by no means to this advanced stage alone that such measures are adapted, for it is a matter of the highest importance, that from a very early period of the paralysis, the little patients should be subjected to this treatment.

If the legs be affected, it is not surprising that the child, who has, perhaps, gained but imperfect use of its limbs, and is making its first essays in walking when the paralysis appears, should feel such a sense of insecurity, even when the power of motion has returned to a considerable extent, that it will refuse to make any renewed efforts to walk. And the

[1] For a full description of the best forms of electrical batteries for medical purposes, the reader is referred to some of the manuals on medical electricity, as Meyer, Tibbits, etc.

The best batteries in the American market are made by Fleming & Talbot, of Philadelphia, or by the American Galvano-faradic Manufacturing Company of New York.

parents, finding all their attempts to persuade or compel it to do so unavailing and distressing to the child, are apt to desist, waiting until increased power of movement returns: a delay which is too often followed by all the steps of the atrophic period.

To supply the indispensable exercise of the muscles, and in a form attractive to the little patients, numerous mechanical contrivances have been resorted to.

While the legs are still almost powerless, some form of baby-jumper at the same time delights the child and effectually exercises its limbs. When the power of motion has returned to a somewhat greater extent, we gain the same results even more completely by the use of the go-cart or velocipede, a frame or a chair upon wheels, the motive power being furnished by the alternate pressure of the rider's feet upon a pair of treadles which are connected with the wheels by cranks. This imparts such a sense of security and so much pleasure, that the child can readily be encouraged to take enough exercise to preserve the play of the articulations, and to aid in developing muscular power.

Dr. West makes a single objection to the use of the go-cart; that it encourages the tendency to lean very much forward in walking, which always exists until after the little patients have learned to walk pretty well; he, therefore, advises that, after the child has gained some facility in the use of the go-cart, a jacket should be worn, supplied with a stout strap before and behind, so that the attendant can conveniently hold them and support the child's weight more or less completely, thus enabling it to walk without being thrown forward as when stepping in a go-cart.

In children of from five to seven years even, the use of crutches is soon required, and it is desirable, so soon as possible, to abandon the other contrivances spoken of, and trust the child to its own exertions to walk with a pair of crutches.

When the paralysis affects the arms, precisely the same principle should guide us, and every form of persuasion, of stratagem, and contrivance, must be used to induce the child to exercise the crippled member. Turning a hoop, or raising a weight by means of a cord passing over a pulley, furnish good exercise to the arm; or we may encourage the little one to use a contrivance, also called a velocipede, in which the wheels are turned by handles, instead of treadles, attached to the cranks.

In addition to these forms of exercise, however, it is often found necessary to employ splints of different kinds, such as Stromeyer's, which enables the angle of the splint to be changed without removal from the limb, and various modes of extension to counteract the tendency which exists to contraction of the paralyzed part. In some cases, indeed, all means are powerless to avoid this consequence, and we are obliged to resort to the section of the tendons of the contracted muscles and subsequent extension, though tenotomy should not be performed until time has been allowed to show the extent of permanent paralysis, and until the conjoined use of electricity and orthopedic apparatus has proved insufficient to restore the limb to its shape.

It may readily be surmised that this orthopedic plan of treatment is

one requiring the utmost patience and persistence, and the most loving persuasion and encouragement; for, indeed, it must be pursued, in face of all apparent failure, for months and years. Nor must we be satisfied during this period with these efforts we are making to restore the power of the muscles; but careful attention must be paid to the nutrition and general health of the child, and we must continue the use of the warm douche, in conjunction with the persistent use of electricity, of stimulating frictions, and of every remedy calculated to promote the general nutrition of the child.

ARTICLE XII.

FACIAL PARALYSIS.

Paralysis of the muscles supplied with motor power by the facial nerve, is frequently met with as a temporary condition in infants who have been delivered by forceps, as a result of the pressure of the blade of the instrument upon the nerve as it emerges from the cranium. It is by no means rare, however, during childhood, and either appears suddenly after exposure to cold, when it is possibly due to pressure caused by congestion and swelling of the tissues around the stylo-mastoid foramen; or more gradually, when it is usually due to pressure from an enlarged gland, or to disease of the petrous portion of the temporal bone.

The symptoms of this affection are so striking that no difficulty can exist as to its diagnosis. The eye upon the affected side remains open; the power of knitting the forehead and of raising the eyebrow is lost; the angle of the nose and mouth on the same side hang down. The tears trickle over the cheek, and the conjunctiva frequently becomes injected or inflamed; saliva dribbles from the mouth, portions of food collect between the teeth and paralyzed cheek, and there is inability to whistle, spit, or distend the cheeks with air. During the acts of laughing or crying, the face becomes distorted, owing to the immobility of the paralyzed side, while the antagonistic muscles act strongly and draw the features towards the sound side.

In addition to these symptoms, which are common to all cases of facial palsy, there are others which depend upon the point at which the lesion involves the trunk of the facial nerve. Thus if the nerve be paralyzed between its point of emergence from beside the pons and the point where it gives off its petrosal branches (soon after entering the Fallopian canal), there will also be paralysis of one side of the soft palate, greater acuteness of hearing on one side, and loss of the sense of taste on one-half the anterior part of the tongue. This latter symptom is due to the implication of the chorda tympani branch. If, therefore, the seat of the lesion is in the Fallopian canal between the points of origin of the petrosal branch and the chorda tympani, the palate will not be paralyzed but the sense of taste will be lost.

It is usually true that if the nerve be paralyzed before the origin of the stapedius branch, the hearing becomes more acute; but in children the cause of the palsy is so often necrosis of the petrous portion of the temporal bone associated with disease of the internal ear, that there is frequently deafness with purulent otorrhœa. Finally, if the point of paralysis be near the stylo-mastoid foramen and below the chorda tympani, none of the above symptoms will be present, and there will only be the palsy of the external muscles already indicated.

The possibility of mistaking simple facial paralysis for hemiplegia from cerebral disease must be borne in mind, though attention to the symptoms of the case will prevent any error in diagnosis. Thus in hemiplegia of cerebral origin, the paralysis is usually ushered in by convulsions and coma; the frontalis and orbicularis oculi muscles are not paralyzed; the sense of taste is not affected, but, on the other hand, the masseters, temporals, and pterygoids, supplied by the fifth nerve, occasionally are paralyzed, and the tongue is protruded towards the paralyzed side; and, finally, there is loss of power in the arm and leg on the same side.

Webber (*Chicago Jour. of Nervous and Mental Disease*, July, 1876, p. 363) records several interesting cases where the facial palsy appeared after convulsions, and while the paralysis of the arm and leg was very transient so as to have passed away before the case came under observation, the loss of power of the muscles of the face was persistent, and was associated with impairment of electro-muscular contractility. In these unusual cases the author thinks the lesion was in the brain, affecting the centre of innervation for the facial muscles, which the researches of Hitzig and Ferrier tend to locate in the lower part of the central ascending convolution.

The prognosis of cases of facial palsy must evidently depend upon the cause. When the paralysis is due simply to exposure to cold, a cure may be expected, though the affection is often very tedious, the paralysis at times persisting for months. But when, on the other hand, it depends upon disease of the temporal bone, the prognosis is usually unfavorable.

The treatment must also be modified according to the cause of the attack.

In simple acute cases, the application of hot fomentations to the part, or one or two leeches near the stylo-mastoid foramen, should always be directed, and is often productive of good results. Later in the affection, if the paralysis persists, small blisters should be repeatedly applied near the point of exit of the nerve.

Electricity is here also of very great service, and the same curious observation, which was mentioned in atrophic infantile paralysis, as to the power of the direct current to excite muscular contractions when the muscles have ceased entirely to respond to an induced current, has been frequently made in this affection (Baierlacher, Neumann, Radcliffe, Hillier).

In addition to these local remedies, the internal use of strychnia, iron, iodide of potassium, is often followed by benefit. In cases where there is reason to suspect that disease of the bone, or scrofulous enlargement of

the cervical glands, are the cause of the paralysis, the patient should be put upon the use of iodide of iron or cod-liver oil.

ARTICLE XIII.

PROGRESSIVE MUSCULAR SCLEROSIS OR PSEUDO-HYPERTROPHIC MUSCULAR PARALYSIS.

DEFINITION.—This curious affection is characterized by progressive loss of power, which first appears in certain groups of muscles, and advances until nearly all the muscles of the body may be involved, while at the same time the affected muscles increase in size and firmness owing to excessive hypertrophy (sclerotic) of their interfibrillar connective tissue. The muscular fibres usually present changes themselves, and at a later stage there is a process of fatty degeneration or accumulation in the newly-formed interstitial tissue.

HISTORY; SYNONYMS AND FREQUENCY.—True progressive muscular atrophy is extremely rare in young children; and among the cases which have been described, as by Meryon,[1] a certain number seem to belong to the disease now under consideration. The merit of having first clearly recognized and described the distinctive features of this latter affection, certainly belongs to Duchenne, whose first observations were published more than twelve years ago.[2] Since then cases have been reported in rapid succession until the number now upon record must exceed 100. The disease cannot therefore be regarded as a very rare one. There have been, we believe, but nine cases placed upon record in this country: one by Drs. Ingalls and Webber,[3] by one of ourselves,[4] by S. Weir Mitchell,[5] by E. M. Estrazulas,[6] and by Dr. C. T. Poore;[7] two by Dr. George S. Gerhard,[8] and two by Dr. W. A. Hammond.[9] We have had an opportunity of carefully studying four of these cases.

Various names have already been applied to the affection. It was originally called "hypertrophic paraplegia of infancy," by Duchenne, but he has since substituted the terms, paralysis with muscular sclerosis (paralysie myosclérosique), or muscular paralysis with apparent hypertrophy

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1 Pract. and Path. Researches on Paralysis. London, 1864, p. 200, *et seq.*

2 De l'Electrisation Localisée, 2ème ed., Paris, 1861.

3 Boston Med. and Surg. Journal, Nov. 1870.

4 Clinical Lecture on a case of Progressive Muscular Sclerosis, by William Pepper. Philadelphia Med. Times, June 15th and July 1st, 1871.

5 Photographic Review, October, 1871.

6 Obstetrical Journal of Great Britain and Ireland (American Supplement, p. 81), Sept. 1873, vol. i, No. 6.

7 New York Medical Journal, June, 1875.

8 Philadelphia Medical Times, October 16, 1876, p. 29.

9 Dis. of Nervous System, 6th edition, 1876, p. 492, *et seq.*

(paralysie musculaire pseudo-hypertrophique). It has also been called "lipomatosis luxurians musculorum progressiva" (Heller); lipomatous muscular atrophy (Seidel); progressive muscular paralysis, as a result of hypertrophy of the interstitial fatty tissue (Niemeyer); fatty muscular hypertrophy (Bergeron and Lutz); pseudo-hypertrophic spinal paralysis (Hammond); and, finally, progressive muscular sclerosis (Jaccoud and others). We much prefer this latter term, since it expresses the true pathological process which is present, and at the same time does not tend to confound this disease with any of the forms of true paralysis, from which it is, in reality, clearly distinguished by the facts that its essential feature is a progressive change in the structure of the muscle, and that the loss of power is dependent upon the change in the muscular tissue, and is not primary, as in all true palsies.

Causes.—The essential causes of progressive muscular sclerosis are unknown. There are, however, some influences which exert marked control over its occurrence. One of the most important of these is *early age*, since in a very large majority of cases the disease begins in childhood, and has even appeared in some cases to be congenital (Niemeyer). Although, however, it must be distinctly classed among the affections of childhood, it has been shown (Benedikt, Lutz, and Laycock) to occasionally occur in adult life. *Sex* also exerts a powerful influence: of 45 cases collected by Estrazulas (*loc. cit.*), in which this point was noted, it occurred only 7 times in females.

The curious fact has also been observed, that several children in the same family are apt to be affected, probably indicating some hereditary tendency. Eulenburg[1] is consequently inclined to regard the disease as dependent upon some congenitally defective formation of the central nervous system, probably in the cells of the gray substance of the spinal cord. Instances are on record where four brothers were affected (Meryon); and in another two brothers (Eulenburg); and in still another by the son of the latter author, in which the affection first showed itself in three sisters successively in the eighth year of their age.

Symptoms.—The disease either begins in early infancy, and is first manifested at the time the child should begin to walk, or it makes its appearance some years after the power of walking has been acquired.

The disease usually affects first the muscles of the legs, and advances upwards; in Niemeyer's case, on the other hand, it began in the gluteal muscles, and subsequently affected all the muscles of the lower extremities. The early symptoms are, therefore, connected with walking, and it is observed either that the child does not begin to walk until very late, and then walks imperfectly, or that, having walked well for several years, he begins to be readily tired by standing or walking, and soon presents peculiarities in his gait. In a few instances, pains in the limbs have been complained of in the early stage. When the disease is fully established, though before it has advanced far, the mode of walking and standing are quite characteristic. The patients find that, without some support, these opera-

[1] Virchow's Archiv, liii, 361.

tions become more and more difficult and painful, and that they are subject to frequent falls. In order to maintain their equilibrium while standing or walking, the lower dorsal and lumbar spine is arched forwards, while the upper part of the spine, the shoulders and head are bent backwards, frequently to so great an extent that their point of equilibrium falls behind the pelvis, thus producing the deformity known as "ensellure" or "saddle-back." The legs are widely separated, and in walking the body is inclined laterally towards the leg which rests on the ground, thus producing a characteristic balancing of the body during progression, while the arms are swung about, and the legs are advanced by jerks, describing a small arc.

While this impairment of strength and power of progression is developing, the affected muscles undergo remarkable changes. For a time they may be noticed merely to cease developing and increasing in size, or, more rarely, as in the case reported by one of ourselves (*loc. cit.*), and which is quoted below in full, they may present a well-marked stage of atrophy. After the stage of muscular weakness has lasted for a variable time, from a few months to two or even three years, whether or not there has been any noticeable atrophy of the affected muscles, a progressive enlargement of them makes its appearance. This usually affects the gastrocnemii first, then the glutei, the lumbar muscles of the spine, of the trunk, and finally the muscles of the arms, and even of the face and tongue. In five of the recorded cases, the heart has been hypertrophied. In one of these, reported by Dr. B. W. Foster, quoted by Poore (*loc. cit.*), the heart was normal when first examined, but three years later, and without apparent cause, it was found to be enlarged.

The above order is not invariably followed, and in by no means every case is the affection of the muscles so universal. The apparent hypertrophy may occur in nearly all the muscles which have shown weakness, but in general, according to Duchenne, it does not, and may even be limited to a very small number of them. The same observer (*loc. cit.*), thus describes the appearance of the muscles after this consecutive enlargement has occurred.

. . . "The hypertrophied muscles are firm and elastic; they become very hard while they contract, and show all the relief or projection which properly belongs to their contracted state; they then appear to form a hernial protrusion through the integument, which is very thin; moreover, their great size shows off the apparent smallness and delicacy of the joints at the knee, ankle, etc."

When this pseudo-hypertrophy is marked, and affects many muscles, it gives a most curious appearance to the children. Niemeyer speaks of his patient as looking "as if he had the body and head of a weak child on the hips and thighs of a strong man;" and J. Lockhart Clarke, in describing one of Duchenne's patients, says: "He looked like a little Hercules. Every visible muscle of the body, except the pectorals, was enormously developed; his head, even, appeared swollen, and the temporal muscles stood out like convex shells. Yet, when the poor boy attempted to walk, he labored to get along, presenting the most grotesque appear-

ance; and when laid on the ground, he was wholly unable to rise by his own unaided efforts." [1]

Dr. Mitchell (*loc. cit.*) calls attention to the fact, however, which we have also observed, that the enlargement of the calves is lower down than would be the case in excessively developed, but well-formed limbs.

The marked enlargement of the muscles of the calves is often attended with forced extension of the feet, producing double pes equinus or equino-varus. In the case reported by Estrazulas (*loc. cit.*), there is also marked enlargement and retraction of the posterior muscles of the thigh, with atrophy of the extensor group, so that there is forced flexion of the legs, rendering the boy unable to stand at all. Knoll [2] also describes such contractions in the enlarged muscles, but they are not usually present. According to Berger,[3] fibrillar contractions are of constant occurrence in the affected muscles: this does not accord with our own observations, nor with many of the reported descriptions of the disease. In one of the cases reported by Gerhard (*loc. cit.*) there was constant tremor of the flexors of the legs and feet, and of some of the muscles of the forearms.

The electrical condition of the affected muscles is peculiar. Frequently the results, when tested with faradaic currents, are different from those obtained with galvanism. The results also vary at different stages of the same case. Usually the muscular contractility, as tested by faradization, is impaired in all the affected muscles, those which are hypertrophied, however, contracting more actively than those which are atrophied. The galvano-contractility is also slightly impaired. The electro-muscular contractility has been found unimpaired in the earlier stages of the disease; but later it diminishes, the muscles continuing, however, to respond actively to galvanism after they have partly lost their power of responding to faradization.

Electro-muscular sensibility has been found normal or impaired in different cases: in one of our patients it was diminished to faradization, but remained acute to galvanism.

The skin over the affected parts often presents a marbled or mottled appearance. In one case that we have seen (described by Mitchell, *loc. cit.*), the mottling "consists of spaces of pallid skin surrounded by quite regular circles of congestion, which affect an irregular polygonal shape." The skin is usually thin and delicate, and can be easily lifted from the muscles. Disorders of the cutaneous sensibility have not been usually found, but Berger (*loc. cit.*) describes violent neuralgic pains and formication, followed at a later stage by anæsthesia. We have already alluded to the pains in the limbs occasionally complained of in the early stages of the disease.

The temperature of the parts is lowered. This can be distinguished by the hand, and has been found, on careful thermometric study, by Mitchell,[4]

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[1] Trans. of London Path. Soc., vol. xix, 1868, p. 6.

[2] Wien. Med. Jahrb., 1872; and in Syd. Soc. Bienn. Retrospect, 1871–72, p. 71.

[3] Deut. Arch. f. Klin. Med., March, 1872, Bd. ix; Hft. 4, 5, p. 363.

[4] This case was re-examined by Gerhard (*loc. cit.*, p. 31) at a later period of its development with the following results: right deltoid, 92°; left deltoid, 92½°; right thigh (inner side), 94⅕°; left thigh (inner side), 94⅕°; right calf, 90°; left calf, 90⅗°.

to be as follows: Left axilla, 97.5°; right axilla, 97°; perineum, 94.5°; right calf, 91.5°; left calf, 91°; and Estrazulas, in the case observed by him, reports the temperature in both axillæ 98°; on right calf, 91⅜°; and on left calf, 91°.

The following case, which has already appeared in print (*loc. cit.*), may be quoted as an illustration of many of the previous remarks:

W. E., æt. 20, was admitted to the Philadelphia Hospital, April 19, 1871. He was born in Virginia, and has resided there or in the District of Columbia until the present time. His parents are both dead,—his father from cholera, his mother from some unknown cause. He had two sisters and a brother, all of whom are dead,—two from unknown causes; but one sister had paralysis (apparently hemiplegia) and was unable to walk for some time before her death. The patient himself was a delicate and weakly child so far back as he can recollect. He never suffered either from malaria or rheumatism. He was engaged in the country on a farm, and his strength was overta-ked by heavy lifting. He never, however, met with any injury. Six years ago he began to notice gradually increasing loss of strength in the legs, which progressed so slowly that for eighteen months he was still able to run about, though not so actively as other boys. He was not obliged to use a cane until two years ago, and since then only in walking considerable distances. This gradually increasing debility was attended with no pain, formication, or subjective sense of change of temperature in the legs. There were also no contractions or cramps of the muscles. The progressive debility had not continued long before he noticed that it was necessary, when he was standing or walking, to throw his shoulders back and protrude his abdomen and lower part of the thorax, thus showing that the muscles of the back were affected at a very early date. During this early period he could walk quite naturally, but in running he threw his shoulders far back and stretched his legs widely apart; he assumed the same position also in going up an elevation. Two years later the muscles of the arms became affected in the same way as those of the legs and back. During the first three years he merely noticed that the legs did not grow as they should do, but afterwards atrophy began, first in the muscles of the calves, shortly after in those of the thighs and of the back, and soon afterwards in those of the shoulders and arms. About two years ago, after the atrophy of the muscles of the calves had become very marked, he noticed that they began to increase in size, and this growth has continued until they have acquired a size much greater than they ever had previously. This process of renewed growth next appeared, about one year ago, in the muscles of the forearm, and has continued at a slow rate. During all this time his weakness has steadily increased; he has, however, never been kept in bed by it, but has been able to get about feebly by the aid of a cane. He has never had a sense of constriction about any part of the body. His appetite throughout has been good, his digestion fair, and bowels regular. His urine has always been passed with ease, and has merely been noted to be occasionally yellow. About one year ago he was seized, without any apparent cause, with a severe epileptic convulsion, and since that time he has had similar attacks at intervals of from fifteen to thirty days. He has usually been unable to tell when these fits were coming on, but occasionally he has had a strange feeling in the head, and has thought of foolish things, before the attacks. The fits have been attended with entire unconsciousness, sudden falling to the ground, and muscular convulsion. He has usually been half a day in entirely recovering from them. He has never had more than two convulsions on the same day.

Present Condition.—His expression is natural, mind active, and special senses unaffected. The muscles of the face are not involved, and their action is perfect. His tongue is clean and moist, appetite fair, digestion easy, and bowels regular. There is no enlargement of the abdominal viscera. The urine is normal and secreted in

normal quantity. His respirations are easy, twelve in the minute, chiefly diaphragmatic: the vesicular murmur is soft and healthy. The cardiac sounds are normal. The pulse is 75, in the recumbent position.

Muscular System.—The muscles of the neck (sterno-cleido-mastoids and extensors of the head) are of fair size, and their movements are strong and free. The trapezii are feeble, and he retracts the shoulders with difficulty and feebly. The pectoral muscles are moderately wasted and feeble. The scapular group of muscles are less wasted and the scapulæ do not project markedly from the thorax, so that the serrati magni are probably not much wasted and enfeebled. The deltoids are extremely wasted and he is unable to raise either arm within thirty degrees of the horizontal plane; when the arm is raised, there is a marked depression below the acromion process. The biceps muscles are also extremely wasted, and he is able to flex the forearm only a little beyond a right angle. The triceps muscles are also very feeble, and the long head of each is greatly wasted, while the external and short heads appear as quite prominent fleshy masses.

The forearms seem unduly large in comparison with the atrophied arms, and are in reality larger than they have ever previously been. They have, moreover, a peculiar blunt and swollen appearance, owing to the sudden enlargment of the muscles above the wrists. The atrophy of the forearms seems never to have reached the degree attained elsewhere, so that the degree of consecutive hypertrophy has not been so marked as in the calves. The grasp of the hands is decidedly weaker than would be expected from the size of the forearms, that of the right being much weaker than that of the left hand. There has been no atrophy of the muscles of the hands.

When he sits up in bed, he is only able to hold the shoulders back with effort; there is increased bowing forward of the vertebral column, with absence of the lumbar depression. There is decided wasting of the erector spinæ muscles on either side. When lying in bed, the lumbar spine is raised, so that the obliquity of the pelvis and hypogastric region is increased. The muscles of the abdomen and thorax are not wasted, and preserve good strength.

When he is lying down, the feet are strongly extended and adducted (equino-varus), so that the toes point towards each other, while the soles rest on the bed. There is great prominence of the tarsus. The muscles of the thighs are all much wasted, as are those of the buttocks. It is with difficulty that, when lying down, he can draw up the legs by the action of the flexor muscles. He has much more power of extending them by the quadriceps extensors. The rotators, abductors, and adductors of the thighs are much less affected. He can move in bed only by a wriggling motion.

The calves appear as large as those of a vigorous man, contrasting very strangely with the wasted thighs. They feel quite firm, even when relaxed, and when he contracts the muscles they stand out well, and are hard and elastic. The heads of the gastrocnemii especially become prominent, standing out like firm subcutaneous tumors. He has considerable power of flexing, adducting, and abducting the feet, but the extensors are very feeble. The muscles of the right thigh and leg are decidedly stronger than the corresponding ones of the left side.

In rising from the recumbent position into a sitting one, he is obliged to make a very strong effort. When about to stand up, he throws his body forward till it almost rests on his thighs, and then, placing his hands on his knees and rising a little from his seat, he slowly raises his body by sliding his hands up his thighs; and when he has raised himself as far as possible in this way, he places one hand after the other on a chair-back or edge of a table, and leans forward. He then, by jerks of the alternate sides of the body, draws his legs forward, thus assuming more and more nearly an erect position. So soon as he approaches this, the legs are widely separated, the shoulders thrown quickly back, and the abdomen protruded, and, after tottering a few times, he secures his equilibrium in this peculiar position. It is very tiresome for him to stand without some support, and when he does so he

bears with his whole weight on the right foot, the sole of which rests flat on the ground, while the left leg is thrown forward in advance, and the heel elevated from the ground. When a support is afforded him, he places both hands on it, and leans forward, rising on the balls of the feet, so that the heels are raised one-half inch from the ground. In this position he stands for half an hour or more at a time. The muscles of the calves are contracted and thrown into prominent relief.

In walking, as in standing, the shoulders are thrown very far back, and the lumbar depression is rendered very deep; the arms hang down by the sides, coming decidedly behind the line of the buttocks. The legs are kept quite widely apart. He advances each one by resting his weight on the opposite foot, and then swinging forward the whole side, the foot describing a slight arc. At the moment of thus swinging forward either leg, he rises slightly on the opposite foot. While standing on the right foot, the whole sole rests on the ground, though the heel merely touches it lightly; but when his weight is thrown entirely on the left leg, the left heel still does not touch the ground. The effort of advancing each leg is evidently great; the muscles of the thighs tremble and quiver, but those of the calves contract forcibly and are thrown into bold relief. Walking is very tiresome, and gives him pain and soreness in the back. No fibrillar contractions are seen in any of the muscles.

Electric examination, April 23d, 1871.—The muscles of the forearm (tested on the right side) contract well under a faradic current of rather unusual strength; they also respond well to faradization of the brachial plexus. Electro-muscular sensibility is not acute, though this may be a mere individual peculiarity. The muscles of the arm, the pectoralis major, and the trapezius all contract on faradization, whether direct or applied to their motor points. It requires rather too powerful a current to produce these effects. A still more powerful current is required to induce contraction of the thigh muscles, but they all respond, though feebly: the sensibility to the current is impaired. The contractions of the flexors of the leg on the thigh are the most feeble, and are obtained only by very strong currents. The muscles of the leg respond more actively than the muscles of the thigh, whether the electrode is placed over the nerve in the thigh, or on the motor point of the muscle, or directly over its body.

When tested with a galvanic current, the muscles of the calves of the legs contract with each interruption and renewal of a current of rather unusual strength (twenty cells, Stöhrer), and electro-muscular sensibility is acute. The muscles of the thighs also respond, but with more difficulty, to the galvanic current.

The following measurements were taken:

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both hands and feet readily become bluish on exposure to cold. The color of the surface is, however, everywhere normal, without any mottling.

April 30.—He had to-day an epileptic attack, with frothing at the mouth, general muscular spasms, and unconsciousness, lasting for eight minutes. There was deep stupor and sleep for four hours subsequently, and he did not entirely recover until the following morning. The fit was preceded for about a minute by the foolish fancies he has frequently had before.

Ordered syr. phosphat. comp., fʒij, t. d. Faradization of arms and legs on alternate days.

A fragment removed by Duchenne's "emporte-pièce" from the left deltoid was of a slightly pale reddish color. When examined microscopically, a large majority of the fibrils showed distinct, though often fine and delicate, transverse striation. In a few instances, striation was entirely absent, the fibrils looking homogeneous and much like ground-glass cylinders. In a very few fibrils, also, distinct longitudinal striation was visible, and in others there was multiplication of the nuclei in the sarcolemma. In not a single fibril was there any trace of fatty degeneration. The fibrils varied in size from $\frac{1}{465}''$ to $\frac{1}{230}''$, or even, in a few cases, $\frac{1}{160}''$. The striation was particularly faint, or at times even absent, in the largest fibrils. There was a large amount of interstitial white fibrous tissue, with abundant granular matter containing many oval nuclei. In places there were small collections of minute fat-globules or refracting granules.

Fragments removed from the gastrocnemii presented closely analogous conditions. The muscular tissue was merely rather paler red than normal. The muscular fibrils varied greatly in appearance and in size. The transverse striation was in some fibrils perfectly healthy, but in a majority it was altered, though in various ways. Thus, in some it was very faint and difficult to distinguish; in others, it was wholly absent, the fibrils presenting the appearance of fine ground-glass. In other fibrils there was a marked appearance of longitudinal striation, due to delicate fibres or very fine fusiform cells arranged in the long axis of the muscular fibril. In many fibrils there was distinct excess of the nuclei of sarcolemma, which appeared as large oval nuclei with a punctiform nucleus. A few fibrils presented streaks of minute fatty granules along their centres, and a very small number were decidedly fatty. The muscular fibrils varied greatly in size also. Many were about $\frac{1}{250}''$ to $\frac{1}{330}''$ in diameter; but a number were $\frac{1}{450}''$ to $\frac{1}{400}''$, while others were as much as $\frac{1}{125}''$, $\frac{1}{140}''$, $\frac{1}{200}''$ in width. There was a large excess of interstitial tissue, in places taking the form of long, narrow, wavy bands of pure white fibrous tissue; in others, appearing as abundant granular stroma, thickly strewn with oval nuclei. There was also some curly, elastic fibrous tissue. There was a considerable amount of interstitial fat, existing as scattered globules, or arranged in patches of large, closely aggregated fat-globules. In places, isolated muscular fibrils lay imbedded in this fibroid tissue so as to be scarcely visible; but in other places a number of fibrils lay directly in contact with each other, forming a little bundle, around which the excessive growth of interstitial tissue had occurred. The arterioles and capillaries appeared healthy. No nerve-fibrils were detected.

The patient continued for several months upon the above treatment, and appeared to gain slightly in strength. The recurrence of his convulsions was checked by full doses of bromide of potassium; still it could not be said that any material improvement had occurred, when he left the hospital, and was lost sight of.

There is usually an entire want of disturbance of the general health. The appetite remains good until a late period, digestion is well performed, and the action of the bowels is regular. Neither the rectum nor the urinary bladder becomes paralyzed. There is frequently an entire want of cerebral symptoms, and the mind may be clear until the close of the case.

In several instances, however, the patients have been of feeble intelligence or even idiotic; and in the case above reported, it will be remembered that the disease was complicated with epileptiform convulsions.

Course and Duration.—As will be inferred from the foregoing description, the duration of this disease is very considerable, varying from five to fifteen years, or even more. It may occupy several years in reaching its full development, and may then remain at this stage for several years, or even until a tolerably advanced period of youth, but finally it is succeeded by a stage in which the loss of power becomes more complete and extensive, involving the upper extremities and muscles of respiration, and confining the patients to the recumbent position. During this final stage there is a rapid decrease in the size of the hypertrophied muscles, and the limbs may even come to present an appearance of great atrophy.

Death usually occurs before adult age from sheer prostration or from some intercurrent affection of the respiratory organs.

Prognosis.—The course of this disease is steadily progressive, and despite the various plans of treatment adopted, usually leads to a fatal result. In one case, however, recovery took place, and in one other there was some improvement. In the case we have here reported, there seemed to be some temporary improvement under treatment.

Diagnosis.—The diseases from which it is most important to distinguish progressive muscular sclerosis are atrophic infantile paralysis and progressive muscular atrophy. In infantile paralysis, however, the suddenness of attack, frequently associated with fever or with some cerebral disturbance as convulsions; the occurrence of complete and more or less extensive paralysis; the gradual disappearance of the paralysis in some parts, while in others it remains permanent; the diminution and ultimate loss of electro-muscular contractility; the occurrence at a later period of fatty degeneration and atrophy of the affected muscles, with arrest in the development of the bones and marked deformities; and the entire absence of any secondary enlargement of the parts involved, constitute a series of distinctive features so clear and decisive as to render the differential diagnosis easy and certain.

A disease from which it is much more important to carefully distinguish progressive sclerosis of the muscles is progressive muscular atrophy occurring in childhood. The especial importance of the relations of these two diseases depends on the fact that both are alike diseases of nutrition of the muscles, thus constituting a group quite distinct from all the forms of true paralysis. In both the disease begins—usually without any apparent cause—insidiously, and progresses slowly but surely. In both the loss of motor power is secondary to the changes in the muscular tissue; in both the muscular degeneration and consequent loss of power almost invariably progress steadily to a fatal result. These two diseases, then, stand related to each as being alike caused by disturbance of the trophic nervous system, but they are at the same time most positively separated from each other by marked differences in their course and symptoms.

Thus, in progressive muscular atrophy, the disease nearly always begins

in the upper extremities, and invades subsequently the trunk and lower extremities. Indeed, Duchenne has pointed out that when this disease appears in childhood, which is quite rare, it usually begins in the face, where it produces atrophy of the orbicularis oris and the zygomatici, and does not extend to the trunk and extremities until after a period varying from two to three years. It then follows the same descending course seen in cases occurring in adults. The atrophy usually affects the muscles irregularly, so that various deformities and vicious positions of the parts involved are developed. Microscopic examination shows a progressive fatty degeneration and atrophy of the muscular fibrils, and in proportion as this increases there is loss of power and of electro-muscular contractility. One further symptom of high diagnostic value is the frequent occurrence of fibrillar contractions in the affected muscles, which, although stated by Berger to be of constant occurrence in progressive muscular sclerosis, has not been found so by ourselves or other observers. Finally, the muscles which have progressively atrophied never undergo any secondary enlargement, nor does microscopic examination reveal any lesion of the interfibrillar connective tissue. In all these particulars, then, progressive muscular atrophy differs widely from progressive muscular sclerosis, which is almost exclusively a disease of childhood, beginning in the muscles of the lower extremities and advancing upwards, producing a peculiar mode of standing and walking, and in which the affected muscles, with or without a previous stage of atrophy, undergo remarkable enlargement, usually without fibrillar contractions, and with preservation of electro-muscular contractility till a comparatively late period of the disease. The results of microscopic examination, also, as detailed in the next paragraph on the morbid anatomy, are entirely different from those observed in progressive atrophy.

Morbid Anatomy and Nature.—There is still an urgent need of careful, skilfully conducted microscopic examinations of the nerve centres in this disease. The examinations which have been made up to the present have not yielded uniform results. In two of them, Cohnheim's (when however the microscopic study was not conducted with the requisite care and thoroughness) and Charcot's,[1] no lesions were found in the spinal cord; while in the cases reported by Müller,[2] Barth,[3] and Lockhart Clarke,[4] positive lesions of the cord were discovered, chiefly affecting the anterior columns of gray matter and the large nerve-cells which exist there. Eulenburg had already suggested that the pathological origin of this affection would be found in some defective formation or disease of these parts; and in the first publication made on this subject by one of ourselves, when Cohnheim's imperfectly studied case was the only one on record, we stated

[1] Sur l'état anatomique des muscles et de la moelle épinière dans un cas de paralysie pseudo-hypertrophique, Arch. de Phys. March, 1872, p. 228.

[2] Beiträge z. Path. Anat. u. Phys. d. menschlichen Rückenmarks, Hft ii, Leipzig, 1870.

[3] Beiträge z. Kenntniss d atrophia musculorum lipomatosa; Arch. d. Heilkund., Leipzig, 1871, p. 120.

[4] Medico.-Chir. Trans., vol. xlvii, 1875, p. 247.

that analogy with other diseases of the nutrition of the muscles supported this suggestion. Hammond (*op. cit.*, p. 500), "feels warranted in at least provisionally accepting the view, that the anterior tract of gray matter is the seat of lesion in pseudo-hypertrophic paralysis." Charcot, on the other hand, contends that the anatomical cause of this affection is not seated in the spinal cord. Berger (*loc. cit.*) assumes the existence of trophic nerves, and attributes the disease to some disturbance of their function. Duchenne, on the other hand, ascribed it to a paralysis of the vaso-motor nerves; and others again regard it as a primitive muscular lesion. It is evident, therefore, further careful examinations of the spinal cord in this disease are necessary before a definite conclusion can be reached on this point of vital importance.

The condition of the affected muscles themselves has been very carefully studied during life, on small fragments removed by Duchenne's trocar[1] (emporte-pièce), and the results confirmed by examination after death.

When examined by the naked eye, their color is altered, and the muscles present either a uniform pale or yellowish appearance, or are marked with stripes of yellow or yellowish-white; on section they shine with a dull, greasy lustre.

The results of microscopic examinations vary somewhat at different periods of the disease. The changes affect both the muscular fibrils, and even more markedly, the interfibrillar connective tissue.

In the early stage, Berger asserts (*loc. cit.*) that he found in two cases an absence of change in the interstitial tissue, and a marked hypertrophy of the fibrils themselves. This enlargement has not, however, been constantly observed. The fact of its occurrence, and of its persistence in some fibrils even in a comparatively advanced period of the disease, is confirmed by the observation of Leyden,[2] Estrazulas (*loc. cit.*), Knoll (*loc. cit.*), and ourselves. In the later stages, many of the fibrils are pale and small, being occasionally reduced, according to Cohnheim, to $\frac{1}{5}$th their normal diameter; in some places empty sheaths of sarcolemma are seen. Many of these fibrils, though altered in size, present no other morbid condition, either fatty or granular. Knoll observed in some of the border fibres a tendency to split into two; and Martini[3] describes a peculiar process of fission or division of some of the atrophied fibres. In the cases recorded by Meryon (*loc. cit.*), which were probably of this form of disease, a granular degeneration of the muscular fibres, with rupture of the sarcolemma was observed.

The most marked change is, however, in the condition of the interstitial tissue. It is not known definitely whether this precedes all change in the

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[1] This useful little instrument is shaped like a trocar. The blade is, however, a hollow cylinder, composed of two parts, one of which, bearing the point, is fixed, while the other can be withdrawn a little by sliding a movable button on the handle. The trocar is introduced closed into the substance of the muscle, the button withdrawn, so as to open the cylinder and allow a fragment of muscle to project into it; the button is then pushed forward, cutting off and securing the little morsel of tissue.

[2] Berl. Klin. Wchnschr., 1866.

[3] Centralblatt, 1871, 641; in Syd. Soc. Bienn. Retrospect, 1871–72, p 70.

muscular fibrils themselves. But at least by the time that enlargement of the muscular masses can readily be detected, there is usually, despite the two observations of Berger, marked proliferation of its nuclei and hyperplasia of the fibrils. This continues to increase until at places the muscular fibres are separated by broad tracts of wavy fibrous tissue, interspersed with fine nuclei. At a later period this is associated with increasing interstitial fatty accumulation and degeneration, which advances with varying rapidity, even leading in some cases to such extreme accumulation of fat as to be visible to the unaided eye as yellowish streaks. It is probable that the muscular fibres may temporarily share the exaggerated nutrition of the surrounding connective tissue, but later, as this interstitial tissue accumulates, the fibrils are subjected to severe pressure, and undergo atrophy in many instances. The entire process, therefore, seems to be of a strictly sclerotic character, so far as the interfibrillar connective tissue is concerned, but associated with an irregular and as yet undetermined stage of true hypertrophy of the muscular fibrils themselves.

TREATMENT.—The results of treatment in progressive muscular sclerosis have so far been highly unsatisfactory. The internal remedies from which most benefit may be expected are those which tend to improve nutrition, and especially to improve the tone of nutrition of the nerve-centres. Among these, cod-liver oil, iron, the compound syrup of the phosphates, and arsenic, may be specially mentioned. In the case reported by ourselves, where there was the complication of epileptiform convulsions, benefit was derived from a course of bromide of potassium.

The remedy, however, from which most good is to be expected, is electricity. This has been used by Duchenne with great benefit, in the form of faradization of the affected muscles. It is asserted by Benedikt, that good results have been attained in three cases by the use of the direct current, the copper pole being placed over the lower cervical ganglion, and the zinc pole along the side of the lumbar vertebræ, by means of a broad metal plate. Others have, however, tried this mode of treatment for a long time without any success. As, however, no more plausible mode of treatment has yet been suggested, we should be inclined to adopt it in conjunction with direct faradization of the affected muscles, and the use of the internal remedies above recommended.

ARTICLE XIV.

NIGHT TERRORS.

THE night terror of children is a condition, in some respects, analogous to the nightmare of the adult. It is not quite the same, however, for in nightmare the subject is relieved of the symptoms so soon as he awakes from the sleep in which the dream has occurred, while in night terror the

symptoms continue for some time after the patient has been roused sufficiently, to utter cries, and to exhibit in the expression of the countenance, and in the movements, an accordance with the painful idea which occupies the mind. It is perhaps, more akin to somnambulism than nightmare. But we will cite some of the cases we have met with, and then endeavor to explain the pathology of the condition, and to describe its proper treatment.

Several years since, one of us had the charge of a family of five children, all of whom were more than usually intelligent, and all were liable in early childhood to frequent attacks of night terror. One of these children died early of serous effusion into the ventricles of the brain, occurring after a severe attack of diarrhœa. The eldest child, a son, who became quite a distinguished student and lawyer, was specially liable to this condition. He would wake partially from sound sleep, screaming, struggling, and exhibiting all the signs of a violent terror. This condition lasted for several minutes after the screams and struggles had begun, during which time it was evident that he was under the influence of some terrifying idea. The only thing to be done at the time was to hold him gently in the arms, and endeavor to rouse him into full wakefulness by soothing words and caresses. During his early years he was unable to explain the character of the idea which caused the distress. At a later period he recollected that the terrifying thought was always one connected with some object of vast size. Many of the attacks, he said, arose from his seeing in his sleep an elephant in the nursery, which, from being small in size at first, expanded before his eyes to such a size that he was being crushed between it and the walls.

In another case, we were sent for to see a young child, one of a large family, of nervous and rather timid type, which, whilst playing on the floor of the nursery one morning, was bitten in the foot by a tame parrot as it hopped about the room. The child, though not seriously bitten, was very much alarmed at the time. On the following night, at midnight, it started suddenly from a sound sleep, shrieking, "Take the parrot away, take the parrot away," and was so alarmed and terrified, and struggled so violently and so long with the idea, that the mother, a very sensible and experienced person, became quite alarmed lest it should have a convulsion, and was on the point of sending for us. At last, by carrying it about and soothing it gently, it was fully waked and the terror passed away for the time. This scene was repeated for several nights afterwards at about the same hour, but with diminishing violence, until the impression faded away and disappeared. At the time of the occurrence the child was perfectly well, and when we visited it on the following day and for several days afterwards, there was no disturbance of the health requiring medical interference. The attacks were evidently the result of the vivid impression made upon the child in the daytime, which, by the play of memory during sleep, reproduced to the child all the pain and terror endured at the moment of the occurrence.

We were sent for on another occasion to see a little girl of six years of age, who had alarmed the mother greatly during the previous night by partially waking from sound sleep, screaming, "Take the white dog away,

oh, take the white dog away!" with such terror in the countenance and eye, such agitation and struggling of the limbs, that the mother feared it must have a fit. It was many moments before it could be roused sufficiently from the delirious terror to recognize those around it, and to know that there was no dog by its side. The terror was repeated for several nights at about the same time, and then gradually passed away. In this case, the child had been walking in the street with the mother, on the day before the first dream occurred, and had been suddenly shocked and terrified by a large white dog brushing sharply against her, as it was careering along the street. There was no disturbance of the health at the time nor afterwards. As in the last case, the attack was evidently the result of the reproduction in a dream of the fright it had had in the street.

The following case was still more curious. It is related very much in the language of the mother. The child, a girl two years and two months old, was the daughter of a very bright and highly educated mother, and of a father of unusual intelligence and force of character. The child was herself very precocious and active-minded. The parents were both very healthy persons. On the night of Sept. 13th, 1873, the child awoke partially in a great fright, screaming, trembling, and covered with cold perspiration. Nothing calmed her for some time. She repeated over and over again, "Teeth bite you, teeth bite you." Finally, at the end of an hour, she was roused from the state of half sleep, the sobs and crying ceased and the attack ended, but at dawn of the same night there was another seizure which was not quite so violent. During the attack she begged to have her head covered, evidently fancying that this protected her from some threatening object. During the following day she manifested great fear of the large slop jar in the nursery, and could not be induced to approach it. When her father took it into his hands to explain to her that it was "only a jar," she screamed most pitifully and seemed in abject terror. Being a child of peculiarly vivid imagination, it was supposed that she had, by some freak of fancy, come to imagine the top or opening of the jar, to be an open mouth armed with teeth, ready to rend and tear her. She conceived, also, a great terror of the carved ornaments on the head-board of her crib, and, indeed, these fears became so marked and so great, that she was moved into another room, where the furniture was plainer and unvarnished, so that the shadows and reflections might not feed her disturbed fancy. In December she was seized with typhoid fever, from which she did not recover until February, 1874. In that month her mother had another child, a boy. When she was taken into the chamber to see her little brother, she had another nervous attack, in which she fancied that an animal was biting her mother and that it might bite her also. The nervous seizures at night continued to recur at intervals of about five weeks, generally after violent exercise or hearty eating, until May, 1875, when a severe attack of scarlet fever seemed to eradicate them in great measure. At the present time, she has a night terror only when her imagination has been, in some way, excited, or her sympathies overtaxed.

With one more case, which shows the curious features of this sleep-in-

toxication in a very marked manner, we shall end the citation of cases, and pass on to a consideration of the pathology and treatment of the condition.

A gentleman, whose eldest son was rather remarkable for his intellectual development, was roused from a sound sleep in the early morning by a touch on the shoulder. On waking he saw this boy, then about twelve years old, standing by the bedside, dressed in his wrapper, his legs bare, and with his bare feet in slippers. The boy said: "Father, there are robbers in the house, they are downstairs now, but I do not think there is any danger, for I have been downstairs and have locked the doors, but I thought I had best tell you." The father thus waked suddenly from sleep, thought at first that the child was insane, but seeing some peculiar fixity in his look and manner, it flashed into his mind that the child was acting under the influence of a dream. He touched him sharply, and said loudly, "My son, you are sleeping; wake up, wake up." The boy drew a long, deep breath, gaped, waked, and said, "Why, so I am," and walked off to bed again in the most natural manner.

Pathology.—The best explanation of the conditions which exist in this curious disorder of sleep is, we think, to be found in the works of writers on forensic medicine. Thus, Dr. Johann L. Caspar (*Forensic Medicine, Syd. Soc. Ed.*, vol. iv, p. 273), remarks that "the dreaming state passes quite insensibly into that of somnolence, that middle state betwixt sleeping and waking, in which the connection with the outer world is neither that of sleep nor waking. The dreaming state is wholly sleep, somnolence is half sleep, half waking. In it the senses are neither quite awake nor quite roused, but are surrounded by a cloud of dream phantasms; the somnolent man sees and hears self-made phantoms instead of real objects; he hears a shot fired, and dreams of it, while it was only a stool that fell. He reasons logically, as is well known to be the case also in dreams, in regard to the impressions supposed to be felt, and may, since muscular action is not prevented by sleep, act in the most illegal manner."

In the *Treatise on Medical Jurisprudence* (Philadelphia, 1855, p. 119), by Wharton and Moreton Stillé, in the article on "Mental Unsoundness as connected with Sleep," it is stated that "under this general head may be grouped somnolentia or sleep drunkenness, somnambulism, and nightmare, the two last of which may be joined." Sleep is interrupted, they suppose, by whatever terminates the peculiar condition of the brain upon which sleep depends, by the natural exhaustion of the state of the brain, by vivid and sudden impressions on the senses, and by disagreeable sensations. "Now, in a certain morbid condition of the brain this awakening is not complete, and does not restore the waking state with a full and correct perception of surrounding things, but an intermediate state between sleeping and waking is produced, which resembles intoxication, and is called the *intoxication of sleep* (schlaftrunkenheit). This state admits of action, which is directed by the phantoms of the dream; talking in sleep being very nearly allied to waking, and dreams themselves being midway between sleeping and waking, for in the depths of sleep we no longer become conscious of dreams." In this explanation they differ somewhat

from Caspar, who asserts that dreams are "purely phantasmagoric conceptions arising spontaneously in the brain, which continues to act during sleep and during the so-called dreamy waking, without any stimulation produced by the external world through the senses." Wharton and Stillé say further: "It is important to distinguish somnolentia, or sleep-drunkenness, which is a state which in a greater or less extent is incidental to every individual, from somnambulism, which is an abnormal condition incident to very few." The experience of every-day life demonstrates how much the former enters into almost every relation. Children, particularly, sometimes struggle convulsively in the effort to wake up, which often is continued for several minutes. The very exclamations, "wake up," "come to," which are so common in addressing persons in the waking condition, are scarcely necessary in bringing to the mind many recollections of cases where the waking struggles were peculiarly protracted. Of course there are constitutions where this struggle is peculiarly distressing, just as there are constitutions in which the tendency to sleeplessness is equally marked. If we recall to the reader the fact, that it is in the state of somnolentia or sleep-drunkenness, that acts of violence have been committed by persons, as stabbing a friend, shooting a passer-by who sought to wake a sleeping sentinel, and other acts of this kind, for which the unfortunate individual has been tried for his life, all of which unhappy events have been committed in the mental state induced by some dream, which has pursued the patient into the only partial awakening, it will not be difficult to understand the phenomena we have described as occurring in some of the cases of night terrors above cited.

Causes.—In some children it evidently needs but a vivid impression upon the mind in the waking state, to produce in the course of the following night, and sometimes for many nights afterwards, the dream which is to cause all the phenomena of the severest night terror. The child may be in perfect health, and yet the mind shall, in sleep, so act as to reproduce in full or in exaggerated force, the terrors which have been first felt in the waking state, and perhaps whilst the child was in full, happy play. Such were the cases in which the child had been bitten by a parrot whilst playing on the floor, and that in which it had been shocked and terrified, whilst walking the streets, by the large dog brushing against its person. In other cases, children predisposed to this condition by some unusual activity of the brain, have the attacks whenever their health is deranged in any way, as by indigestion, or by febrile disturbances from any cause. We have met with the attacks often in the various greater or lesser perturbations of health which accompany the different diseases of childhood.

Treatment.—The only treatment necessary during the attack is for the mother or nurse to take the child into her arms, and endeavor by gentle and soothing means to wake it fully from its half sleep. Gentle movements, caresses, soft words, stroking the head and limbs, indeed, the very conduct which any tender mother would naturally adopt towards a terrified and frightened child, are the proper means to be used in the paroxysm.

If, at the time the child is having these attacks, there is any fault in the health, this should be attended to. The digestive system especially

ought to be carefully examined; constipation should be relieved; the diet ought to be arranged with great care, so that it may be readily digested, and yet be abundantly nutritive. If the patient is pale, iron ought always to be given for some weeks. If there be any trace of periodic disturbance from latent or open malarial disorders, quinia is of the utmost use and importance. When the attacks recur night after night, we know nothing so useful as the bromide of potassium or sodium, of which from two and a half to five grains may be given at bedtime for one or more weeks. It is often wise, particularly when the disturbance is of obstinate continuance, to add from one to two or three minims, according to the age, of deodorized laudanum, to the dose of bromide.

CLASS V.

GENERAL DISEASES.

INTRODUCTORY REMARKS.

This great class includes a large number of diseases, both acute and chronic, in which the system at large, including the blood, is affected by the morbid process. For the sake of greater clearness and convenience, the chronic diseases of this class which appear to us to call for a special discussion in the present work, will be treated subsequently in a separate class, termed "Cachectic Diseases." The acute general diseases may further be subdivided into those which are *diathetic*, as rheumatism, and those which are *zymotic*, or dependent upon the action of some infectious principle introduced from without into the system.

The zymotic diseases include some which are unattended with eruption, as mumps, diphtheria, and malaria, as well as the great class of eruptive fevers.

ARTICLE I.

ACUTE RHEUMATISM.

As it is not designed to enter into a full discussion of the numerous affections which merely occur in childhood in common with the other periods of life, we shall present but a brief account of rheumatism in children, alluding particularly to those points in which it differs from the same disease in adults.

The importance of this subject is, we believe, not usually appreciated; and it is not treated of at all in many of the treatises on diseases of children. Rheumatism in children deserves careful consideration, however, not only on account of its frequency and peculiarities, but also on account of its marked tendency to cardiac complications, and of its recently established relation to chorea. This question has been treated of under the head of the latter affection, and we will limit ourselves at this place to the discussion of acute articular rheumatism.

Symptoms.—Acute rheumatism expresses itself in the child, as in the adult, by painful inflammation of one or more of the larger joints, usually accompanied by a high grade of febrile action. It is probable, however,

that in the majority of cases in children, the fever is not so intense nor the course of the disease so long, as in adults.

The fever, which is one of the most marked symptoms, may precede the development of inflammation of the joints by one or two days, or may coincide with the appearance of pain and swelling. It is generally marked in severe cases, and attended by frequency of the pulse, great heat of the skin, and, usually, copious acid perspirations. The heat of the skin and frequency of the pulse constitute a good index of the severity of the disease, and we may always apprehend a dangerous attack when the temperature rises above 104° or 105°.

With this febrile action, we find disturbances of the digestive functions; the tongue is heavily coated, the appetite lost, or nausea may be present, and the bowels are sluggish, the evacuations being dark and offensive.

The local phenomena attending this fever depend upon acute inflammation of some of the large joints.

Occasionally the ankles, knee-joints, wrists, elbows, and shoulder-joints will be simultaneously affected; but in far the majority of cases, a few only of these articulations will be involved, and the others become affected subsequently, if indeed they do not escape entirely. But one of the most characteristic features of this specific rheumatic inflammation, though most marked in the chronic form, is its tendency to shift its seat, and we may find the intense pain and heat of one part transferred within twenty-four hours to a distant joint. We can rarely learn from the little patients the character of the pain which causes such bitter complaints; in one mild case, recorded by Rilliet and Barthez, it was compared to frequent light blows given upon the affected joints.

The *heat* of the inflamed part is always much increased, and it is not unusual to find its temperature ranging from 100° to 105° (Aitken).

The *swelling* is generally considerable, so that the shape of the parts may be much changed. When the knee-joint is inflamed, the effusion may raise the patella from its position on the condyles.

The skin over the inflamed joints usually presents a more or less decided blush.

We must not, however, overlook the fact that the severity of these articular troubles is not always commensurate with the rheumatic fever, and that frequently, especially in very young children, the local signs may be slight or even absent, and the only feature which tends to reveal the real nature of the disorder may be soreness, evinced by cries on every attempt to move the patient.

Duration.—The duration of acute rheumatism varies exceedingly. According to Rilliet and Barthez, it follows a much more rapid course in children than in adults, occasionally yielding at the end of six days, and nearly always before the fifteenth day. We have, however, seen the rheumatic fever last twenty-one days, and before convalescence was fully entered upon, six weeks had elapsed.

There is a marked tendency to relapses and second attacks in rheumatism, at whatever age it occurs; and we frequently meet with children

of twelve or fifteen years of age who have passed through three or four acute attacks of this disease.

Causes.—*Age.*—Early infancy appears to protect, to a certain extent, against this affection. Rilliet and Barthez allude to a case occurring at the age of seven months; but the earliest age at which they met with it was at four years in a single case. We have ourselves met with it, although in an imperfectly developed form, in a number of cases in young children; and are satisfied that the nature of these attacks is often overlooked.

We have ourselves observed one case in the second year, and several others between the close of the second and fifth years.

The influence which *sex* exercises upon the frequency of rheumatism in childhood seems still undetermined. It is usually stated that boys are far more liable to the disease than girls, but in our own experience it has been more frequent in girls; and from the register of the Children's Hospital in London (quoted by Tuckwell, *St. Barth. Hosp. Rep.*, vol. v, 1868, p. 102), it appears that of 478 cases of rheumatism treated during sixteen years, 252 were in females, and only 226 in males. The marked difference in this respect between rheumatism in children and in adults may probably be explained by the fact that the two sexes are exposed to the exciting causes much more equally in childhood than in later life.

Cold and Dampness.—Of external causes, the most prominent undoubtedly are, sudden vicissitudes of temperature, especially when joined with dampness of the atmosphere, whereas the mere degree of coldness exercises but little influence upon its development. Of course the action of damp and cold is markedly increased by insufficient clothing.

Complications.—We have already alluded to the occurrence of chorea and cerebral symptoms in connection with rheumatism (see article on chorea), and the most important and frequent of all these complications, the various inflammations of the membranes of the heart, have been treated of under the head of diseases of that organ.

Prognosis.—Uncomplicated rheumatism in childhood, though at times severe, is scarcely ever fatal. When complicated, however, with endo- or pericarditis, the gravity of the prognosis must depend upon the extent and severity of the inflammation. For although, even when the heart is seriously involved, the child frequently survives the acute symptoms, it too often bears with it the seeds of premature death, in an organic disease of that organ.

Diagnosis.—The diagnosis of acute rheumatism, after the appearance of the articular symptoms, can hardly present difficulty. When, however, marked rheumatic fever, accompanied merely by vague pains, precedes by several days the development of any local symptoms, the diagnosis must remain uncertain, or we may be led to regard as rheumatism one of those cases of phlegmon of the deep tissues of the extremities, such as is alluded to in the introductory essay of this work. In addition to this, we must be careful to distinguish the articular affections occurring in pyæmia, or those supervening upon attacks of small-pox and scarlet fever, which are probably also of pyæmic nature. The diagnosis in these cases must be

chiefly established by attention to the general symptoms and the patient's history; to the occurrence of repeated chills or irregular febrile paroxysms, the diarrhœa, the greater degree of prostration and more rapid emaciation, and the more frequent fatality. The joints involved in these latter affections present large collections of creamy pus, and the articular cartilages are discolored, or eroded and destroyed in patches.

Finally, Rilliet and Barthez cite a case (from *Jour. Hebdomadaire*, t. ii, p. 260) of hæmorrhage under the periosteum of the clavicles, which simulated rheumatic inflammation of the sterno-clavicular joints, but which could be distinguished by ordinary attention to the general symptoms, in case of the occurrence of such a rare condition.

From our own experience we should think that, during the early stage of rheumatic fever, the affections with which it might be most readily confounded, are pleurisy and pneumonia, and typhoid fever.

The absence of the physical signs of the two former affections, and of the diarrhœa and delirium of the latter, should, we think, lead the physician to suspect the rheumatic nature of the attack. And if, in addition, there should be any fixed pain about the limbs, or unusual soreness and pain on being moved, or if any sign of cardiac inflammation be detected, this suspicion would be confirmed. Thus in a case seen by one of us, where at first the height of the fever and the great thirst led us to suspect the existence of pneumonia or pleurisy—of which, however, no physical signs could be detected—the occurrence, on the third day, of complaints of pain in the right groin, led to a more careful examination of the heart, where the presence of a soft, faint mitral murmur, declared the nature of the attack.

Treatment.—The indications for treatment presented by acute rheumatism have been universally recognized as uniform, but the measures adopted to meet them embrace almost all known remedies.

The prominent indications are:

1. To aid in the elimination of the rheumatic poison, which has set up the specific inflammations and fever.
2. To relieve pain.
3. To guard assiduously against all complications, and to aid convalescence by suitable nourishment and tonics.

Among the remedies which appear to be most productive of benefit, are *alkalies*, especially the bicarbonate of soda and acetate of potash, as recommended by Garrod; the bromide of ammonium has also been used considerably of late, with apparent benefit. When the fever is very marked, nitrate of potash, in carefully graduated doses, is often beneficial.

The *iodide of potassium* is most serviceable in cases of muscular rheumatism, or in somewhat chronic cases of the articular form. Rilliet and Barthez assert that they have derived more benefit in the inflammatory complications of rheumatism (endo- and pericarditis, and pleurisy), from large doses of this salt than from any other drug.

We are not aware of any observations which have been made upon the use of salicylic acid in rheumatism occurring in children, but from its well-established value in reducing the temperature and relieving the pains

of this affection in adults, we have no doubt that it will be found of service in acute rheumatism in childhood.

The remedies we have ourselves found most useful, consist of acetate and bicarbonate of potash with opium, which we are in the habit of giving during the acute stage, according to the following formula:

℞.—Potass. Acetat., ... ʒj.
Potass. Bicarb., ... ʒj.
Tr. Opii Deodor., ... gtt. xxiv.
vel Tr. Opii Camph., ... fʒij.
Syr. Zingiberis, ... fʒj.
Aquæ, ... ad fʒiij.

Ft. sol. S.—A teaspoonful every two or three hours, at four or five years of age.

Iron, particularly in the form of Basham's solution of the peracetate of iron, should be given so soon as the intensity of the fever has mitigated. The necessity for this remedy is but too often seen in the sallow, anæmic appearance of convalescents from rheumatism, which proves the rapid and extreme disintegration of the red corpuscles of the blood during an acute attack of this disease.

When the acute symptoms have subsided, the alkalies may be diminished and withdrawn, and *quinia*, in the dose of one grain every four hours, at the age of five years, may be given in connection with opium:

The following formula is one we frequently use for the administration of these remedies in this and other conditions:

℞.—Quiniæ Sulph., ... gr. xxiv.
Liq. Morph. Sulph., ... fʒij.
Acid. Sulph., Dil., ... gtt. xxx.
Curaçoa, ... fʒij.
Syrupi, ... fʒvj.
Aquæ, ... ad fʒiij.

Ft. sol. S.—A teaspoonful every four hours, at four or five years of age.

To fulfil the second indication, the mitigation of pain, opium must be given in proportion to the severity of the suffering. It is best given in small doses at short intervals, and by administering it in combination with ipecacuanha, as in the form of Dover's powder, we derive the double benefit of a sedative and diaphoretic action. We have already given the formula by which we usually direct it in this disease. The inflamed and painful joints should be bathed with a sedative liniment, as of sweet oil, chloroform, and laudanum, and enveloped in bats of wool, and then covered with oiled silk, so accurately applied as to exclude entirely the external air.

In addition to the other remedies, particular attention must be paid to the condition of the bowels, and if constipation exists, as is very frequent, mild saline laxatives or laxative enemata should be administered as frequently as required. Anything like purgation, however, should be avoided, on account of the excruciating suffering often produced by the movements necessary to have a stool. We desire, however, to call atten-

tion to the fact that young children with this disease may persist in lying in one fixed position for even several days, dreading to be touched; so that there is added to the inevitable pain of the disease, the distress occasioned by the long-continued contact of single points of the opposing articulating surfaces. Under these circumstances it is wise, and greatly promotes the comfort of the patient, to gently change the angle of the limbs by arranging pillows so as to support them and alter their direction.

In regard to the last indication—the prevention of complications—the most important means is the avoidance of all exposure of the patient to damp or to changes of temperature. In the fulfilment of this, the greatest care must be paid to the temperature of the sick-room, to the clothing of the patient, and to the mode of conducting all our examinations. Dr. Chambers, in his admirable lectures upon this subject (*Clinical Lectures*, American edition, pp. 156, 177, etc.), dwells with special force upon this point, and enjoins the exclusive use of blankets and flannels for the bedding and clothing of patients with rheumatism, and gives the following summary of his observations of the effects of this precaution alone in the treatment of nearly two hundred cases of rheumatism: "That bedding in blankets reduces from sixteen to four, or by three-fourths, the risk of inflammation of the heart, diminishes the intensity of the inflammation when it does occur, and diminishes still further the danger of death by that or any other lesion."

If, for any cause, local depletion should appear contraindicated, the immediate application of a blister is to be recommended.

The importance of confinement to bed in this disease is difficult to overestimate; the inflamed condition of the joints absolutely demands it, and the tendency to cardiac inflammation warns us to save the heart all unnecessary exertion, which strict attention, as above recommended, to the equable warmth of the surface, effects better than any other means.

As to the diet in this affection, we must be guided by the acuteness of the symptoms and the condition of the patient. If the fever be marked and the child vigorous, a diet chiefly consisting of milk and water is best suited to the early part of the attack, but so soon as the febrile stage has passed off, or when the patient is of feeble constitution, we may give soft-boiled eggs, and meat-broths, with advantage; and frequently we will find concentrated nourishment and a moderate amount of stimulus required towards the close of the case.

Complications.—In those cases where, despite our precautions, the membranes of the heart are threatened with inflammation, as evinced by sudden pain in the cardiac region, frequency of pulse, and oppression—even before the development of any murmurs—we should lose no time in employing local depletion by leeches or cups, abstracting as much blood as the urgency of the symptoms and the vigor of the constitution justify. After the removal of the cups or leeches, or blister, warm mush-poultices should be applied steadily over the whole præcordial region.

ZYMOTIC DISEASES.

Under this title, as already stated, we include those acute general diseases which are dependent upon the action of some infectious morbid principle introduced into the system from without. They embrace a non-eruptive group, of which we shall describe diphtheria, mumps and malaria, epidemic cerebro-spinal meningitis, and the group of eruptive fevers.

ARTICLE II.

DIPHTHERIA.

Definition; Synonyms; History; Frequency.—Diphtheria is an acute febrile, moderately contagious, and infectious asthenic blood disorder, occurring both endemically and epidemically; without characteristic eruption, and distinguished by a disposition to the formation of false membranes upon inflamed mucous surfaces, especially in the fauces, or upon abrasions of the cutaneous surface.

It is the disease called by the older writers, angina maligna or gangrenosa; cynanche maligna; garotillo; angina suffocativa, under which name it was described by Dr. Samuel Bard, of New York, in one of the best of the early essays upon this subject (*Trans. Amer. Philos. Soc.*, vol. i).

It is, indeed, thought probable, that the history of this affection can be traced back to a period beyond the time of Hippocrates; but unquestionably the writings of Aretæus, who flourished in the second century of the Christian era, contain a distinct description of this malignant sore throat. He describes it under the names of ulcus Syriacum and malum Ægyptiacum.

From this period, there is quite frequent mention of the disease in the works of medical writers; the earliest account of its appearance in modern times being given by Hecker, who describes an epidemic of it that prevailed in Holland, in 1337.

About the middle of the last century, it prevailed in Paris, where it was described by MM. Malonin and Chomel; and in some parts of England, where it was studied and described by Fothergill, though it is now doubted whether the disease to which he refers was not more nearly allied to scarlatinous angina.

The first full description of this affection published in this country, was the paper, already referred to, by Dr. Bard, based upon an epidemic which appeared in 1771; the views advanced in which have been universally recognized, even to the present day, as most clear and just.

From that time, the complaint seems to have attracted but little attention, until its occurrence at Tours, in 1818, and subsequent years, called forth the treatise of Bretonneau in 1826, in which he gave the first precise notion of the disease, and bestowed the name diphtherite upon it.

Since then it has occurred frequently epidemically in France; in 1857 it appeared almost simultaneously in England, and in the extreme western part of our own country, and from that time has occurred in the form of epidemics of greater or less extent and severity, in the most varied climates and seasons, in almost all known parts of the globe.

Diphtheria, the name by which this epidemic pseudo-membranous angina is commonly designated, is a synonym of the word diphtherite, originally used by Bretonneau in his treatise on this subject.

Διφθερα and *Διφθερυς* both mean "the prepared skin of an animal;" and *Διφθεριτης* and *Διφθεριας* signify alike, "that which is covered with a skin or membrane."

No cases of death from diphtheria in Philadelphia are reported in the annual lists of mortality published by the Board of Health, until the year 1860. In the preceding report, however, Dr. Jewell mentions that several severe cases had occurred, some of which had proved fatal. One of us can, however, assert from his personal experience, that well-marked cases of diphtheria were of not rare occurrence in this city for a number of years before that time, but were reported under other names, and usually as either croup or angina.

It is probable, however, that the disease did not prevail at all extensively previously to its great outbreak in 1860, as may be seen by a reference to the number of deaths from croup and scarlatina, returned for the years preceding and subsequent to that date.

TOTAL NUMBER OF DEATHS FROM

	Scarlatina.	Croup.	Diphtheria.
1855,	163	265	
1856,	992	268	
1857,	704	256	
1858,	241	292	
1859,	232	312	
1860,	206	354	307
1861,	329	304	502
1862,	461	258	325
1863,	275	444	434
1864,	349	455	357

The total number of deaths from scarlatina, from 1855 to 1859 inclusive, were 2332; from 1860 to 1864 inclusive, 1620, or 712 less than in the previous period.

The total number of deaths from croup from 1855 to 1859 inclusive, were 1393; from 1860 to 1864 inclusive, 1815, or 422 more than in the previous 5 years. And, further, during the latter 5 years, 1860 to 1864, the deaths from diphtheria amount to 1925.

Causes.—In regard to the epidemic and occasionally endemic nature of diphtheria, the evidence is unanimously favorable, but it is still, to a certain extent, an open question as to how far it possesses contagious and infectious properties.

Numerous authorities might be cited in favor of either of these to the exclusion of the other; but the evidence adduced convinces us that diph-

theria is both contagious and infectious also, though to a moderate degree only.

Bard, Trousseau,[1] Guersant, Valleix,[2] (who has himself fallen a victim to this disease), Rilliet and Barthez,[3] Wood,[4] Empis,[5] and many others, attest to its contagiousness; and we have ourselves seen unmistakable instances in our own practice.

Brettoneau[6] also maintains strongly the infectious nature of diphtheria, and holds that it is transmitted directly by contact with the morbid product generated by the local disorder, *i. e.*, the pseudo-membrane; and it must be admitted that the cases now on record, in which the disease has been so transmitted, are too clear and well authenticated to permit of doubt.

Apart from these well-ascertained properties, nothing is as yet known with regard to the general conditions which favor its production; and it appears to have prevailed with equal severity in healthy and unhealthy situations; in damp marshy districts and in dry hilly regions; in the crowded filthy houses of great cities, and in sparsely populated villages; in the depth of winter and in the intense heat of summer.

Nor can it yet be positively asserted (although it is probably true with regard to diphtheria, as in the case of other zymotic diseases), that children of feeble constitution and those subjected to bad hygienic conditions, or debilitated by severe illness, are particularly exposed to it, especially in the sporadic form.

Of late years, we have been inclining to the opinion, although as yet any positive evidence is wanting, that the prevalence of diphtheria and especially its virulence, are favored by defects of drainage and by contamination of the air and drinking-water.

The effect of local causes, of a depressing character, upon the production of diphtheria, was investigated by Dr. Ballard,[7] in regard to 57 fatal cases. Inquiries at the houses where the 57 deaths had occurred, showed that in 24 instances the houses were damp, and that defective drains or some similar cause gave rise to offensive smells; in four houses the inmates were overcrowded, and the ventilation deficient; in 8 cases, the drinking-water was foul, or there was some noxious accumulation; and in 25 cases, nothing whatever could be discovered amiss in the hygienic condition of the houses.

It is certain, however, that occasionally diphtheria appears in a sporadic form, and isolated cases occur which can be attributed to no known cause whatever.

We subjoin a table of the mortality from croup and diphtheria in this community during the seven years from 1862 to 1868 inclusive; upon which we base, to a great extent, the remarks which follow as to the causation of the latter disease.

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[1] Clin. Méd., 2ème ed., 1865, t. i, p. 385.
[2] Guide du Méd. Prat., 4ème ed., 1861, t. i, p. 530.
[3] Mal. des Enfants, 2ème ed., 1853, t. i, pp. 343–369.
[4] Pract. of Medicine, 6th ed , 1866, vol. i, pp. 505–525.
[5] Memoirs on Diphtheria (New Syd. Soc. ed., 1859), p. 332.
[6] Id. Op., pp. 127 and 177.
[7] Med. Times and Gaz., July 23d, 1859.

Mortality Table of Croup and Diphtheria during Seven Years, from 1862–68, inclusive.

Month.	1862.		1863.		1864.		1865.		1866.		1867.		1868.		Mean of these Seven Years.		Mean Temperature for Seven Years.	Mean Fall of Rain during Seven Years.
	Croup.	Diph-theria.	Croup.	Diph-theria.	Croup.	Diph-theria.	Croup.	Diph-theria.	Croup.	Diph-theria.	Croup.	Diph-theria.	Croup.	Diph-theria.	Croup.	Diph-theria.		
January, .	44	30	36	34	59	27	44	33	43	24	22	17	34	12	40.3	25.3	30.87°	3.328
February,	24	40	27	42	39	26	50	30	31	19	13	9	8	7	27.4	24.7	33.89°	4.103
March, . .	29	26	26	24	62	43	44	28	30	21	20	17	18	6	32.7	23.6	40.85°	4.328
April, . . .	15	22	34	31	36	15	23	22	13	8	21	10	16	12	22.6	17.1	52.27°	3.97
May, . . .	17	22	11	17	41	27	18	12	27	19	12	9	11	10	19.6	16.8	62.77°	5.959
June, . . .	7	12	17	18	19	21	12	20	11	12	6	6	10	2	11.7	13.	71.97°	5.239
July, . . .	8	24	20	33	11	22	15	10	4	12	8	7	4	6	10.	16.3	77.71°	3.375
August, .	7	24	12	35	19	30	15	14	12	15	3	8	8	4	10.8	18.6	76.62°	4.105
September	16	24	55	68	34	34	21	12	4	13	4	5	10	7	20.6	23.3	68.31°	5.616
October, .	18	40	49	36	33	47	33	25	22	16	25	11	26	18	29.4	27.6	56.3°	3.19
November	36	32	69	34	51	31	43	29	24	18	16	8	29	12	38.3	23.4	46.68°	3.62
December,	37	29	87	62	51	34	32	25	18	15	35	11	32	22	41.7	28.3	34.7°	3.822
Total,	258	325	443	434	455	357	350	260	239	192	185	118	206	118	. . .	. . .	. . .	. . .

Season.—As we have already remarked, the influence of season upon the prevalence of diphtheria is comparatively slight, and there are numerous records of epidemics occurring in the summer, as well as in the winter months. Notwithstanding, however, it will be seen that in our own city the mortality from diphtheria does not vary very much during the months from September to March inclusive, whilst during the other five months it falls off from thirty to fifty per cent., the minimum mortality usually occurring in June. We have before had occasion to allude to the difference, in this respect, between diphtheria and croup, which latter disease shows in the clearest and most marked manner the direct influence of season upon its frequency.

Thus croup is far most frequent during the three months of November, December, and January, and, with the exception of February, becomes less and less frequent as you leave these months in either direction, until during July, the hottest month of our year, it falls to even less than one-fourth of its maximum frequency. During the same month, diphtheria, whose maximum mortality is one-third less than that of croup (both maxima occurring in December), causes more than half as many more deaths than croup does, the proportion being 16.3 to 10.

Sex appears to have absolutely no influence upon the frequency of diphtheria, since of 1804 fatal cases occurring in this city during the above seven years, 901 were males, and 903 females.

Age, on the other hand, unquestionably exerts a very strong predisposing influence, a large majority of all recorded cases occurring between the ages of one and eight years.

Of the 1804 cases in our table, 190 occurred under the age of one year; 335 between one and two years; 725 between two and five years, and 355 between five and ten years. Although the liability thus diminishes, in an uncertain ratio, with advancing years, no age is exempt from it. By reference to the influence of age upon the frequency of true primary croup, it will be seen that the maximum of its frequency is also attained between the ages of one and five years. We would also call attention to the much greater frequency with which diphtheria occurs in later life than croup; since of 2136 deaths from croup, but 77 were over ten years of age; while of 1804 deaths from diphtheria, not less than 199 occurred after that period. Of course it is evident that the above statistics not only prove that diphtheria is much more frequent during the first decade of life than at any subsequent period, but also that it is much more fatal then.

NATURE.—In his earliest writings upon this subject, Bretonneau attached little importance to the constitutional symptoms attending diphtheria, and upheld the view that it was essentially a local affection; and though he subsequently somewhat modified his views, he yet only admitted that the constitution becomes involved secondarily.

It is indeed true that the epidemics which have occurred during the past twenty-five years seem to have been attended by far more grave constitutional symptoms than were present in the cases upon which Bretonneau's memoir were founded. And at present, it appears to us, that a careful study of the very numerous reports of epidemics occurring in all parts of

Europe, Great Britain, and the United States, especially during the past ten years, can leave no doubt upon the mind that diphtheria is a blood disease, attended with marked constitutional disturbance, which is usually of a decidedly asthenic character.

This view is at present almost universally adopted; and in accordance with it, we find diphtheria removed from the place which it formerly held in systematic treatises, among the local affections of the pharynx, and discussed as one of the general diseases.

The chief arguments in favor of its being a constitutional disease, are its epidemic and contagious nature; the continued febrile action, of asthenic type, which attends its course; the marked alteration of the blood mass in color and consistence; the tendency to pseudo-membranous exudation on mucous membranes, or abrasions of the skin; the occurrence of albuminuria; and, finally, the frequent development of paralytic sequelæ, showing the presence of some morbid agent, acting especially upon the nervous system.

Bouchut,[1] to a certain extent, agrees with Bretonneau. He divides diphtheria into false, or non-infecting, which is mere pseudo-membranous angina; and the true, or infecting, which involves the entire system, by means of the absorption of septic substances from the pharynx. In this respect it resembles pyæmia, and produces swelling of the lymphatics, alteration of the blood, albuminuria, and even metastatic deposits.

Pathological Anatomy.—*False Membranes.*—We have already dwelt upon the fact, that the pseudo-membranous exudation can no longer be regarded as the essential and most important element in diphtheria; it is, however, one of the most constant and striking phenomena, and in certain cases, where it extends into the larynx, becomes the effective cause of death.

It has been most carefully studied in regard to its mode of development and extension, seat, and microscopic characters, by Empis, Bretonneau, Wade,[2] Thompson, Darrach,[3] Trousseau, Sanderson.[4]

Mode of Development.—When fully developed, the pseudo-membranous deposit has the ordinary appearances of a fibro-plastic membrane; but this stage is preceded, according to the researches of Empis and others, by the exudation of a sero-mucous, transparent, and viscid fluid, which varies in abundance in different cases, at times even forming, as noticed by Trousseau and Empis, in the neighborhood of parts lately covered by deposit, a sort of submucous exudation, sufficient to raise the epithelium in the form of phlyctenæ.

This sero-mucous liquid does not long remain transparent and diffluent, but soon becomes a little less transparent in points, gains a yellowish tint, acquires greater density, and adheres more strongly to the subjacent mucous membrane. These points, at first isolated and circumscribed, soon coa-

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[1] Mal. des Enfants, 4ème ed., pp. 907–923.

[2] London Lancet, February 5, 1859 (*et ante*).

[3] Trans. Coll. of Phys. of Phila., February 6, 1861 (Amer. Jour. Med. Sci.).

[4] Brit. and For. Med.-Chir. Rev., Jan. 1860.

lesce so as to form a delicate pellicle, but slightly cohering, and capable of being raised from the mucous membrane by slight traction; although, owing to its friability, it is difficult to raise a piece of any considerable size.

This pellicle is more dense and thick at its centre than towards the edges, and soon after its formation, the exudation continuing beneath it, and coalescing with it, it gains in thickness by the apposition of an under layer; until, when the membrane is fully developed, it may consist of several layers, and appear imbricated.

At this period its adhesions are so strong that, if it be detached from its connections, slight hæmorrhage will follow, or numerous minute bloody points may be seen upon the subjacent mucous membrane.

According to Empis, the appearance of the opaque spots in the clear sero-mucous fluid is due to a precipitation of fibrin independently of any agency of living tissue. Thus the tubular casts which form in the air-passages are rarely adherent, and are usually much smaller than the cavity occupied; and in cases of tracheotomy he has noticed the canula to become lined within a few hours with a layer of whitish concretion, the thickness of which continually increased, and which was evidently only the result of coagulation of the liquid by which the sides of the canula were constantly covered.

Color.—The color of the pseudo-membrane varies at different stages, and somewhat according to its seat.

In the fauces, the deposit is often whitish at first, but soon acquires a yellow tint; though in some cases it is quite gray, and produces the appearance of extensive sloughs on the fauces and pharynx. In severe cases, there is usually a bloody sanious fluid effused, which imbues the pseudo-membrane, discolors it, and promotes its decomposition, so that it forms dark-colored shreddy patches, exhaling a fetid, gangrenous odor.

It is essential to bear in mind that these appearances of the fauces in diphtheria are usually due to decomposition of the false membrane alone; and that, if this be removed, the mucous membrane will generally be found merely raw, excoriated, and oozing blood.

It is, however, true that in certain epidemics the rule has been for serious lesions of the mucous membrane, involving even its entire thickness, to occur.

In milder cases, where the disappearance of the false membrane can be studied, it is never seen to separate all at once, leaving in its place a cicatrized surface, but the pellicle gradually diminishes in thickness and extent. When the pseudo-membrane extends into the larynx, it is more apt to remain whitish throughout its course there than in the fauces.

Consistence.—The consistence of these deposits varies considerably. In cases of ordinary severity, where the symptoms are not of a very adynamic type, the pseudo-membrane is often quite firm, tenacious, and elastic; while in grave asthenic cases, with severe inflammation of the throat, the deposit is apt to be much less firm, or even quite pultaceous.

It has been attempted to base upon these conditions and corresponding microscopic appearances, a division of diphtheritic pseudo-membranes into

two classes, answering to the well-known division of inflammatory lymph into the fibrinous and the corpuscular.

Microscopic Anatomy.—There were formerly different views entertained with regard to the minute anatomy of the pseudo-membranous deposits in diphtheria.

Vogel originally associated with the disease the presence of the oidium albicans, the parasite which we have seen to be characteristic of muguet; and, more recently, Laycock, of Edinburgh, has insisted upon the occurrence of this cryptogam in the pseudo-membranes of diphtheria.

Dr. Wade, of Birmingham, has noticed also in some cases, in or near the exudation, the spores of the leptothrix buccalis, a fungus very commonly met with in the secretions of the mouth and pharynx.

Further investigations have shown, however, that these parasites are occasionally present in numerous diseased conditions of the mouth and fauces, and that their occurrence in diphtheria is to be considered as a mere accident, and not as an essential part of the affection.

The microscopic appearances which are constant, are the ordinary elements of corpuscular lymph: exudation cells or even pus-corpuscles, granule-cells and free fatty granules, and more or less abundant and closely interlacing fibrillæ, mixed with epithelial cells of various shapes and sizes. In the majority of specimens, the corpuscular elements greatly predominate, the fibres being few and small; and indeed it is only in the firmer, more tenacious, pseudo-membranes that much true fibrillation is noticed.

Chemical Characters.—The false membranes contract and shrivel when treated with alcohol; mineral acids, such as sulphuric, muriatic, nitric, or chromic; strong solutions of nitrate of silver; or solutions of the per-salts of iron.

On the other hand, they soften more or less quickly when treated with alkaline solutions, as of potassa, soda, lime, or ammonia; or of chlorate of potash, chlorate of soda, bromide of potassium; or with glycerin and various other agents. Recently, pepsin and lactic acid have also been announced as powerful solvents. These various chemical properties are constantly turned to account in the treatment of diphtheria, in guiding our selection of the most appropriate local applications.

Condition of the subjacent Mucous Membrane.—Even before the appearance of the slightest exudation, the mucous membrane of the fauces is often seen to be red and somewhat swollen. After the pseudo-membrane is fully developed, it is of course impossible, without forcibly detaching it, to gain any idea of the condition of the mucous membrane beneath, and unquestionably very many of the descriptions given of extensive gangrenous ulceration of the fauces and pharynx, have referred merely to the changes in the pseudo-membrane due to its decomposition and the imbibition of sanious fluid.

In the vast majority of cases, the subjacent mucous membrane is not truly ulcerated, but is merely much congested and swollen, with an excoriated and roughened appearance from removal of its epithelium, and occasionally presents spots of ecchymosis.

At times it is whitish, opaque, or unnaturally pale; while in other cases

it is purplish or otherwise discolored. When the deposit is raised up, especially if it be of the firmer variety, it is often seen to be attached to the surface beneath by numerous small filaments, as though processes of the deposit passed into the mucous follicles.

Although these may be considered as the most usual conditions of the mucous membrane, it is undoubtedly true that in some cases extensive and deep ulceration, and even gangrene occur, exposing the muscular tissue of the pharynx, or even producing the destruction by sloughing of an entire tonsil gland.

This accident occurs much more frequently in some epidemics than others, as may be readily seen by a comparison of the accounts given by different authors of the anatomical lesions noticed in the epidemics they have respectively studied.

The submucous tissue is often œdematous, infiltrated with bloody serum, or is the seat of an interstitial exudation of lymph. In some cases the œsophagus and the muscular tissue around the fauces and pharynx are congested and infiltrated.

When croup ensues, the mucous membrane of the larynx and trachea is more or less swollen and congested, and, according to West, presents distinct erosion of its surface, with small ulcers about the edges of the glottis, in a larger proportion of cases than ulceration is met with in the fauces. M. Isambert[1] suggested that this condition might serve to distinguish diphtheritic from idiopathic croup; but West has met with precisely similar ulceration of the mucous membrane of the larynx in cases of primary croup, and is disposed to regard its presence or absence as mainly dependent on the rate of progress of the disease towards a fatal termination.[2]

Seat of the Exudation.—The pseudo-membranous deposit is usually first seen upon the tonsils and soft palate, and in some cases is limited to these parts throughout the whole course of the case.

Frequently, however, the exudation spreads and coats the pharynx more or less extensively, or extends into the posterior nares, or downwards through the larynx into the trachea and bronchi, or more rarely into the œsophagus.

It is rare for any exudation to occur on the mucous membrane lining the cheeks, or upon the gums, though according to some authors, as Hutchinson,[3] Trousseau, and Bouchut, ulcerative stomatitis is in reality buccal diphtheria. The epiglottis is at times covered with a pseudo-membranous deposit, so as to become swollen, rigid, and almost immovable, and hence partially obstructing, without being able to protect, the entrance into the larynx.

The tendency for the exudation to extend into the nasal passages varies much in different epidemics, and when present, almost always betokens the great gravity of the case.

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[1] Arch. Gén. de Méd., March and April, 1857.

[2] Diseases of Children, 4th Am. ed., 1866, p. 356.

[3] Med. Times and Gaz., March 19th, 1859.

According to Bretonneau, the exudation occasionally begins in the nares and extends thence in so insidious a manner as readily to escape detection.

We will discuss more fully the questions relating to the extension of the exudation into the larynx under the head of diphtheritic croup.

The diphtheritic pseudo-membrane is not, however, limited to these mucous surfaces, but is occasionally seen, and especially in very severe cases, to form upon the mucous membrane of the vulva or of the anus.

It is, moreover, a most significant fact in regard to this affection, that any portion of the external cutaneous surface which has been denuded of epidermis, may become the seat of this deposit, and that in some cases the pseudo-membranous formation is even limited to the skin, constituting the so-called external or cutaneous diphtheria. So far, however, from the attending constitutional symptoms being less severe in the external than in the ordinary form, the tendency to deposit upon the cutaneous surface usually presents itself in cases of a typhoid adynamic type.

It appears, indeed, that this pseudo-membrane may occur at any point of the body to which the atmospheric air has access; but it has never been noticed on parts which are removed from its influence.

Notwithstanding these apparently distinctive features of the diphtheritic deposit, it is impossible by mere ocular or microscopic examination to distinguish it from the pseudo-membranous deposit in cases of ordinary scarlatinous angina.

It is more, therefore, in the peculiar constitutional disturbance that we must look for the specific nature of diphtheria, than in the presence and characters of the false membranes.

The *Submaxillary Glands* are almost always enlarged, though they rarely acquire the enormous size and peculiar brawny induration so often noticed in scarlatina. It is, moreover, very rare for this condition to terminate in suppuration of the gland.

The *Heart* has been found, by Hillier,[1] in a state of fatty degeneration in two cases, and by Bristowe (*id. loc.*) in one; all of which were rather chronic. We have observed marked granular degeneration of the cardiac fibre in several instances, however, where the disease had been of a violent and rapidly fatal form. In some instances where symptoms of endocarditis were present during life, the auriculo-ventricular valves have been found in an incipient stage of inflammation. (Bridger.[2]) We have also observed in several cases, in at least one of which a valvular murmur was heard during life, incipient inflammation of the mitral valve, with rows of minute, delicate, beadlike vegetations fringing the free borders of the leaflets. In other cases, pericarditis has been developed during the course of diphtheria. We desire to call particular attention to these cardiac complications, on account of their great importance as influencing not only the prognosis of the attack itself, but possibly also the subsequent development of chronic cardiac disease.

Heart-clots of large size and firm consistence, evidently of ante-mortem

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[1] Diseases of Children, Am. ed., 1868, p. 154.

[2] Med. Times and Gaz., Jan. 1864, p. 201; and Brit. Med. Jour., Oct. 22d, 1864.

rmation, are also found in a certain number of cases where death has een preceded by peculiar signs of circulatory embarrassment.

The *Lungs* are not rarely found inflamed and consolidated to a greater less extent. In other cases the exudation is found penetrating deeply to their structure, filling the smaller bronchial tubes, and the lung itself in parts collapsed or carnified.

Bouchut speaks of having seen small apoplectiform patches, similar to hose which precede the so-called metastatic abscesses in pyæmia.

The *Kidneys* are at times quite healthy; in other cases, however, they ave been found congested, and the renal epithelium granular and de- ached, so as to distend the tubules, which also contain fibrinous casts nclosing granules of hæmatin, blood-corpuscles, or a few altered epithelial lls). (Hillier (*loc. cit.*), Greenhow,[1] etc.)

The *gastro-intestinal canal* presents no lesions of importance; in a few ases enlargement of the solitary glands of the lower part of the ileum as been noted.

Secondary Form.—When diphtheria appears in the secondary form, the mucous membrane is more violently inflamed. It is of a deep red color, ough, and very much thickened and softened. The tonsils are large and oft, uneven, and often infiltrated with pus. In addition, the mucous membrane is far more frequently and seriously ulcerated in this form than n the primary. False membranes are almost always present, generally n different portions of the fauces, and more rarely over their whole ex- ent. They are generally rather soft and thin, of a whitish, grayish, or ellow color, dispersed in fragments and easily torn.

The inflamed parts are usually bathed in a purulent fluid. The sub- naxillary glands are large, red, and soft; and, in addition, there may be found various lesions of other organs, due to the primary disease, in the course of which the diphtheritic angina has been developed.

Symptoms.—Diphtheria occurs both in a sporadic and epidemic form; t also presents itself either as a primary or secondary affection. The symptoms of this latter form are, however, so involved with the symptoms of the diseases in the course of which it is developed, that it seems desira- ble to consider it in connection with them severally.

It would appear that, under the influence of widespread epidemic in- fluences, the symptoms of diphtheria have of late years presented a higher degree of severity. Owing to the fact, however, that, until the descrip- tion of diphtheria by Bretonneau, it was confounded with anginose scarla- tina, with ulcerated sore throat, etc., it is extremely difficult to form a correct comparison between the disease as we are now familiar with it, and as it undoubtedly occurred in former years.

In a strictly systematic discussion it might be well to divide diphtheria into a mild form, which would include most sporadic cases and many of the epidemic ones, and a severe form, under which head would be com- prised all cases distinguished by a high degree of constitutional disturb- ance. For practical purposes, however, it is sufficient to give a descrip-

[1] On Diphtheria, New York, 1861, p. 160.

tion of the ordinary course of the disease, dwelling upon some of the most important symptoms, and alluding to the chief peculiarities which at times present themselves.

Local Symptoms.—*Examination of the Throat.*—The onset of diphtheria is often very insidious; so that our attention may not be called to the throat by any complaint of the patient, even when a considerable amount of exudation is already present.

If the throat be examined, however, on the first day of the disease, the exudation may often be found even at that time, though it is sometimes not found before the second day. The fauces generally present more or less swelling and redness prior to the appearance of the false membrane, which almost always shows itself first on one of the tonsils only, in the form of whitish or opaline spots, like coagulated mucus, which soon run together and extend over the whole gland, and then to the soft palate and pharynx, though it sometimes remains limited to the tonsils and soft palate. A little later in the attack the plastic deposit exists in the form of layers of greater or less extent; it has lost its transparency, become firmer in consistence, thicker, and changes from a white to a yellowish-white or lardaceous, and sometimes grayish color.

The breath in this case is offensive, but not fetid; and there is but little salivation.

When, in favorable cases, the disease is left to pursue its natural course, the pseudo-membrane becomes thinner, assumes a grayish tint, and falls off about the sixth or seventh day. When, on the contrary, topical remedies are applied to the throat, the membrane is often detached after one, two, or three days, but may be reproduced several times before the conclusion of the case.

In some unfavorable cases, on the contrary, even though the exudation may disappear more or less completely from the pharynx, it extends downwards into the larynx, and we have true croup developed, which but too often proves fatal in spite of all remedies.

In more violent cases, the pseudo-membrane, about the time that it begins to be detached, assumes a grayish or blackish color, and hangs in shreds from the surfaces to which it was attached. The fauces, under these circumstances, present a gangrenous aspect, the mucous membrane having an appearance as though it were falling off in sloughs; the breath is extremely fetid, and there is more or less abundant salivation, or in some cases an expuition of sanguinolent fluid.

There can be no doubt that it was from misconception of such cases as these, that the titles of gangrenous and putrid sore throat arose.

As the exudation disappears from the pharynx, the swelling of the parts affected gradually subsides. The mucous membrane, from which the plastic matter has just fallen, is more or less injected and red; the tonsils and soft palate are sometimes found to be reduced below their natural size.

Even when the throat affection is very severe, there is not often so much difficulty in opening the jaws nor in deglutition as is met with in scarlatina.

The *submaxillary glands* are almost always enlarged and slightly painful to the touch, about three or four days after the appearance of the pseudo-

membrane. The enlargement is usually greatest on the side where the inflammation of the fauces is most intense. The surrounding cellular tissue shares in the inflammation, so that the swelling is often very great, and impedes the movements of the jaw; it is rarely, however, save in very bad cases, so hard and painful as the corresponding swelling in scarlatina.

Pain and Difficulty in Deglutition.—There is sometimes no complaint of pain in the throat, although, even at the outset, swallowing is usually somewhat difficult and painful, and pressure behind the angles of the jaw causes a moderate degree of suffering. In some cases, especially of the sporadic sthenic form, the earliest symptom may be excessive pain on swallowing.

As the pseudo-membranous exudation increases, and the submaxillary glands become swollen and tender, deglutition becomes more difficult and painful, and, at times, attempts to swallow fluids are followed by cough and the return of the fluid through the nostrils.

In cases where the false membranes decompose and acquire a gangrenous aspect, and typhoid symptoms are present, the pain and difficulty in swallowing, if they have existed, are apt to disappear.

Varieties depending upon Extension of the Exudation.—1. *Croupal Variety.*—It would be a matter of much interest to determine in what proportion of cases this complication may be anticipated, and whether there be any definite and constant relation between the amount or character of the exudation in the pharynx and its extension to the larynx. As yet, however, no general conclusions can be arrived at in regard to any of these points. The frequency of its occurrence varies much in different epidemics, the proportion varying from one or two per cent. to as high as fifty per cent. of all the cases. Indeed, as in an epidemic referred to by Trousseau, the disease may, in almost every instance, assume a primary laryngeal form.

As might be expected from the considerations presented under the head of croup, this complication occurs more frequently and is much more fatal in children than in adults.

It is a well-recognized fact that true diphtheritic croup is nearly always preceded or accompanied by pseudo-membranous exudation in the fauces or pharynx, but the amount of deposit in these latter places may be extremely small and yet be followed by extensive exudation in the air-passages; while, on the other hand, there is often copious deposit upon the pharynx in cases where the larynx does not become invaded.

No case, indeed, is free from the chance of this complication; it constitutes the chief source of danger in the mild variety, and yet is occasionally met with as the immediate cause of death in the most malignant attacks.

The pseudo-membrane is quite frequently found, in cases where the air-passages have become involved, to extend through the larynx and trachea, as far down as the tertiary bronchi, or in some instances, even to their finest divisions.

In this respect diphtheritic croup does not differ from primary croup,

unless it be, indeed, that it seems to be more frequent in the former for the exudation to extend to the smaller bronchial tubes.

We have seen that there is no essential difference in the condition of the mucous membrane beneath the deposit in the two affections; and that they are equally liable to be associated with inflammatory conditions of the lungs.

Unless, therefore, the more highly corpuscular character of the exudation in diphtheria constitutes a ground of distinction between these two forms of croup, it seems difficult to establish a diagnosis between them on merely anatomical grounds.

When diphtheritic croup is secondary, appearing in the course of measles, scarlatina, or other general disorders, the conditions found after death in the larynx are much the same as in primary diphtheritic croup. The mucous membrane here, however, as in the fauces, is usually more intensely inflamed, and is more frequently ulcerated.

The possibility of the occurrence of croup should never be lost sight of, and every case should be treated as though it tended to invade the larynx. It is especially important to detect the very earliest signs of the approaching danger, since its onset is frequently extremely insidious.

If violent cough is excited by attempts to swallow liquids, it usually indicates that the epiglottis is inflamed, and the seat of pseudo-membranous exudation, which impedes its movements and thus allows the fluid to pass into the larynx. The extension of the exudation to the larynx is indicated by the cough acquiring a rough croupy sound, though it often has not the loud clangor of ordinary croup; the respiration becoming sibilant, and the voice weak and hoarse.

When the false membrane in the larynx is fully developed, the voice is almost or quite extinct, and the cough, losing its croupy character, becomes stifled and less frequent. The respiration is now peculiar; there is constantly a certain degree of dyspnœa, as shown by the frequent labored breathing, but there are, in addition, paroxysms of suffocation, induced by spasm of the laryngeal muscles, during which the dyspnœa is frightful, and attended with tossing of the whole body and the most violent efforts at inspiration.

Death may occur during one of these paroxysms; but usually they subside and are followed by intervals of comparative ease, soon interrupted by the recurrence of the same alarming phenomena.

The intervals become more and more brief, and finally the patient sinks into a comatose condition, and dies with all the symptoms of asphyxia. If, during the violent efforts at respiration which attend these paroxysms of dyspnœa, or owing to the action of remedies, portions of the exudation are dislodged and coughed up, the most urgent symptoms are often immediately relieved. It is, however, but a deceitful repose, for in most cases the pseudo-membrane reforms, and the recurrence of the croupy voice and sibilant respiration announce that the danger of suffocation is again imminent.

In favorable cases, however, either when the membrane does not reform, or when it is dislodged as often as formed, recovery may occur; the par-

oxysms of dyspnœa recur at lengthening intervals, and finally disappear; the cough becomes gradually more soft, and fragments of pseudo-membrane, mixed with muco-purulent fluid, are discharged; the voice returns, and the capilary circulation becomes re-established.

In some cases, when the exudation has extended through the larynx and trachea deeply into the minute bronchial tubes, there is an absence of marked croupal symptoms, and death occurs slowly, after extreme dyspnœa and oppression of the chest, with all the symptoms of deficient aeration of the blood. These cases occur more frequently in adults than in children on account of the larger size of the larynx in the former.

The reader is referred for a more full account of this condition to the article on pseudo-membranous laryngitis.

2. *Nasal Variety.*—We have already mentioned that Bretonneau states that the disease occasionally begins at the nares, and extends thence in a most insidious manner. More frequently, however, the affection of the nares is consequent upon an extension of the exudation from the pharynx.

This complication is second in gravity only to the occurrence of croup. It impedes still further the already obstructed respiration, is attended with a foul acrid discharge from the nostrils, and, in addition, experience has shown that it is usually a sign of great malignancy in the case. According to Trousseau, the result is almost always fatal, the blood-poisoning being marked, as shown by the great alteration in the physical properties of the blood, the proneness to hæmorrhages, the waxy pallor of the skin, and the ultimate fatal termination by syncope.

The detection of this complication in its incipient stage is therefore of the highest importance, and Bretonneau (5th memoir, *Syd. Soc. Trans.*, pp. 196, 197) has laid down the most minute directions for its recognition at this stage. If the patient present any evidence of disease of these passages, as a slight snuffling or coryza, during the prevalence of diphtheria, the finger should be placed behind the angle of the lower jaw, below the lobe of the ear, and thence passed down the side of the neck, and if swelling of the cervical glands be noticed, it renders it probable that there is false membrane in the nares.

If, further, the upper lip be found reddened exclusively under one nostril, and that on the side of the glandular swelling, or if the swelling exists on both sides, but unequally, and if the lip is correspondingly reddened, the probability that there is nasal diphtheria is converted into a certainty, since ordinary coryza, acting equally on both nostrils, produces equal redness of both sides of the upper lip.

3. *Cutaneous Diphtheria.*—It is one of the characters of diphtheria which entitles it to be regarded as a blood disease, that different and distant parts are apt to become affected simultaneously or consecutively with the peculiar inflammation and exudation. We find, indeed, that in many cases of diphtheria there is a tendency to the formation of pseudo-membrane upon any portion of skin denuded of its epidermis.

This tendency varies greatly in different epidemics; according to our experience it is of rare occurrence in this city. It was, however, noticed by Bard nearly a century ago, and has been made the subject of special study

by Bretonneau and Trousseau.[1] The pseudo-membrane forms upon any blistered surface; upon leech-bites; upon excoriations; in fissures, as behind the ears, or at the angles of the mouth; or on the outlets of the vagina and rectum.

The part that is to be the seat of pseudo-membranous deposit becomes surrounded by an erysipelatous redness; it is painful, exudes an abundant fetid serous fluid, and soon becomes covered with a grayish false membrane. This deposit gains in thickness from beneath; and, at the same time, extends in every direction, by the development of vesicles in the neighborhood, the bases of which become the seat of diphtheritic deposit.

The layers of membrane, bathed in the fetid serous fluid, soon change color, decompose, become horribly offensive, and impart the appearance of true gangrene.

Trousseau has observed this cutaneous exudation in cases where no affection of the throat existed, and has clearly established the identity of these various forms of diphtheria by facts collected in an epidemic in the neighborhood of Orleans, where the disease in some persons presented its ordinary features, while in others the exudation occurred on the vulva, on blistered surfaces, on the hairy scalp affected with favus, or upon ulcers.

The constitutional symptoms which accompany cutaneous diphtheria are usually extremely grave and adynamic.

General Symptoms.—In the mild form of this disease the invasion is often highly insidious; there is usually fever, but the strength and appetite are not much disturbed at first. There is at the same time, in some, but not all cases, pain in the throat, which may or may not be accompanied by difficulty of deglutition. Both these symptoms are, however, often very slight, or they may be entirely wanting, a fact with which the practitioner should be well acquainted, as this absence of local symptoms by which to explain the cause of the sickness, gives to the disease, in some instances, a remarkably insidious character which may well mislead. In one fatal case, at three years of age, that came under our notice, there were neither complaints of pain, nor difficulty of swallowing, so that the parents had not the least suspicion of the throat being the seat of disease, though we found it violently inflamed, and covered with deposits of thick false membrane in points. On another occasion, we were sent for to see two children who had been sick for four days with slight fever, languor, and loss of appetite, but who were not thought to be seriously ill. We found them laboring under extensive pseudo-membranous angina, with the early symptoms of croup. They both died a few days later of croup. The symptoms, prior to the development of the croup, had been so mild in both cases as to cause no alarm, and yet the anginose disease had evidently been progressing insidiously for several days. We attended, a few years since, for three days in succession, a boy who was attacked suddenly with vomiting and slight fever, loss of appetite and languor, and whom we supposed to be suffering from mere gastric irritation. His only local symptom was pain in the chin, and this was not reported to us until afterwards.

[1] On Cutaneous Diphtheria, Arch. Gén. de Méd., 1830 (et loc. ante cit.).

The mother chanced to look into his throat, and, finding there some whitish spots, sent us word. We found him with very considerable membranous exudation, which was fortunately prevented from extending into the larynx by proper treatment. Quite frequently have we been sent for to see children attacked with croup, and on finding the fauces thickly covered with exudation, have been told that the patient has been ailing for near a week before with languor, slight peevishness, loss of appetite, and some little pain in the throat. To this point, the strangely insidious character of the anginose symptoms in the early stage of many cases, we cannot too strongly invite the attention of the reader. It is one of the very greatest importance, since at that time, above all others, ought the case to be placed under proper treatment.

It is to this class of cases that, owing to the trifling character of the constitutional symptoms, the name of diphtheroid sore throat is sometimes applied, although inaccurately, since it is calculated to create doubt as to their essentially diphtheritic nature.

It has been, on the other hand, stated, that, during epidemics of diphtheria, cases occur which present the usual general symptoms, with some difficulty of swallowing and swelling of the cervical glands, but in which no pseudo-membrane is formed, the fauces being merely of a dark-red color, with swelling and elongation of the uvula, and sometimes tumefaction of the tonsils.

Such cases are rarely fatal, and, as a rule, yield readily to the ordinary treatment for diphtheria.

In addition to these mild cases, in which the chief danger is from the extension of the exudation into the larynx, the disease in many instances, and especially under the influence of epidemic causes, assumes a grave form, in which the danger depends not upon an accidental extension of inflammation, but upon the essential alteration of the blood, and the condition of the entire system.

In these cases also the onset may be insidious, though it is often preceded for a short time by general malaise, indisposition to play on the part of children, and to exertion on that of adults, and slight swelling of the cervical glands, and pain on deglutition.

Whether these prodromes have been present or not, a more or less marked chill ushers in the febrile action, which is often quite intense for a few days; so that, when the throat affection is decided, a doubt may exist for a short time whether the approaching attack is one of scarlatina or diphtheria. The fever, however, soon subsides almost completely, sometimes indeed leaving the surface pale and cooler than natural. The pulse may remain frequent, but is weak and compressible; and the general symptoms are all characteristic of deficient vital force.

There is not usually any marked mental disturbance after the second day, the child being intelligent, though dull and indisposed to pay attention to anything.

There are but few symptoms of digestive disorder; the appetite, which is often retained for the first day or two, soon diminishes, and the child often becomes unwilling to take any food, partly from the pain caused by

the efforts to swallow, partly from complete anorexia. There is rarely any vomiting, unless provoked by remedies; and the bowels, though usually torpid, occasionally incline to be loose. The urine is rather scanty, quite frequently albuminous, and upon microscopic examination is found to contain renal epithelium and casts from the renal tubules. This symptom will be again and more fully alluded to among the complications.

At the same time, the submaxillary glands enlarge, and the fauces assume the appearances we have already described. There is a great increase in the secretion of saliva, which often dribbles quite profusely from the mouth, and is apt to be offensive, though rarely fetid. In many cases there is in addition a discharge from the nostril, which becomes acrid and offensive when there are false membranes in the nasal passages.

The voice is commonly obscured and nasal, or somewhat hoarse, even when the larynx is not involved.

Cough sometimes exists, and may have a slightly ringing spasmodic character, due to mere irritation of the larynx, though it usually resembles in sound that produced by the action of hawking, rather than a common cough.

In a very small proportion of the cases, an eruption, resembling that of scarlatina, appears at irregular periods in the course of the disease. It appears, however, that this eruption lacks the punctated appearance of the scarlatinous rash; does not appear at any fixed day of the disease; is irregular in its progress, and is not followed by desquamation.

The reports of it are, however, scarcely numerous or accurate enough to enable us to say positively that intermingled cases of scarlatina have not been mistaken for diphtheria, or that the two poisons may not have been acting jointly.

The further course of these cases varies widely. If the result is to be unfavorable, the depression and loss of strength increase rapidly; the surface grows pale or sallow, and is below the natural temperature; the pulse becomes exceedingly frequent and feeble; the fauces assume a gangrenous appearance from decomposition of the false membranes; the swelling of the cervical glands increases, and the patient often refuses to make the effort to swallow, though deglutition is still generally possible; there is a constant fetid discharge from the mouth and nostrils; the breath is horribly offensive; and death ensues amid the most profound prostration. Or, at a much earlier period of the disease, the fatal event may be precipitated by the extension of the exudation to the larynx.

We must also allude to the occasional occurrence of sudden death, even in cases not of the gravest type. This dreadful accident appears to result from paralytic failure of the heart's action, or, less frequently, from the sudden formation of heart clot; and the fact that it may occur, should call for the most careful attention to the avoidance of all exertion on the part of the patient.

If, on the other hand, the case tends toward recovery, the false membranes become detached and thrown off, the strength improves, the pulse becomes fuller and stronger, and the appetite returns. Even in advanced

convalescence, however, there is serious danger, as will be seen more fully hereafter, of the occurrence of troublesome or even fatal sequelæ.

In a still more severe group of cases than those above sketched, the symptoms are of the most asthenic or malignant type.

In these cases the anginose affection, though it may be severe, rarely attracts much attention. The pseudo-membranes in the fauces are soft and pulpy, and, when examined microscopically, highly corpuscular and granular; they soon decompose, and become discolored by the blood which exudes from the mucous membrane. There is, moreover, a strong disposition for the exudation to extend to the posterior nares, or to appear on various portions of the external cutaneous surface. The breath and the discharge from the mouth and nostrils are indescribably fetid. In some cases true ulceration, and even gangrene, of the fauces occurs. There is, however, less pain complained of, and less indisposition to swallow than in many lighter cases, owing probably to the depression of the nervous centres from the poisoned state of the blood. There may be high fever during the first few days, but this soon disappears, and is replaced by a deadly pallor of surface; extremely feeble, running pulse; and at times low muttering delirium.

Passive hæmorrhages from the nostrils, mouth, rectum, or other mucous passages, are of frequent occurrence.

The result in these cases of profound diphtheritic infection is almost invariably fatal; death resulting quietly from pure exhaustion, without the development of any complications.

The *duration* of diphtheria varies considerably. Ordinary cases recover in about seven, eight, or nine days, whilst more severe attacks are often protracted until the end of the second week.

It is impossible, however, to say that the disease has actually run its course in this time, since there are sequelæ which may appear during advanced convalescence, and retard the recovery even for many weeks.

On the other hand, in fatal cases, death may occur from croup, as early as the end of the second day; though usually the larynx does not become implicated under five or six days, and this accident may occur so late as the twelfth or fourteenth day of the attack.

In extremely malignant cases, death may also occur during the first few days. On the whole, however, it may be said that the majority of deaths from all causes occur in the period between the sixth and twelfth days. When death results from one of the sequelæ, either disease of the kidneys or paralysis, it may be deferred for weeks, or even for several months.

Prognosis.—In cases of ordinary severity, when the patient is seen early, and the disease remains limited to the pharynx, the result is usually favorable; though no case, not even the mildest, is free from danger, either of extension into the larynx or bronchial tubes, of exhaustion, or of the supervention of some complication, such as endocarditis, or the formation of heart-clots. If, on the contrary, the exudation extends to the nasal passages, the prognosis is more unfavorable; and when the larynx becomes implicated, the prognosis is exceedingly grave; if the disposition to the

production of false membrane spread to the skin, rectum, or vulva, the prognosis is also very grave, and death generally occurs in a state of profound adynamia.

If any other signs of unusual malignancy are present, such as abnormal slowness, or great frequency and smallness of pulse; marked prostration, with pallor and coolness of the surface; great tumefaction of the cervical glands; abundant pseudo-membranes, pultaceous and rapidly decomposing; hæmorrhages from various mucous surfaces; acrid, fetid discharges from the mouth or nostrils; intense and persisting albuminuria, with diminution of the amount of urea excreted; the prognosis is, of course, much more unfavorable.

It must be remembered, however, that no one of these symptoms, nor even any combination of them, is necessarily of fatal import; that cases are often rescued apparently from inevitably impending death; and that, however threatening the symptoms may be, it is our duty, in this disease even more than in many others, to persevere to the very latest moment in the judicious application of suitable remedies.

It is as yet impossible to arrive at any plausible estimate of the average mortality of diphtheria, so widely does the proportion vary in different epidemics. Neither sex nor temperament appear to have any influence upon the result; but extreme youth undoubtedly renders the prognosis much more grave.

The prognosis in the secondary form of diphtheria is also more unfavorable than in the primary.

Diagnosis.—We have already sufficiently dwelt upon the general symptoms and local signs which enable us to detect diphtheria, in every instance, after the disease has fully developed itself.

In examining the fauces in the early stage of the affection, it is well to remember that in simple angina, the crypts of the tonsil-glands occasionally become so distended by their secretion as to present the appearance of small, round, and slightly elevated whitish patches, which might readily impose upon a hasty observer for pseudo-membranous deposits.

In regard to the value of the peculiarities upon which a differential diagnosis between diphtheritic croup and idiopathic primary membranous croup is so frequently based, we have fully expressed our opinion in the article on the latter disease, to which we would refer the reader.

Diagnosis from Scarlatina.—The great resemblance which at times exists between the anginose symptoms of scarlatina and diphtheria has led some authors to suggest that they are identical diseases, and the following further points of resemblance have been adduced: the two affections prevail frequently simultaneously in the same region, and even in the same family; in certain cases of diphtheria, a rash, very similar to that of scarlatina, is said to appear; and the urine, in diphtheria, is frequently albuminous. That this similarity is, however, more apparent than real, is evident from the following considerations.

1. Although in some epidemics of diphtheria a rash is said to have been occasionally noticed, its occurrence is at most the rare exception, instead

of the almost invariable rule, as in scarlatina; it differs, too, from that of scarlatina, in appearing at irregular periods, in being partial, appearing suddenly in patches, not deepening gradually in intensity, and in being of a uniform erythematous redness, without the punctated appearance peculiar to the scarlatinous eruption.

2. The albuminuria of diphtheria presents these distinctive features as compared with that of scarlatina, that there is not always any diminution in the amount, nor any constant change in the character of the urine when it is present; that it occurs in the early part of the attack, and increases as the disease approaches its height, or may disappear suddenly, even in the early part of its course; that although usually noticed in severe cases (and probably a very unfavorable symptom), there seems to be no necessary connection between the urine becoming non-albuminous and the disease assuming a milder type.

3. There is a wide difference in the sequelæ which succeed the two affections; dropsy scarcely ever following diphtheria, while various paralytic phenomena, which are rarely noticed after scarlatina, are of frequent occurrence. It is very much more common, also, to have suppuration of the glands of the neck after scarlatina.

4. In the same way, endocarditis, though it has recently been noticed in a few cases of diphtheria, is much more frequent in scarlatina.

One of the most positive proofs of the essential difference of these two affections is the fact, attested by universal experience, that they exercise no protective power whatever against each other, and that individuals whose systems are protected against a second attack of scarlatina, are fully as likely to contract diphtheria as those who have never suffered with either of these diseases.

It may also be added that second attacks of scarlatina are very rare, while they seem to be much more common in diphtheria.

It seems evident to us, therefore, that in the present state of our information upon this subject, scarlatina and diphtheria must be regarded as entirely distinct affections, although presenting quite numerous points of singular resemblance.

Complications and Sequelæ.—*Albuminuria.*—We have already briefly alluded to the peculiarities of the albuminuria of diphtheria, but the importance of the symptom merits a more full discussion.

The occasional presence of albumen in the urine in cases of diphtheria was first noticed by Mr. Wade in 1857, who also found associated with the albumen, tube-casts and renal epithelium. It was shortly afterwards recognized by MM. Bouchut and Empis[1] in thirteen out of fifteen cases; and since then has been found, in a varying proportion of the cases, by many observers in different epidemics.

The character of the urine when it contains albumen is not constant, but usually it is quite pellucid, of acid reaction, and apparently free from any deposit; although, on standing, both tube-casts and epithelium may settle to the bottom. The quantity also varies considerably, Hillier hav-

[1] De l'Album. dans les Mal. Couenneuses, Compt. Rendus, 1859.

ing found it much diminished, while, according to West and Wade, it frequently remains normal.

The amount of urea excreted is usually increased in diphtheria, and, according to Sanderson, the presence of albumen and tube-casts in the urine is not necessarily associated with any interference in its elimination, but this does not agree with the examinations of others, who have found a diminution of the solid excreta when albumen was present.

The quantity of albumen varies much, being at times a mere trace, and again being present in large amount. The kinds of tube-casts noticed by Wade, and which are the ones usually found, were small, waxy casts; casts of a similar size, but granular, probably from commencing disintegration; and ordinary epithelial casts, and fibrinous flakes.

Albuminuria in diphtheria occurs at various stages of the disorder, in some cases even during the first few days. It not rarely comes on insidiously, and may manifest its presence by no peculiar constitutional symptoms. There can be, however, little doubt of the grave import of its appearance, though as yet its exact significance has not been accurately defined.

It is indeed true, that it has been found in large quantities in cases which have preserved a mild character throughout (Sanderson); but on the other hand, Bouchut and Empis regard it as a highly unfavorable sign, coinciding with very great gravity of the disease; and Wade believes that the quantity of albumen is usually in direct proportion to the retention of effete material, and that indications of impairment of the renal function are almost constantly precursors of an unfavorable termination.

Hillier (*op. cit.*) examined 38 very severe cases in regard to this point, and found albumen present in 33, 32 of which proved fatal, while of the 5 free from albuminuria, all recovered.

The albumen appeared in 1 case on the fourth day, in 3 on the fifth day, in 2 on the seventh day, in 5 on the ninth, and in 1 each on the thirteenth and nineteenth days. Usually the albumen disappears from the urine as the severity of the symptoms diminishes, but Bouchut has known it to persist after convalescence, and finally produce, as in Bright's disease, anasarca and hydrothorax.

Heart-clot.—The formation of coagula in the cavities of the heart during life has been noticed in many conditions of the system; and this terrible, because almost necessarily fatal accident, is now always dreaded in the course of several diseases, of which diphtheria is eminently one.

There have even been epidemics of an unknown nature, but where the only discoverable lesion have been enormous fibrinous concretions in the heart. Such epidemics have been recorded by Huxham, Chisholm, and recently by Armand.[1]

The symptoms mentioned by these authors as significant of this accident are, pain at the pit of the stomach; difficulty in respiration; extreme anxiety and restlessness; anxious expression and depression of spirits;

[1] Des Concretions Fibrineuses et Polypiformes du Cœur, 1857.

slight, dry, and rather spasmodic cough; the face being at times livid, and the surface dry and inclining to be cool, with coldness of the extremities. The pulse was small and irregular, and, in some of Armand's cases, an abnormal murmur was detected in the heart; there was usually considerable dulness over the cardiac region; the respiratory murmur remained pure and quite full, and the chest normally resonant.

According to Robinson, the first observation of sudden death in diphtheria from the formation of heart-clot was made by Dr. Werner, of Linz, in Austria, in 1842; and the second by Winkler, in 1852.

In England, Dr. Richardson[1] appears to have been the first to call attention to the difference between these symptoms ef embarrassed circulation and those of obstructed respiration, as met with in diphtheritic croup.

His account of the symptoms of the former condition agrees closely with that given above as to the coolness and almost marbly pallor of the surface; the moderate lividity of the face; the constant restlessness and intense anxiety; the feeble, quick, and irregular action of the heart, with a muffled character of the sounds, and in some cases an abnormal murmur. He also calls attention to a peculiar prominence of the anterior part of the thorax in very young children, which he believes to be strictly diagnostic of fibrinous obstruction.

In obstruction of respiration, on the other hand, the surface becomes livid, the veins turgid, and the muscles are often convulsed; the heart-sounds are clear, though feeble, and the breathing is the first to stop at death, instead of the circulation, as in the other case.

In three cases occurring in the practice of one of ourselves,[2] in which we were able to diagnosticate the condition, death took place on the twenty-first, twenty-fifth, and twenty-eighth days respectively. In each case the local symptoms had given way and almost disappeared, and the children seemed to have entered upon convalescence, when slight but steadily increasing signs of circulatory embarrassment became perceptible, and after a few days' battling against the constantly increasing obstruction, the little patients each died as though worn out by the unequal struggle.

In no case was there any evidence of any other organ being implicated; one of the cases was, however, complicated with albuminuria.

The pulse was not noted to be over one hundred; the cardiac sounds were unattended with murmur, but confused, indistinct, and seeming as though reduplicated.

There was no marked paralysis, but in one case partial paralysis, and in another marked muscular debility.

At the autopsy, in each case, the right side of the heart was full of clots, which were either dark-colored, with whitish spots, or yellowish-white throughout, quite firm, and adherent to the endocardium, and appeared to have been forming for several days. In one case, a clot in the left ven-

[1] Med. Times and Gaz., March 8, 1856; British Med. Jour., Feb. 16, and April 7, 1860.

[2] Dr. J. F. Meigs, Am. Jour. Med. Science, April, 1864, vol xlvii, p. 305.

tricle presented at its lower extremity a broken, irregular, uneven, and frayed or granulated appearance, as though the disintegrating process by which thrombi are broken up, had commenced in it. In none of the cases were there any evidences of endocarditis. The same accident has been observed during the past ten years by Dr. Barry,[1] Mr. H. Smith,[2] and Mr. C. R. Thompson,[3] and many others, and in a valuable thesis published recently[4] by Dr. Beverley Robinson (now of New York), ten cases are fully described, in at least five of which the ante-mortem formation of clots occurred.

The symptoms which he deduces, from a careful analysis of his own and the other recorded cases, as indicative of this condition are: coolness of the extremities, pallor of the face, prostration, anxiety, agitation, and peculiar intense dyspnœa; associated with a feeble pulse, dull, weak, and veiled heart-sounds, and frequently with the signs of emphysema of the lungs.

Most of the cases have occurred in young subjects, and the clot has formed late in the course of the disease, or even after convalescence has begun. The cause of this deposition of fibrin is not very apparent; in our article on this subject, already referred to, it was suggested that the coagulation might depend upon some peculiar change in the tissue of the endocardium, analogous to that which gives rise to the diphtheritic exudation on mucous surfaces.

No such alteration has, however, as yet been detected, and Dr. Richardson, to whom the profession is so much indebted for his investigations upon the coagulation of the blood, attributes it, in this case, to a deficiency of the volatile agent which retains the fibrin in solution, together with an actual increase in the amount of the fibrin of the blood, this combination producing the most favorable condition possible for fibrinous deposition.

Endocarditis.—Although in the above cases no lesion of the endocardium has been found, inflammation of this membrane has, as already stated (page 660), been quite frequently noticed in diphtheria. It has usually appeared late in the course of the disease, and has been attended with pain in the præcordia, frequent pulse, hurried respiration, an anxious countenance, with in some cases a systolic murmur. In fatal cases, there was found a roughened, reddened, thickened appearance of the valves, as if due to interstitial deposit. In some cases, also, a granular or fatty degeneration of the muscular fibres of the heart has been observed, as by Bristowe, Hillier, Robinson, ourselves, and others.

Paralysis.—One of the most frequent and important, and certainly the most peculiar of the sequelæ of diphtheria, is the occurrence of paralysis. It originally attracted the attention of MM. Trousseau, Lasègue, and Faure, under the form of difficulty of deglutition, and a nasal character

[1] British Med. Jour., 1858.
[2] Med. Times and Gaz., Dec. 17, 1859.
[3] Med. Times and Gaz., Jan. 7, 1860.
[4] De la Thrombose Cardiaque dans la Diphthérie. Paris, 1872.

of the voice; but since then has been observed in the most varied forms and degrees, affecting both general and special sensation and the power of motion. In most cases, every trace of the primary disease has disappeared before any paralysis is noticed; the patient sleeps, eats, and digests well, yet many cases emaciate, and there is often marked pallor of the surface. In many instances, also, especially in children, there is great irascibility or irritability of temper.

Most frequently a nasal character of voice and regurgitation of liquids through the nose are the first symptoms to call attention to the disease, though these may be preceded by some slight difficulty in articulation, or by alteration of the sense of taste at the back of the tongue. On examining the fauces the soft palate is found hanging relaxed, and, if it be pricked, there is no contraction of it, nor does it give the patient pain.

At times but one side is paralyzed, and the uvula is drawn towards the sound side. The affection may extend no further than the fauces, and soon disappear; or it may advance, the eye usually becoming next affected, following the throat affection, and preceding any paralysis of the limbs. The impairment of vision is rarely of long duration, lasting from a few days to two months, and is of every grade, from mere inability to read fine print to perfect blindness.

Dr. Greenhow has noticed that the pupils become dilated, and act sluggishly under the influence of light, for a day or two before the sight becomes sensibly impaired, and may remain so for a time after sight has been regained. He has also observed that patients who were unable to read with unassisted sight could do so with the aid of convex glasses, so that he attributes the impairment of sight to paralysis of the ciliary muscle and temporary loss of the adjusting power.

In addition to this want of accommodation, however, depending on paralysis of the ciliary muscle, Bouchut believes that there is in many cases, and especially in those who have had albuminuria, a serous infiltration of the fundus of the eye, due to the anæmic condition of the blood, and which may impair the nutrition of the optic nerve, and even lead to its atrophy.

The following case, which came under our observation recently, at the clinic at the University of Pennsylvania, affords an interesting illustration of the peculiarities of this form of paralysis. The ophthalmic examination was made by Dr. S. D. Risley, who has kindly placed the results at our disposal.

Case.—Emma W., æt. 7 years, suffered with an attack of sore throat, the nature of which was not recognized by the physician in attendance. It was quite severe, was accompanied by marked swelling of the glands at the angles of the jaws, and compelled her to be confined to bed for a week or ten days. Soon after convalescence began, it was noticed that her voice became altered, and that she occasionally regurgitated fluids that she attempted to swallow. Her general health improved, however, and in a few days she returned to school, which she was soon obliged to quit in consequence of rapidly increasing inability to read, on account of the print seeming blurred and "the letters running together."

Two weeks later, or about five weeks from the time of the first attack, examination of the eyes showed the fundus of both eyes entirely healthy. *O. D.*, $V = \frac{20}{xx}$. Acuteness of vision, as determined by Snellen's types, normal, and she can read Jr. No. 14 at $2\frac{1}{2}'$. *O. S.*, $V = \frac{20}{xxx}$, and she reads Jr. No. 16 at $2'$. *O. D.* emmetropic; *O. S.* hypermetropic $= \frac{1}{48}$. With glasses $+ \frac{1}{12}$ (convex glasses with $12''$ focus) *O. D.* reads Jr. No. 1 at $12''$, *O. S.* at $14''$. The pupils react promptly to light.

She was directed to wear $+ \frac{1}{12}$ glasses for near work, and strychniæ sulph., gr. $\frac{1}{60}$, was ordered four times daily. This was in a few days increased to five times a day, and its use was followed by prompt improvement, so that in less than two weeks the power of accommodation was entirely restored.

Deafness may follow this amaurosis; then the lower limbs become affected, the patient becoming paraplegic, and next the upper extremities; then the muscles of the alimentary canal and bladder, causing impaction of the rectum with fæces and retention of urine, or the sphincters of these organs alone may be involved, and lead to involuntary discharges. Finally, the muscles of the trunk, including those of respiration, may become paralyzed, and in some very rare cases even the muscles of the heart are involved. It is stated that the paralysis of the extremities is never strictly unilateral. The paralysis is rarely confined to loss of motion, but, in a majority of cases, sensation is either much modified or lost; and indeed in some instances there has been no loss of motion, the sentient nerves alone being affected. In other cases the sensibility has been found exalted, or there has been in the same case hyperæsthesia in the upper, with anæsthesia in the lower extremities.

The paralysis, whether it be of motion or sensation, is progressive and gradual, even in the same set of muscles, and usually involves one limb before it extends to other parts. The mind, though often feeble and dull, acts correctly in most cases.

During the continuance of these phenomena, the appetite may remain good and digestion easy; but there are often marked evidences of the continuance of some morbid action in the economy. The surface is of an earthy, sallow hue, calorification is often imperfect, and the circulation is much depressed, the pulse being small, weak, and much reduced in frequency.

In some cases, indeed, the affection runs on to a fatal issue, usually consequent upon a failure of one of the vital functions of circulation or respiration. M. Faure has given a vivid picture of these sequelæ in their worst form, when the patient, paralyzed, indescribably prostrated, with imperfect speech and power of deglutition, impaired vision, imbecility of mind, œdema, and even gangrene of the extremities, finally dies in some fainting fit, or passes away almost imperceptibly.

The result of diphtheritic paralysis is, however, favorable in a large majority of cases; thus of 77 cases collected by Dr. Reynolds, but 9 were fatal. We have ourselves never met with a fatal result in a single instance, although a large number of cases, some of them of very severe character, have come under our observation. The duration is, however, more uncertain, varying from one or two weeks to several months, the mean duration being about a month.

It is as yet impossible to advance any satisfactory explanation of the cause of these grave paralytic sequelæ. They occur probably in one-fourth of all cases, in greater or less degree, and are noticed with at least equal frequency after mild as after severe attacks.

At first, indeed, the faucial paralysis was attributed to some such local cause as inflammation of the sheath of the nerves supplying these parts, and Greenhow still contends that the nerve affections bear some proportion to the local severity of the attack, the paralysis and anæsthesia being more complete on that side of the fauces which has been most severely affected by the primary disease; but we have been able to satisfy ourselves that this does not occur with any uniformity. Charcot and Vulpian have, however, demonstrated in a case of paralysis of the palate, lesions both of the palatine nerves and muscles. It is difficult to determine whether such lesions are of constant occurrence in the ordinary cases which rapidly recover. It seems improbable, also, that in cases where widespread paralytic symptoms are present, which subsequently entirely disappear, any serious lesion of the nerve-trunks or of the muscles could have existed.

Nor is the occurrence of albuminuria necessary for the development of paralysis, since the urine is often quite normal throughout the entire course of cases, which are nevertheless followed by marked palsy.

The most plausible view we can entertain of the nature of these nerve affections, is that they are the direct effect of the diphtheritic poison, which while modifying the blood crasis, and so acting on the system at large, has an especial tendency to the nervous system; while at the same time, some of the local forms of the paralysis may be associated with lesions of the nerves and muscles of the part affected.

Ataxic Form.—In some cases, which are comparatively rare, the nerve affection does not constitute actual paralysis, but takes the form of locomotor ataxia. In such cases, the muscular force in the affected parts, usually the lower extremities, is not materially diminished, so that the patient can move them forcibly when he is lying down; but there is such a degree of incoördination in the motions communicated to them, that combined movements, even in the supine position, may become impossible. It is, however, especially in walking, that this loss of coördinating power manifests itself; the gait becomes irregular, the patient falls if the eyes are closed, and the case presents all the characteristics peculiar to well-marked locomotor ataxia.

The first instance of this diphtheritic ataxia appears to have been observed by Jaccoud[1] in 1861; it was soon after noticed by Eisenmann;[2] and more recently a well-marked case has been reported by Dr. Gray,[3] in a boy of nine years old, following an apparently mild case of diphtheria. It is evident, also, as pointed out by Jaccoud, that a certain number of the cases which have been reported under the name of diphtheritic paralysis, have in reality been examples of locomotor ataxia, the paralysis hav-

[1] Les Paraplégies et l'Ataxie du Mouvement, p. 631, Paris, 1864.
[2] Die Bewegungs Ataxie, Wien, 1863.
[3] London Med. Times and Gazette, February 6th, 1869, p. 141.

ing been only apparent. We have met with two well-marked examples ourselves, in both of which entire recovery followed. This diptheritic ataxia is in all probability due to the same unknown morbid condition or dyscrasia, which causes the actual paralytic symptoms which are more frequently observed as sequelæ of diphtheria. It usually yields to the treatment recommended for the latter conditions, though in Gray's case, death occurred, apparently from rapid loss of nervous power, seven weeks after the appearance of the nervous symptoms.

Treatment.—The treatment may be usefully considered under the two heads of local and general. Of late years, the importance of the latter has been more and more recognized as supreme, and, indeed, the utility of all local treatment has even been questioned on the ground that the throat affection is merely a local evidence of the constitutional disease, and that the disease rarely kills save by involving organs beyond the influence of such agents. We have, however, no doubt as to the very great importance of proper local treatment; although, on the other hand, we are not prepared to say, with some eminent authorities, as Trousseau, that topical applications are the most successful and important remedies in diphtheria.

The great objects to be held in view in the local treatment, are to favor the separation of the pseudo-membranes, and to prevent their extension from the fauces into the larynx and nasal passages.

Local Treatment.—The most important of the local remedies are included in the lists of astringents and caustics.

Of these, nitrate of silver has properly been used more than any other substance for many years past, and is highly recommended by MM. Bretonneau, Valleix, Grisolle, Rilliet and Barthez, Trousseau, West, and many others.

It is employed both in solution and substance. The latter form is, however, open to the objections, that if the extent of the false membranes be at all considerable, the solid caustic can seldom be applied to more than a small portion of it, and that it is attended with the risk of slipping from the porte-caustic into the pharynx, and thence passing into the stomach.[1] The solution is therefore generally preferred. M. Bretonneau advises its employment in the proportion of half an ounce of the salt to an ounce and a half of water; and West employs a solution of the strength of a drachm to an ounce.

We have usually made use ourselves of a solution of ten or twenty grains to the ounce, and have found it abundantly strong. It may be applied either by means of a piece of sponge fastened upon a proper handle, which is the best method, or a camel's-hair pencil, nearly as large as the end of the little finger. The application should be made once, twice, or even three times in the course of the twenty-four hours.

Hydrochloric acid is also frequently employed, either pure or diluted

[1] Dr. Geddings recommends, when it is desirable to use the solid nitrate, to reduce it to powder, and to roll the sponge probang, previously moistened with mucilage of gum arabic and squeezed, in the powder until a sufficient quantity adheres, and to apply it thus prepared to the diseased parts.

with from one to ten parts of honey; the more dilute forms being used in the case of children.

It possesses the great advantage over the other mineral acids, that its caustic action does not extend much from the point of application, but is open to the objection of causing a white plastic exudation on any part of the mucous surface, not covered with false membrane, with which it may come in contact, which may lead the physician into error.

When the limits of the pseudo-membrane can be seen in the pharynx, following M. Bretonneau's advice, the acid may be used more concentrated, and the sponge, after being dipped into the acid and squeezed so as to be merely moistened, should be carried rapidly into the pharynx, and withdrawn after lightly cauterizing the surface.

When on the contrary, the limits of the membrane cannot be seen, the acid should be more diluted, and leaving more of it upon the sponge, this should be passed down over the epiglottis and then pressed against the base of the tongue, by raising strongly the handle to which it is tied, in order to express a few drops upon the mucous membrane of the larynx. The cauterization is to be performed once or twice a day, according to the necessity of the case. For children under ten years of age, the sponge ought to be about half as large as a pigeon's egg. It is to be fastened to a piece of flexible whalebone, by making a crucial incision into it, introducing into this the end of the whalebone, and securing it with good sealing-wax, which is not acted upon by the acid as any ligature would be. When about to be used, the whalebone is warmed and curved into such a shape as will allow it to pass into the pharynx without touching the roof of the mouth. M. Valleix proposes that the sponge should be fastened to the whalebone with waxed thread, and that this should be covered with sealing-wax, to preserve it from the action of the acid. This would certainly be safer than the mere wax alone.

Applications of powdered alum, tannic acid, and chlorinated lime, are recommended by writers of high authority. In slight cases, in which the disease shows but little disposition to extend, such applications may answer very well; but when the attack is threatening, and especially when the exudation is spreading, we should neglect these minor remedies, and resort at once either to nitrate of silver, dilute muriatic acid, or the tincture of the chloride of iron. If, however, these powders are employed, they may be applied by means of a throat brush, or by causing a sufficient quantity to adhere to the forefinger of the right hand, and conveying it upon this to the diseased surfaces.

The astringent and caustic preparations of iron have lately been introduced in the treatment of this affection with much benefit. They cause the pseudo-membranes to contract and shrivel, and thus favor their separation, while, at the same time, they modify the action of the mucous membrane, and also tend, as does the sol. sodæ chlor., to correct the fetor arising from the putrefaction of the false membranes, and to prevent poisoning of the system by absorption.

The tr. ferri chloridi and the ferri perchloridum are among the best preparations, and may be applied, either pure or diluted, several times in the

course of twenty-four hours. Monsell's salt, in powder, has also been highly recommended by Beardsley, of Connecticut, and possesses the same mode of action, though somewhat more escharotic.

Carbolic acid, diluted with glycerin and water, applied by a mop to the throat, appears to possess almost equal virtue in causing the separation of the pseudo-membranes, and preventing their re-formation.

Various applications have also been recommended from the fact that they exercise a direct solvent power over the pseudo-membranes, and thus promote their removal. Among those which have been thus recommended are solutions of lime, potassa, and soda; solution of chlorinated lime; of chlorate of potash or soda; of permanganate of potash; of bromide of potassium; of pepsin; and of dilute lactic acid.

Dr. Jacobi (*Amer. Jour. of Obstet.*, May, 1868, pp. 13–65), has published an analysis of the relative value of these solvent applications. According to him, lime-water requires four to ten hours to thoroughly liquefy soft diphtheritic exudation; while for firm pseudo-membranes, it requires from thirty to seventy-two hours. Potash and soda, and their salts, act more slowly; and the one other application which he recommends as equally rapid in its action is a solution of bromine gr. j, bromide of potassium gr. j, in f℥vj of water.

We have carefully tested the latter solutions, as well as those mentioned above, and from the results of repeated tests, have concluded that lime-water is the most powerful in its solvent action upon pseudo-membranous exudations. We have frequently found, when fragments of firm white exudation have been placed in lime-water at a temperature even lower than that of the buccal cavity, that the exterior began in a very short time (half an hour) to undergo disintegration, and that the whole fragment was reduced in a few hours to a granular putrilage. It is, however, undoubtedly true that this effect will be produced with very different rapidity upon different specimens of pseudo-membrane.

There is no real difficulty in making use of any of these applications, if the children be properly managed. One or two assistants must hold the patient in such a way that the head shall be thrown backwards, and the hands and feet secured. The physician must depress the tongue with the handle of a spoon held in the left hand, while he holds in the right the pencil or sponge mop. If the child refuse to open the mouth, it can generally be made to do so by holding the nose in order to force it to breathe through the mouth. If this fail, all that is necessary is to press the handle of the spoon against the teeth, when the patient will soon become too much fatigued to offer further resistance.

Gargles.—When the patient is sufficiently old and intelligent to be able to use gargles thoroughly, any of the substances which have been recommended as local applications may be thus used, being of course largely diluted. Thus tr. ferri chl., hydrochloric acid, sol. sodæ chlorinatæ, in the proportion of f℥j or f℥ij to f℥vj, or chlorate of potash in strong solution, may be used as gargles with much advantage in some cases.

These solutions may also be very efficiently applied to the throat in a finely divided condition, by means of the steam or hand-ball atomizer; a

mode of application which is peculiarly useful in cases where the pseudo-membrane has extended to the larynx. As it is often impossible to employ gargles, and as we attach very great importance to the frequent use of mild solvent applications, particularly lime-water, we would strongly recommend the use of the steam atomizer for this purpose.

A very convenient and ready application, and one from which we have obtained marked advantage in several cases, especially where the exudation had extended to the larynx, is by covering the patient's head with a sheet, and introducing a vessel containing slaking lime, so that the steam may be freely inhaled. It is probable that the chief benefit is here derived from the warm watery vapor; though a small quantity of lime, in the form of impalpable powder, probably gains entrance to the fauces and air-passages.[1]

Ice.—In a rather early stage of the disease, if there is much heat and engorgement about the throat, cold, wet compresses may afford temporary relief; and great benefit is often obtained in cases where there is much swelling and inflammation of the fauces and pharynx, by the free internal use of ice, allowing the patient to hold small pieces of it almost constantly in the mouth.

Other external applications may also be employed to reduce the swelling of the cervical and submaxillary glands, render deglutition more easy, and relieve suffering; and, in this way, the persistent use of poultices or spongio-piline fomentations are of service.

It is essential to remember, however, that all blisters or irritating applications capable of destroying the epidermis, must be carefully avoided, owing to the tendency, already alluded to, of the pseudo-membranous deposit to occur on such abrasions.

When the nasal fossæ have become implicated from extension of the pseudo-membrane, one of the dilute solutions recommended as gargles should be injected frequently through the nostrils, or the desired effect may be even more thoroughly secured by the use of the same fluid through a Thudichum's nasal douche.

General Treatment.—Whatever differences of opinion may exist in regard to the relative merits of the various local applications we have enumerated, all high authorities are now agreed as to the general character of the constitutional treatment which should be adopted.

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[1] Bouchut has lately strenuously advised active cauterization of the fauces, or ablation of the tonsils, not only for the purpose of removing the exudation which appears on them, which he considers the localization of the disease, but also of facilitating respiration.

According to him, the operation of ablation has now been performed fifteen times, five by himself, and ten by MM. Domere, Symyan, Speckahn, and Paillot, with successful results in each case, no false membrane reappearing.

Despite this favorable report, however, the procedure appears to us objectionable, regarding, as we do, the importance of the local condition as secondary to that of the alteration of the blood. The operation must further cause the greatest alarm and most powerful resistance on the part of young children, and it seems highly improbable that a large proportion of cases should be attended with the same fortunate exemption from a recurrence of pseudo-membranous formation, as occurred in Bouchut's cases.

Some years ago, before opportunities had been presented for studying diphtheria in its epidemic form, as it has since occurred, it was customary to employ moderate depletion early in the attack, if the patient was vigorous and strong, and to follow this by the use of mercury and antiphlogistics, with a view of subduing the febrile excitement, and causing the dissolution and absorption of the pseudo-membrane.

With the increase of knowledge, however, of the true pathology and natural history of the disease, which has been gained of late years, all depleting and antiphlogistic plans of treatment have been, by common consent, abandoned as indefensible either in theory or practice, and all efforts are directed to promoting the nutrition of the patient and supporting the strength of the system, as indicated by the marked tendency to prostration, the feeble pulse, and the manifest deterioration of the blood.

It is probable that those cases in which bloodletting and the administration of mercurials were adopted with such apparent benefit, were either erroneously considered diphtheritic, or that the disease, when occurring sporadically, as it formerly did, was of a far more sthenic type than it has presented of late years.

It must be added, however, that in the sporadic cases still frequently met with, when no grave epidemic influence is prevailing, the use of alkalies, as soda, combined with small doses of calomel, has been found very successful.

Regarding diphtheria as a constitutional affection, depending upon a peculiar alteration of the blood, we must admit that we are in possession of no remedy which in any respect merits the name of a specific in its treatment.

Among the best internal remedies, however, are the various preparations of chlorine, iron, and bark, which may be given singly, or, preferably, in combination.

Thus there are no remedies of more uniform and marked advantage than sulphate of quinia and tincture of the chloride of iron, given in full doses at short intervals. Hydrochloric acid or chloric ether may be added to these tonics, and this combination is strongly recommended by West and other high authorities.

The Sanitary Commission, in London, reported very strongly in favor of a mixture containing tincture of the chloride of iron, with chlorate of potash, chloric ether, and hydrochloric acid, sweetened with syrup; full doses being employed according to the age of the patient, and frequently repeated. This combination has been, by Gibb, rendered still more stimulating by the addition of muriate of ammonia.

Oil of turpentine has been recommended (Dr. Perrey, *Med. Times and Gaz.*, March 5th, 1859) in large doses, both for its stimulating effect, and from its tendency to promote the absorption of lymph in adynamic states of the system, where mercury cannot be given.

Chlorate of potash, given in Huxham's tincture of bark, has been vaunted as almost specific in the treatment of diphtheria; but, as re-

marked by West, it unquestionably fails to produce here those excellent effects which are obtained from its use in ulcerative stomatitis.

Permanganate of potash, which has been so extensively used of late years in zymotic diseases, has been used both locally and internally in this affection, but apparently without any very positive advantage.

Emetics; Purgatives.—Emetics are useful when the exudation shows a disposition to extend to the larynx, or when there is much difficulty of breathing from tumefaction of the fauces, or from accumulation of the pseudo-membranous deposits. We would recommend under these circumstances the use of alum or ipecacuanha, as recommended in the article on pseudo-membranous laryngitis; the emetic being repeated in six or twelve hours, if the same indication should continue or recur.

A purgative dose is useful at the commencement of the disease, merely as an evacuant. After that period only such laxatives need to be employed as may suffice to keep the bowels soluble.

Stimulants.—In the milder forms of diphtheria, where no complications exist, the cases usually terminate favorably without the use of any stimulants; but there are many cases, on the other hand, characterized by pallor of surface, marked weakness of the circulation and tendency to prostration, great enlargement of the cervical glands, and extensive disease of the throat, where the pseudo-membranes rapidly decompose and assume a gangrenous appearance, and the urine is frequently albuminous, in which stimulants, freely administered, are positively required.

In cases where such adynamic symptoms are present, we should begin early in the attack with the administration of the weaker stimuli, and employ the stronger forms as the disease advances and the strength of the system succumbs more and more.

Food.—In no disease should more sedulous care be paid to securing to the patient a proper amount of suitable nourishment; and, indeed, in the absence of any remedy which can be looked upon as essential or specific, we must assign, perhaps, the most important part in the treatment of diphtheria to food and stimulants. It is at least certain that where these cannot be administered in proper quantity, all other treatment is unavailing, and hence it is our duty, upon finding that the pain and fatigue experienced by the child when forced to take frequent doses of medicine make it utterly unwilling to take food, to abandon all strictly medicinal treatment, and trust to sustaining the powers of the system by the free use of stimulants and concentrated food.

In cases where mechanical obstruction exists, or where all efforts at voluntary deglutition are obstinately resisted from fear of the great pain caused by the act, nutritious and stimulating enemata must be immediately resorted to. These may consist of beef tea, eggs beaten up in milk, brandy in the form of milk-punch, and, further, may be medicated by the addition of quinia. They should be given every three or four hours, in rather small quantity, and not so concentrated as to irritate the bowel. When thus administered it is quite possible to sustain life for several days, until food can again be introduced into the stomach.

In addition to the local and general treatment above recommended, the

patient should be rigorously confined to bed during the whole treatment, and for at least ten days after the disappearance of the exudation. This caution is given, not only on account of the danger of that most fatal accident, the formation of a heart-clot, but because we have twice known the exudation to reappear when the patient had been allowed to leave the bed at too early a period; and in one of these the exudation extended into the larynx on the occasion of the second attack, in spite of all that could be done, and life was saved only by the operation of tracheotomy.

The most scrupulous cleanliness of the person and surroundings of the patient should be preserved; free and uninterrupted ventilation secured; and on account of the positive, though perhaps slight, contagiousness of diphtheria, it is wise to practice separation of the well children in the family from the sick.

The treatment required in those cases where the pseudo-membrane extends into the larynx, and especially the discussion of the indications for the operation of tracheotomy, will be found in detail in the article on pseudo-membranous laryngitis.

Treatment of Paralysis.—We have already stated that the prognosis in diphtheritic paralysis is usually favorable, the symptoms often disappearing in the course of time without treatment. The cure may, however, be much hastened by a persistence in the administration of iron and quinia, to which strychnia should be added in full doses.

Nitrate of silver has also been employed in full doses with apparent benefit.

The paralyzed muscles should be faradized daily; and, when accessible, sea-bathing or sulphur baths may be employed with advantage.

In those cases where the muscles of deglutition are especially affected, and the nutrition of the patient is suffering from his inability to swallow sufficient food, it is desirable to resort to the use of nutritious enemata.

Treatment of Heart-clots.—Under the supposition that the blood is hyperinotic in the latter stage of diphtheria, the various salines, especially the vegetable ones, such as the citrates and acetates, and ammonia, given either as the carbonate or in the liquid form, have been recommended by Richardson.

When, however, the symptoms indicate that deposition of fibrin has absolutely occurred, it is probable that nothing can be done in the way of curative treatment. Alkalies may be given internally, the vapor of ammonia inhaled, alkaline solutions injected into the veins, but there is little reason to hope that any effect upon the clot can be produced.

In one of the cases reported by us (*loc. cit.*), the clot presented at one extremity a granular, partially disintegrated condition, as though its removal had begun by interstitial action, and the mechanical effects of the blood current; and it is possible that by supporting the powers of nature the removal of the clot might be effected in this way. Indeed, there are cases on record (quoted by Robinson, *loc. cit.*) in which the symptoms have most clearly demonstrated the existence of a clot in the cavities of the heart, where still recovery has occurred.

ARTICLE III.

MUMPS.

Definition; Synonyms; Frequency.—Mumps is an acute febrile specific disease, contagious and epidemic; occurring but once in an individual; attended by an inflammation of the parotid and sometimes of the submaxillary glands, with a tendency to metastasis to the testicles in males and to the mammæ, vulva or ovaries in females; and almost invariably resulting in recovery.

Some authors, as Niemeyer, object to classifying mumps with constitutional diseases; but the fact that it undoubtedly possesses the features enumerated in the above definition, and which, in the present state of our knowledge, must be regarded as specifically characteristic of that class of affections, seems to us to fully entitle it to be included with the other general diseases.

Mumps is known under a variety of names in every language. The terms usually employed to designate it by English and American authors are cynanche parotidea, parotitis, parotiditis, and inflammation of the parotid.

It will be impossible to obtain any definite idea as to the frequency of this affection, until the system has been introduced of registering not merely deaths but all cases of disease, since mumps is scarcely ever fatal. Its frequency is, however, known to vary very widely in different years, owing to epidemic influences; so that while in certain years we do not meet with a single case, in others we are called to a considerable number.

Causes.—Nothing is known in regard to the essential nature of the cause of mumps. The disease is, however, unquestionably contagious, and it quite rarely happens that one member of a family sickens with mumps, without some of the other children being attacked.

Mumps rarely occurs as a *sporadic* affection, but appears, as already stated, in *epidemics* of varying extent and severity, at times being limited to a single locality or even a single institution, and at others affecting large cities or districts.

Season appears to exert a powerful influence upon the development and activity of the specific poison of mumps, since the epidemics occur nearly always in the spring or autumn. According to Vogel, it is said to be endemic on the damp coasts of Holland, England, and France.

Age also exerts an unquestionable influence, by modifying the susceptibility to the contagion of mumps. Thus the disease is far most common between the ages of seven and fifteen years; whilst it is almost unknown before the end of the first year, comparatively rare between the ages of one and five years, and, on the other hand, quite rare in adults.

Although it appears certain, however, that the susceptibility to the contagion of mumps diminishes with each succeeding year after the age of fifteen, we must in great part explain the rarity of the disease in adult

life, by the fact that a large proportion of people have had it in childhood, and are thus protected against a second attack.

Second attacks of mumps are indeed of extreme rarity.

Anatomical Appearances.—Opportunities very rarely occur for the examination of the parotid glands in mumps, since this disease is scarcely ever fatal. Virchow,[1] who has shown that, in cases of symptomatic secondary parotitis, the affection starts in the gland-ducts, maintains that the idiopathic form occupies the same seat. Bamberger,[2] on the other hand, states that the whole gland appears enlarged and reddened, with its tissues swollen and flaccid, owing to an interstitial exudation of lymph. The softness and indolent character of the swelling, however, the fact that it usually extends beyond the borders of the gland, and its usually rapid and complete subsidence, all induce us to believe rather that there is slight catarrh of the ducts, with mere œdema of the interstitial and surrounding connective tissue.

It is only in rare and very severe cases that there is sufficient lymph effused to undergo organization and lead to persistent increase in the size of the gland, or to so compress the ducts as to induce atrophy of the true gland-tissue. In even more rare cases, it is said that suppuration may occur. In the secondary form, on the other hand, such as is seen in connection with the various specific fevers, the occurrence of suppuration is frequent.

Symptoms.—In some cases the attack of mumps is preceded for a day or two by slight prodromes, consisting of restlessness, feverishness, loss of appetite or vomiting; in excitable children, symptoms of nervous disturbance may occur. More frequently, however, the local symptoms appear simultaneously with the fever, and we have generally found positive swelling of the parotid gland upon our first visit to the child.

The earliest local symptom is often pain, complained of under the ear, and increased by pressure and by all movements of the jaw, as in mastication. There is also stiffness felt in opening the mouth. The swelling appears first immediately beneath the ear; the depression between the mastoid process and the ramus of the jaw quickly becomes filled, and the swelling rapidly extends on to the cheek and neck. At first the swelling is flat, indurated, and presents the outlines of the parotid gland; but it soon becomes prominent, the most marked projection usually being observed immediately anterior to the lobe of the ear, and extends beyond the limits of the affected gland. The central part of the swelling corresponding to the parotid, remains firm, indurated, and more or less elastic, while at the periphery it is softer and often pits on pressure. The degree of enlargement varies much in different cases, being at times moderate and confined to the parotid region, while in other cases, it extends over a large part of the neck and face, and may be so great as, especially when both glands are affected simultaneously, to give to the head and neck a pyramidal shape.

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[1] Quoted by Niemeyer (op. cit., vol. i, p. 436).

[2] Quoted by Vogel (op. cit., p. 113).

Quite frequently the submaxillary glands are involved, and the swelling consequently extends along the base of the jaw; in more rare cases, the enlargement is most marked in this region, or, indeed, the submaxillary glands may be almost exclusively the seat of the affection.

The skin over the seat of enlargement is at times scarcely altered in color, or may present more or less marked redness. There is usually only very moderate tenderness on pressure. The pain suffered during the attack varies greatly; in some cases it is merely a marked sense of tension and pressure, while in other instances, it has been complained of as constant and severe, and extending even to the chest and shoulders. The movements of the head are impaired, and those of the jaw are impeded to such an extent that the mouth can only be slightly opened, and mastication is performed imperfectly and with great difficulty.

Usually the swelling increases for from three to five days, remains at its acme for a day or two, and then rapidly subsides, so that in about ten days the face has regained its natural appearance.

Mumps usually involves both parotids, though they rarely become affected simultaneously; the left gland is said to be most frequently the first inflamed, and subsequently, in twenty-four or forty-eight hours, or even when the swelling has disappeared from the side first affected, the opposite gland becomes enlarged. Occasionally the enlargement does not undergo complete resolution, and a circumscribed, painless, hard swelling remains for a variable time in the parotid region. In very rare cases, suppuration is said to have occurred. The salivary secretion is variously affected, and may be either diminished or excessive, or remain unaltered. Occasionally the external swelling is associated with enlargement of the tonsils and œdema of the submucous tisssue of the pharynx. In such cases the difficulty of deglutition is much increased, and there may even be marked obstruction to respiration.

General Symptoms.—Usually the constitutional disturbance in mumps is but slight and subsides even before the swelling of the parotid gland. Until the disease reaches its height, however, there is fever, with heat and dryness of the skin; the pulse and respiration are accelerated, the appetite impaired or lost, and the thirst usually extreme. There may also be, especially in nervous children, marked restlessness, sleeplessness from the pain and discomfort caused by the great swelling of the neck and face, and even mild delirium at night. As already mentioned, however, these febrile symptoms usually disappear about the fifth or sixth day.

One of the most curious features in parotitis is the tendency which occasionally exhibits itself to metastasis. The parts which are liable to be thus secondarily inflamed are the testicles and scrotum in males, and the mammæ, the vulva, and the ovaries in females. The most frequent of these metastatic inflammations in mumps is the affection of the testicle, which is much more common in men than in boys, is usually seated upon the same side with the enlarged parotid, and is attended with enlargement of the body of the testicle, serous effusion into the tunica vaginalis, and œdematous swelling of the scrotum. The swelling of the parotid ordinarily subsides when any of these metastatic affections appear, but occa-

sionally the two inflammations continue together, a circumstance which shows, as Niemeyer points out, that they are in reality due to a common cause, and that no true transference of inflammation takes place from one point to the other. In some instances, the swelling of the parotid subsides a variable time before the development of the metastatic affection, and, during the interval, alarming symptoms of depression and cerebral disturbance have been noticed, and at times referred to a metastasis to the membranes of the brain. There is, however, no actual meningitis present, and upon the redevelopment of the external swelling, these nervous symptoms disappear.

Prognosis; Duration; Course; Termination.—Idiopathic parotitis or mumps almost invariably terminates favorably. The duration of the case varies from four or five days in very mild cases, to ten or twelve in severe ones. As already stated, the inflammation usually terminates in complete and rapid resolution. In some cases, however, a large amount of lymph is formed in the interstitial tissue of the gland, undergoes partial organization, and causes a hard, painless swelling, which persists for some time. In some epidemics, suppurative degeneration of the gland has been noticed, and the abscess which formed has either opened outwardly or into the external auditory meatus. We have known persistent hydrocele to follow the inflammation of the testicle occurring during an attack of mumps.

Diagnosis.—The acute febrile character of the affection, and the peculiar seat and shape of the swelling, always serve to render the disease readily recognizable.

Treatment.—As mumps almost invariably runs a favorable course, the treatment should be of a mild and expectant character.

The child should be strictly confined to bed; the diet should be fluid, partly on account of the great difficulty in mastication, light and digestible, consisting chiefly of preparations of milk and light animal broths. The only internal remedies required are febrifuges, such as spirit of nitrous ether and solution of acetate of ammonia, with a free supply of water and acidulated drinks; occasional laxatives; and, if there is sleeplessness, small doses of Dover's powder or some other anodyne.

Local applications appear to have little or no influence upon the course of the swelling. The only ones to be recommended are warm, light poultices, or light water-dressings, covered with oiled silk, which do not annoy the child, and tend to favor resolution. If the induration be marked and extensive, so as to threaten suppuration, it has been advised to apply a few leeches behind the angle of the jaw. If it should become evident that suppuration has occurred, the abscess should be opened immediately, and the discharge favored by the application of poultices, in order to prevent further destruction of the gland or perforation of the external auditory meatus. In cases where induration and enlargement of the gland persist, absorbent applications, such as inunctions of iodine or mercury, should be made over the tumor.

In cases where alarming symptoms of depression and cerebral disturbance make their appearance after the sudden subsidence of the parotid

swelling, the effort may be made in order to redevelop the external inflammation by stimulating applications to the surface, and by the internal administration of nervous and diffusible stimulants, such as ammonia, musk, or brandy.

After the acute symptoms of the attack have subsided, and the child has fully entered upon convalescence, we would caution against allowing it to leave bed too soon, since we have occasionally observed such premature exposure to be followed by marked febrile sequelæ. Thus in one case, occurring in an adult, there was marked fever lasting for a week; in another case, in a child, there was high fever for ten days; and in a third case, also in a child, there was most obstinate and violent vomiting for four days; so violent, indeed, that we feared lest some renal complication might have been developed; on examination, however, the urine was found to be entirely normal.

ARTICLE IV.

MALARIAL FEVER.

The propriety of introducing a chapter upon malarial fever in the present work, is shown not only by the fact that malarial disease is extremely frequent in children, but also because it presents, as it occurs in them, so many peculiarities as to frequently lead to the true nature of such attacks being overlooked.

Causes; Frequency.—There are cases upon record in which malarial disease appears to have been contracted in utero, and where immediately after the birth of the infant it has presented unmistakable evidences of the disease. We have ourselves met with several such cases, where the symptoms, and the prompt effect of quinine, left no doubt as to the diagnosis. At all periods of childhood, even from the age of a few weeks upwards, there can be no doubt that children readily contract malarial disease on exposure to its cause. Indeed we have met with cases which have shown that the susceptibility of children to malarial poison may be even greater than that of their parents or other adults exposed to the same influences. In children over five or six years old the symptoms of malarial fevers are apt to be almost the same as in adults: the following remarks must therefore be understood to apply especially to those diseases as they present themselves in younger subjects.

Symptoms.—Malaria presents itself in children both in acute and chronic forms. The former occurs both as intermittent and remittent fever. In our article upon typhoid fever we have carefully pointed out the fact, that in children the febrile movement in this latter disease often presents such marked remissions as to have led many authors to confound it with malarial disease, under the name of "Infantile Remittent Fever." But apart from this, true malarial remittent fever occurs in children, and

indeed it is a peculiarity of all forms of malarial disease in early life to present a less marked development both of the paroxysms and of the intermissions. Intermittent fever in children may occur in any of the forms met with in adults, still the quotidian is by far the most frequent, the tertian less common, and the quartan decidedly rare. Whichever form may be present, is apt to present several peculiarities. In the first place, the features of the paroxysms are apt to be imperfectly developed This is particularly true of the cold stage. It is very rarely present as a well-developed chill; in some cases, it seems to be entirely absent, but usually can be detected by careful observation. The child may merely become pale, seem weaker and more languid, or with this there may be distinct coolness of the hands and feet, and blueness of the nails: less frequently is there any discernible rigor, and as before stated a fully developed chill is very rare. The cold stage is of short duration, lasting from a few minutes to a quarter of an hour. It is followed by the hot stage, or in some cases the beginning of the attack is marked by the appearance of fever. The degree of this is rarely very high. Sometimes the child, who has been merely drooping during the earlier part of the day, is noticed to grow more dull, to wish to be constantly in bed, or on the lap, and its head and hands grow warm, with perhaps some flushing of the cheeks. Indeed, in some cases, the fever is so slight as to pass unnoticed, unless the attention of the nurse is directed to it by the physician. In other cases the accession of fever is more marked; the skin becomes very hot, and the cheeks brightly flushed; the child is dull and yet restless; there is rapid breathing, and marked acceleration of pulse. In some children, the fever is attended with delirium, and it is not a very rare thing to have it ushered in by a convulsion. This fact of the occasional occurrence of a convulsion, as a substitute for the chill as the initial symptom of the malarial paroxysm, must be borne in mind as of positive diagnostic importance. The fever lasts a very variable time, and rarely terminates abruptly, as in the case of adults by a sudden defervescence with profuse sweating. Indeed, in many cases, the child seems somewhat feverish during the entire twenty-four hours, but on careful observation is found to present increase of heat at some period of the day, and this is often preceded or followed by a short period during which the child is pale and languid, with cool moist brow and hands. Added to this irregularity in the symptoms and duration of the paroxysms, is the further source of difficulty, that the accession of fever occurs at very irregular hours. In children of even five years of age it may occur at the ordinary time towards noon, but in younger children it may appear much later in the day, or even, as we have several times seen, late in the night.

There are a few other symptoms to be mentioned in connection with the paroxysms. We have already alluded to the occurrence of convulsions ushering in the hot stage. Frequently the child will vomit whatever food was in the stomach at the time of the attack. The urine that is passed during the paroxysm is scanty and high-colored, while not long after the subsidence of the fever, there is apt to be a quite free discharge of limpid urine. Between the paroxysms, if no complication exists, the child may

ppear merely listless, with scanty appetite. Quite frequently, however, ıe disease is attended with some more marked disturbance, either of res- iration or digestion. The complications which we have ourselves most equently observed have been bronchitis and pneumonia. In cases where ıe latter has been present, the seat of the inflammation has occasionally cen the apex of the lung.

The *chronic form* of malaria reveals itself in children in the same way ; in adults. No well-marked paroxysms may occur, but the patient has sallow, cachectic, or anæmic appearance, which of itself is quite charac- ristic. There is more or less emaciation from interference with nutrition, the appetite is poor or capricious, and the action of the liver and bowels uggish and insufficient. Enlargement of the spleen frequently follows, id we have met with well-marked examples of ague-cake in very young ildren. The blood becomes very poor and watery, and this, added to e obstruction to the circulation through the liver and spleen, in advanced ses may lead to ascites or œdema. We are not aware that the marked velopment of pigment-granules in the blood, which has been so often served in the adult, has yet been detected in children suffering with ronic malaria. In some very severe and protracted cases, granular de- neration of the kidneys with albuminuria, and finally uræmia, has seemed follow in quite young children. Some of the manifestations of malaria ich are quite common in the adult, are very rare in children. This plies especially to the various forms of neuralgia, which, as met with in e adult, are so frequently of malarial origin, while we do not remember have met with a single case of this character occurring in children.

Diagnosis.—It is our belief that malarial disease in children is often t recognized, and that this is due, not so much to its real difficulty of tection, as to the fact that the frequent occurrence of the different forms malaria in young children, is not sufficiently borne in mind. Undoubt- ly also there are difficulties in its diagnosis, which do not usually exist adults. These arise, as before said, from the irregularity and imperfect velopment of the paroxysms. Our own experience has taught us in all es of irregular febrile action, especially when occurring during the spring fall, without any discoverable lesion to account for it, to suspect the larial character of the attack. So, too, in cases where some slight lesion disturbance of function exists, and yet the child seems too seriously and obstinately ill for the apparent cause, and presents irregular fever with siderable fluctuations, the idea of the malarial nature of the attack ould always be entertained. In some such cases, where it is impossible reach a definite decision from a study of the symptoms, the diagnosis y be made by the therapeutic test of administering full doses of quinia several days in succession.

Prognosis.—The result of malarial fever is usually quite as favorable children as in adults, when uncomplicated with any serious local inflam- tion. All of its forms usually yield readily to specific treatment. The ef source of danger lies in the tendency to severe bronchitis or pneu- nia. In protracted chronic malaria, the anæmic and cachectic symp-

toms have seemed to us to yield to treatment even more rapidly than in the case of adults.

Treatment.—Children, even at a very early age, bear full doses of quinia very well. The amount which we have usually found necessary to arrest an attack of intermittent fever is three grains daily for children of one year of age or under, and one grain additional for each succeeding year, though we have given as much as five grains by the mouth in the course of the day to children of ten months, and without the slightest ill effect. It may be administered in the form of powders containing one-half grain, mixed with an equal amount of sugar and powdered extract of liquorice, repeated as necessary, and given at such times as to bring the system thoroughly under the influence of the drug before the hour at which the accession of fever has been noticed. Some children, however, will not take the powders without difficulty or nausea, and the quinia may then be given merely suspended in syrup of red orange, or in the following combination:

℞.—Quiniæ Sulph., ... gr. xxiv.
Acid. Sulph. Diluti, ... gtt. xxx.
Syr. Zingiberis, Syr. Simplicis, Aquæ, āā . . fʒj.
Ft. sol.—Dose, a teaspoonful three or four times a day, according to age.

If, however, the stomach rejects it in all of these forms, as we have known it to do, we have found the administration by enema of two grains of quinia in a tablespoonful of starch-water, three times a day, equally successful. We may also resort to the use of suppositories, which when neatly made with butter of cacao and of small size are perfectly well tolerated, as a rule, even by very young infants.

In ordinary acute cases no other treatment is really required. It may be well to give a few doses of some saline febrifuge during each day, until the fever is entirely subdued, and of course any special disturbance of function must be relieved by appropriate remedies. The treatment of pulmonary complications must be subordinate to that of the general disease. All depleting or perturbing treatment must be avoided, and it will generally be found that with the aid of mild counter-irritation, the local symptoms will begin to improve, after the malarial fever has been subdued by quinia. It is necessary to keep up the action of quinia for some time after the paroxysms are broken, because the tendency of the disease to recur is fully as great in children as in adults. We are in the habit of thus continuing it for three or four weeks in diminished doses, giving, however, on each septennary period, dating from the arrest of the paroxysms, the full antiperiodic dose, suited to the age of the patient. At the same time the child should take suitable doses of iron and arsenic, which may be conveniently given in the following form:

℞.—Liq. Potassæ Arsenitis, ... fʒj.
Vini Ferri Amari, ... fʒiij.—M.
Dose.—From a half to a whole teaspoonful thrice daily in water after meals.

In chronic malaria we must persist in the use of quinia, iron, and arsenic,

for a considerable period. At the same time careful attention must be paid to securing the best possible hygienic influences for the child. When practicable, a change of climate should be secured by a journey to the mountains or to the sea-shore. The patient should be warmly dressed, and carefully guarded against all exposure to damp or cold. The diet should be carefully selected, and every error of digestion promptly corrected. Even after the child is apparently restored to health, it should not be allowed to return to the locality where it contracted the disease, and for several successive springs and autumns should take a short course of quinia and arsenic.

In the treatment of the enlargement of the spleen, which frequently occurs in chronic malaria, we have obtained excellent results from the use of hypodermic injections of ergotin into the subcutaneous tissue of the abdominal wall.

ERUPTIVE FEVERS.

We shall describe in this eruptive group of General Diseases, scarlet fever, measles, small-pox and vaccine disease, varicella, and typhoid fever.

ARTICLE V.

EPIDEMIC CEREBRO-SPINAL MENINGITIS.

Definition; Synonyms; History; Frequency.—Among the large number of names which have been applied to this disease, the only additional ones which call for mention are cerebro-spinal fever and spotted fever. The latter has been much used in this country, but as it is based upon a symptom of occasional occurrence only, is evidently inadmissible. The name we have adopted is the one now almost universally accepted.

Epidemic cerebro-spinal meningitis is an acute specific febrile affection, occurring in epidemics of widespread or local character, but not propagated by contagion; characterized by alterations of the blood and by inflammatory changes in the membranes of the brain and spinal cord, and running a most irregular course both as regards symptoms and duration.

Although it is highly probable that epidemics of varying extent occurred previous to the present century, it appears that their true nature was not recognized, and the first distinct account of epidemic meningitis was published in 1805 by Vieusseux. Since that time, however, it has appeared more or less frequently in almost every country of the globe. It began its course in the United States in 1806, and numerous epidemics of it occurred between that time and the year 1816; again between 1823

and 1830; again between 1842 and 1850, and again between 1856 and the present time. The last epidemic began in Philadelphia in 1863, and returned annually for some years, reaching its height in 1866–67. Since then, however, as will be seen from the table below, it has continued to furnish annually a considerable number of deaths.

It was made the subject of several valuable memoirs, among which may be mentioned those of Gerhard,[1] Githens,[2] Levick,[3] and particularly the admirable treatise of Stillé.[4]

Owing to the employment of various names for this disease in the mortality reports, it is difficult to estimate the actual mortality occasioned in this city by it, but a good idea may be obtained from an inspection of the subjoined table, which presents the annual mortality for fifteen years from epidemic cerebro-spinal meningitis, typhus and typhoid fevers, and diphtheria.

	Epidemic Cerebro-spinal Meningitis.	Typhus Fever.	Typhoid Fever.	Diphtheria.
1860	0	14	68	214
1861	0	17	148	502
1862	0	37	654	325
1863	49	131	486	434
1864	384	335	648	357
1865	192	334	773	460
1866	92	96	381	192
1867	102	138	367	119
1868	54	108	395	119
1869	36	49	373	182
1870	36	69	409	172
1871	44	37	313	145
1872	128	35	369	150
1873	246	31	382	110
1874	80	0	461	179

Causes.—The disease we are considering has occurred "in all portions of the temperate zone inhabited by European races and their descendants; in all sorts of localities, among all ranks and conditions of society, at all ages, and in both sexes; and it is therefore in the strongest sense of the word a pandemic disease." (Stillé, *op. cit.*, p. 94.) While its epidemic character is so strongly marked, there is no reliable evidence as to its being contagious. A few authors, however, even of such recent date as Bristowe, assert their belief in its contagiousness.

[1] Amer. Jour. Med. Sci., July, 1863, p. 105.
[2] Ibid., July, 1867, p. 17.
[3] Trans. of Amer. Med. Assoc., xvii, p. 311.
[4] Epidemic Meningitis, Phila., 1867, pp. 178.

Although occurring in both sexes and at all ages, it is more frequent in females, and a large majority of the cases are among minors. The disease has undoubtedly been more frequent and virulent among overcrowded and filthy populations, but there is no reason to think that these conditions exert any more than a general depressing influence.

ANATOMICAL LESIONS.—The chief lesions in this disease are found in connection with the blood and the nervous centres.

Blood drawn from a vein during life usually presents its normal characters or else those indicative of inflammatory action, excepting in cases of the most malignant and rapidly fatal type. On the other hand, in post-mortem examinations, the blood is most frequently found to be dark, and either altogether fluid, or with only small dark and soft clots, in the cavities of the heart and the larger bloodvessels. These alterations are evidently what should be expected in a disease presenting the double condition of a specific blood poison and a distinct and serious local inflammation, which two elements vary greatly in their relative preponderance in different epidemics, and even in different cases of the same epidemic; no definite chemical changes have been ascertained. In cases where the crasis of the blood is greatly impaired, microscopic examination has frequently shown an absence of the ordinary mode of arrangement of the red corpuscles in rouleaux, and a crenated appearance of the corpuscles themselves.

The lesions of the nervous centres are chiefly seen in the meninges of the brain and spinal cord. In the early stage, there is extreme engorgement of the vessels of the meninges, with a loss of the normal translucency of the pia mater and arachnoid. Later, an exudation occurs which at first may be serous, but soon becomes sero-purulent or entirely composed of thick creamy pus, with a varying proportion of lymph. The amount of this exudation varies greatly in different cases; at times being quite scanty, while in other instances, several ounces of pus are present.

The exudation usually occupies the subarachnoid space, and is at times associated with effusion into the ventricles of the brain. The convexity and the base of the brain are both involved, though the exudation is as a rule more abundant over the latter, and especially about the optic chiasm, the fissures of Sylvius, and the base of the cerebellum and under surface of the pons. One or more of the cranial nerves are completely imbedded in the exudation.

The spinal meninges present the same general changes, the vessels being congested, the pia mater infiltrated with sero-purulent fluid, and the subarachnoid space occupied by a more or less extensive exudation. These lesions are usually most marked about the medulla and again at the lower part of the cord. It is probable that the tendency of the exudation to accumulate at the latter point is partly, at least, due to gravity.

The substance of the brain is usually vascular and more or less softened; and the spinal cord presents the same changes, though less constantly and usually to a less degree. In some cases, however, the softening of the cord is extreme, and Hirsch has recorded a case in which the central canal of the cord was distended with pus.

In some cases where death occurs very rapidly, within twenty-four or forty-eight hours, the cerebro-spinal lesions have been found wanting, not having yet been developed to an appreciable extent.

There are no characteristic lesions of any other organ.

Symptoms; Course.—In some cases the attack is preceded by the usual prodromes of acute specific fever; but in many instances it occurs without warning in the midst of perfect health. Usually the actual outbreak is marked by a distinct rigor, followed by fever, prostration, vomiting, intense headache, and pains in the back and limbs. It is soon evident that the patient is seriously ill. He grows restless and tosses about, at times with slightly spasmodic twitchings of the muscles. The intellect often remains clear; but delirium or a disposition to heaviness and dozing may be present. The temperature is rarely very high at first, and the pulse ranges from 90 to 120, according to the age of the child. As early as the second day we may observe that the head is retracted, and thus increases in its degree and soon becomes associated with a tendency to opisthotonos. The other nervous symptoms increase in severity; headache persists, and is even so severe as to elicit screams of pain; the pupils are contracted; there is delirium, with excessive restlessness or even convulsions. Extreme cutaneous and muscular hyperæsthesia are very common symptoms. Vomiting is apt to continue; the bowels are constipated, the abdomen retracted, and the urine is usually retained. The pulse grows more frequent and small, the respiration greatly accelerated, and the temperature increases to perhaps 103° or 104° F. Herpetic eruptions about the mouth are common; and in a varying proportion of cases a purpuric eruption appears from the second to the fourth day. In some instances the course of the symptoms presents marked fluctuations, which may assume the form of distinct quotidian or tertian remissions. In unfavorable cases, stupor supervenes, interrupted by more or less marked spasmodic movements; respiration and circulation become more and more impaired, and the patient dies in profound coma. In favorable cases, on the other hand, the nervous jactitation and delirium diminish, the tetanic muscular spasms relax, the urine is passed voluntarily, the pulse and respiration gradually uniform, and the patient enters upon convalescence.

Death may occur even in a few hours from general paralysis, from the overwhelming effect of a violent and universal meningitis. It may occur in the course of one or two days, in malignant cases with extremely marked blood lesion. In cases of the regular form, death may occur from the fourth to the eighth day, from the effects of the cerebro-spinal lesion; but after convalescence has commenced, the supervention of some complication or sequel may prove fatal, even after the lapse of weeks or months.

Before proceeding to discuss a few of the principal symptoms more in detail, the following case of severe type, which occurred in our practice, may be cited in illustration of the general sketch above given:

Case.—David R., æt. 12 years, in good health, was attacked on June 8th, without apparent cause, with violent headache, languor, and occasional vomiting. Cerebro-spinal meningitis was prevalent as an epidemic at the time (1864).

On June 9th (second day), at noon, headache continued intense, the fever in-

creased in severity, and he vomited twice a greenish liquid. The bowels were constipated, and urine scanty. He lay in a drowsy condition; the eyes slightly injected, but pupils of normal size; the nose was pinched, the mouth closed. There was no rigidity of the muscles of the neck or of other parts. There was marked jactitation, with mild delirium. The skin was dry and slightly pungent; respiration 48, quick and sighing; pulse 105. Over the whole body, but especially on the extremities, there are small petechiæ, of livid color. Abdomen meteoric. Ordered brandy f℥ss. every half hour, a saline laxative, and the following:

℞.—Morphiæ Sulph., ... gr. $\frac{1}{24}$
Acid. Sulph. Aromat., ... ♏v.
Elix. Cinchonæ, ... f℥ss.

Ft. sol.—To be taken every two hours.

In the evening, his mind was more clear; but rigidity and soreness of muscles of back of neck had appeared, with tendency to opisthotonos. Pulse 120, irritable and quick. Vomiting continued. The bark mixture was changed for one containing quinia, morphia, and dilute sulphuric acid. Iced champagne and beef tea were given in small quantities. Counter-irritation by capsicum and whisky.

In the night, at two o'clock, vomiting continued frequent and uncontrollable. Pulse was very feeble, almost threadlike, and very irregular, varying from 100 to 120 within a few minutes' time. Temperature equally variable, surface being alternately burning hot and chilly. Quite conscious, and complains of intense headache; extreme restlessness continues. Frequent thin, dark stools.

June 10th.—In morning, pulse 90, varying from minute to minute; respiration less hurried. Surface warm. He passes urine and fæces. Ordered suppositories of gr. ss. opium and grs. ij quinia every five or six hours; a blister behind each ear; f℥ss. brandy every hour, and concentrated nourishment.

About five hours later, stupor supervened and continued until night, interrupted by fits of violent delirium. Slight convergent strabismus. Petechiæ continue, and there is a herpetic eruption about the mouth. Temperature reduced in extremities. Ordered nutritious enemata; blister 4 x 4 to back of neck; small doses of opium by rectum to maintain its influence.

June 11th.—More quiet; no more active delirium. Bowels open more freely. Urine free, acid reaction, sp. gr. 10.32, with a very heavy deposit of whitish urates. Nourishment and medicines retained by stomach. Pulse 85 to 105, with more volume. Consciousness partially regained; complains of frontal headache and muscular soreness. No opisthotonos. Eyes slightly injected. Continue opium and quinia; beef tea; iced champagne; milk with lime-water.

June 12th.—Condition about the same. Some quiet sleep. Skin of pleasant temperature. Herpes abundant around mouth. Urine quite free, and light colored. Pulse about 100; respirations more full. Treatment continued.

June 13.—Pulse 72 to 100. Consciousness perfect, but complains of intense frontal pain. Temperature almost normal. Petechiæ disappearing; herpetic eruptions on face still marked. Passes urine freely; sp. gr. 10.11; no albumen; bowels costive; quinia discontinued on account of headache. Ordered blue mass, gr. i, every two hours for four doses, followed by a laxative enema, which acted freely, and gave much relief.

June 14th.—Restless, and complaining of his head. Still some retraction of the head, and muscular soreness. Respirations 35; pulse 100 to 116. Stomach retentive. Tongue cleaning, but dry and cracked. Passes urine copiously, very light-colored and watery. Suppositories of quinia and opium resumed; stimulus and nourishment as before.

June 15th.—Doing well. Has emaciated very rapidly. Pulse 110; falling during the day to 96; respirations less sighing and labored. Decubitus more natural,

and movements more easy and free. Opiate suspended. Takes Quinia sulph , gr. i; Acid. muriatis, dil. gtt. x, q. q. h. Stimulus and food as before.

June 16th.—Doing well. Petechiæ disappeared; herpes around the mouth better. Tongue moist, but very sore, with ulcerated cracks covered with pultaceous crusts. Pulse 100, of good volume. Expression natural. No signs of spinal irritation.

June 19th.—Ninth day of disease. Convalescent.

June 20th.—Rapidly regaining strength. Sleeps well, and eats with great appetite. No headache; expression bright and natural. Tongue has healed, and herpes around mouth nearly gone. Bowels regular; urine free and normal. Continues quinia and mineral acids. The subsequent course of the case was that of rapid restoration to health without any sequelæ.

In entering upon a study of the special symptoms, it will first be observed that the mode of onset of the disease is peculiar, and is characterized by its suddenness and by the early appearance of grave nervous symptoms without a high grade of fever.

The symptoms furnished by the nervous system merit the closest study. So important are they that many authors have been led to regard the whole affection as due to the meningeal inflammation, losing sight of the coexistent lesion of the blood. The most marked of them is headache, which, as already stated, appears early, is usually sharp and lancinating in character, and violent in the extreme. It is accompanied with pain along the spine, especially in the cervical region, which is much increased by pressure or by motion. Neuralgic pains are also very common, and at times are extremely severe; they chiefly affect the extremities and the abdomen. From an early period of the case, there is apt to be marked and painful hyperæsthesia of the skin, and also of the muscles; so that handling the patient causes complaints or even cries of pain. Later this may be followed by more or less marked anæsthesia. There are frequently also various forms of muscular spasm. At times a high group of muscles will be affected with spasm, either tonic or clonic. The most frequent instances of this are the retraction of the head from rigid spasm of the cervical muscles, and the tendency to opisthotonos; both of these conditions are very constant, and may be present in a high degree. Trismus is not very infrequent; while in other cases, the muscles of the extremities are affected with spasm; or again, the tetanoid symptoms may assume the form of general epileptiform convulsions, which are much more frequent in children than in adults.

Paralysis in various forms, hemiplegia, paraplegia, but much more frequently as affecting a single cranial nerve (facial, abducens, or oculo-motor) has been observed, but as a rule is not met with until the later stages of the disease. In some cases, marked subsultus is present. In addition to these symptoms, there is rapid and marked debility, frequently associated with vertigo on rising into the sitting posture. Disturbances of the intellect are also more frequent in children than in adults. At first there are great restlessness, jactitation, and wandering delirium, which may persist or be replaced by more or less profound stupor; perhaps occasionally interrupted by active delirium. In fatal cases, this stupor deepens into coma as the end approaches.

There is frequently loss of control over the bladder and rectum, attended with retention or with involuntary discharges.

The organs of *special sense* furnish important symptoms. There is often a uniform, diffused redness of the conjunctivæ. The pupils are usually contracted at first, but later may be dilated or unequal. Not rarely blindness follows; due either to keratitis, to exudative inflammation of the retina or choroid, or to purulent exudation in the chambers of the eye. Squinting frequently results from paralysis of one of the motor nerves of the eye as already stated. In like manner, deafness often results from suppurative inflammation of the internal ear, or from inflammation of the auditory nerve.

The *expression* of the patient varies much at different periods of the disease. In the early stage, the face is often pale, with pinched nose and sunken features. This peculiar facies, which was noted in the case above narrated, is regarded by Hirsch and others as very characteristic.

The *pulse* and *temperature* are less uniformly affected than in any other of the acute specific febrile diseases. At first the pulse may not be much accelerated, but later it may be very rapid, or again, may present remarkable variations at short intervals. The course of the fever is very irregular; in most cases the temperature does not rise above 103° or 104°, and not infrequently is much lower throughout the whole course of the attack.

The disturbance of respiration is marked but very irregular. In the early stages it corresponds with the condition of the pulse; but later it presents irregularities due to the pressure of exudation on the pneumogastric nerves, and may then assume the peculiar form known as *ascending and descending breathing*, which is so frequently seen in the exudative stages of tubercular meningitis.

The *digestive system* presents few constant symptoms. Vomiting, however, is nearly always present in the early stage, and may be frequent and uncontrollable. It is often unattended by any nausea, and there evidently depends an irritation at the base of the brain. We have already referred to the severe abdominal neuralgic pain sometimes complained of. The bowels are usually constipated, and the abdomen retracted. In the later stage, it is not rare for involuntary discharges to occur.

The *urine* presents the ordinary febrile characters, and in addition is at times albuminous or even bloody. There is frequently retention, requiring the use of the catheter, though we think this less frequent in children than in adults.

We have already alluded to the occurrence of *eruptions* on the skin. They are not constant, and in some epidemics have been rarely noticed. Still they constitute very important symptoms in the majority of cases; and indeed the occurrence of a petechial eruption has been so marked a feature in most American epidemics as to render the objectionable name, "spotted fever," the popular title for this affection.

Among these eruptions, groups of herpes are frequently seen on the face, especially about the mouth, while, in more rare instances, erythema and urticaria has been observed. But by far the most frequent and important is the petechial eruption, which appears early in the case, usually in the

form of small spots. The proportion of cases in which such an eruption is present varies greatly in different epidemics. Stillé concludes (*op. cit.*, p. 64) that, taking the whole of the cases of epidemic meningitis in Europe and America, it did not occur in more than 10 per cent. On the other hand, of 96 cases recorded by Dr. Githens (*loc. cit.*), 36 had marked petechial eruptions; and of the cases we have ourselves observed, the proportion has been even greater.

The *duration* of this disease is extremely variable. We have seen it prove fatal in the adult within forty-eight hours from collapse, with all the evidences of profound blood alterations, and before the characteristic lesions of the meninges had passed beyond the first stage. Death has been known to follow even in a few hours, with symptoms of general paralysis.

In cases of ordinary severity which terminate favorably, the duration of the acute attack may be stated as from five to fourteen days, but complete convalescence may be postponed for weeks or months on account of the occurrence of some of the sequelæ so frequent after this affection. On the other hand, death may occur at any period from the first day, as above stated, to as late as months after the original attack. Hirsch states that its duration is between a few hours and several months.

Convalescence may be prompt, satisfactory, and complete; or it may be irregular and protracted, in consequence of the persistence of some symptoms or the development of some of the sequelæ. Among them may be mentioned blindness and deafness due to causes already stated. Some neuralgic pains, dependent upon irritation of the posterior roots of spinal nerves, tonic or clonic spasm of certain muscles, and more rarely paralysis of a single muscle or of one or more members. It will be observed that these sequela are, for the most part, the results of the inflammation of the cerebro-spinal meninges.

The *mortality* varies greatly in different epidemics. According to Hirsch it has varied from 20 to 75 per cent. As we have met with it in this city, the mortality was about 33 per cent.

The *prognosis* should always be guarded in epidemic cerebro-spinal meningitis. Even when the threatening symptoms of the acute attack begin to subside, it is impossible to predict that there will not be left behind some sequel which may protract convalescence indefinitely or induce a lingering and painful death.

The diagnosis of this disease is not difficult. It could scarcely be confounded with typhoid fever; but in case of the coexistence of an epidemic of typhus fever, it is important to note the differential marks by which this latter may be distinguished from epidemic meningitis. Thus the headache of typhus fever is less violent and sharp, and the delirium less active and marked. In typhus, also, the face presents a dusky flush, and the conjunctiva is injected; while in meningitis the face may be pale at first, and the conjunctivæ are of a uniform pinkish color. The rapidity of pulse and elevation of temperature are much more marked in typhus, and follow a much more regular course. The eruption of typhus appears on the third or fourth day; while in meningitis the occurrence of petechiæ is not at all constant, and when present they may appear as early as the first or second

day. On the other hand, the herpetic eruptions so frequent in meningitis are wanting in typhus. Vomiting is much more frequent in meningitis than in typhus. Retraction of the head, opisthotonos, muscular spasms, neuralgic pains, cutaneous hyperæsthesia, irregularity of the pulse and respirations also, which are such marked symptoms of meningitis, are not characteristic of typhus. We may add that although typhus occurs in childhood, it is comparatively rare; while, as we have already seen, epidemic meningitis occurs more frequently among children than at any other age.

We would call attention also to the possibility of confounding mild cases, without eruption, for rheumatism of the cervical and dorsal muscles. We knew this error to be committed in one case, with fatal results.

TREATMENT.—In the treatment of this affection it is necessary to bear in mind its real nature. There can be no doubt, however, that, in the majority of cases at all amenable to treatment, the meningeal lesions must be the chief object of our medication.

The use of cathartics is to be adopted with great caution. A mild saline laxative may be administered, and its action aided by an enema, if marked constipation exists at the onset. But it is to be remembered that but little food can usually be retained, and also that the constipation is the result of the cerebral irritation.

Opium administered freely, so as to quiet the intense pain and nervous restlessness, is to be recommended. Its use will also at times control the cerebral vomiting. It is best given by suppository or enema, or in the form of morphia by hypodermic injection.

Bromide of potassium, as a nervous sedative and antispasmodic, may be employed with advantage.

Ergot has also been highly recommended on account of its well-established power of influencing congestion of the cerebro-spinal vessels; and certainly this would appear sufficient reason for the employment of this remedy alone or in conjunction with *belladonna*.

Our own experience agrees with that of most American physicians, in regard to the beneficial effects of quinine, given in large doses, either by the mouth, or, if vomiting be persistent, in the form of suppository.

Local depletion by leeches or cut cups to the back of the neck and along the spine should be employed, unless the evidences of blood dyscrasia forbid it. After its employment, or instead of it, in case it be deemed inadmissible, the repeated application of dry cups along the spine is to be recommended.

Food should be very carefully administered in small quantities, and if necessary nutritious enemata should be resorted to.

In case of extreme debility, of depression of the circulation, or of tendency to collapse, alcoholic stimulus should be freely employed, and the same is true, when, later in the course of the case, the typhoid state is markedly developed. It may also be necessary to apply external warmth to maintain the temperature of the body.

For the relief of the sequelæ which result from the imperfect absorption of the exudation, and the consequent irritation or pressure upon the roots

of the cranial or spinal nerves, evincing itself by neuralgic pains, muscular spasms, contractions or paralysis, the necessary treatment comprises continued counter-irritation to the spine; the internal use of iodide of potassium, nitrate of silver, or bichloride of mercury; the use of one or the other form of electricity.

ARTICLE VI.

SCARLET FEVER OR SCARLATINA.

DEFINITION; FREQUENCY; FORMS.—Scarlet fever is an epidemic and contagious eruptive fever, characterized by a scarlet rash, which appears on the first or second day of the disease, and ends usually about the sixth or seventh, or in rare cases as late as the tenth; by simultaneous inflammation of the tonsils, and of the mucous membrane of the mouth and pharynx; and which is followed by desquamation.

The frequency of the disease is exceedingly variable in different years, owing to its epidemic nature. This may be readily seen by a glance at the following table, which gives the annual mortality for the past sixty years in this city, from scarlatina and measles:

	Scarlatina.	Measles.		Scarlatina.	Measles.		Scarlatina.	Measles.
1809	3	0	1829	9	53	1849	242	27
1810	2	1	1830	40	7	1850	440	72
1811	3	2	1831	200	23	1851	391	17
1812	1	20	1832	307	118	1852	434	90
1813	0	1	1833	61	1	1853	388	14
1814	0	9	1834	83	7	1854	162	62
1815	0	7	1835	305	248	1855	163	24
1816	0	2	1836	240	4	1856	992	141
1817	0	0	1837	205	49	1857	704	66
1818	1	0	1838	134	123	1858	241	28
1819	2	108	1839	225	136	1859	232	51
1820	31	47	1840	244	2	1860	591	15
1821	13	0	1841	83	119	1861	1190	74
1822	9	0	1842	220	24	1862	461	109
1823	11	156	1843	395	1	1863	275	82
1824	9	102	1844	269	3	1864	349	90
1825	9	38	1845	199	90	1865	624	54
1826	4	101	1846	221	6	1866	491	221
1827	1	9	1847	344	77	1867	367	83
1828	0	58	1848	172	99	1868	224	108

It will be noticed that for five successive years, 1813–17 inclusive, not a single death from scarlatina is reported; and that during twenty years, 1809–28 inclusive, only 99 deaths occurred from this cause; while in the single years 1856 and 1861, 992 and 1190 deaths respectively are reported.

During the entire series of sixty years, there have been 13,016 deaths from scarlatina returned.

Hillier states, that during the eighteen years from 1848 to 1866, the deaths from scarlatina in London amounted to 52,461.

It is impossible to estimate the actual relative frequency of scarlatina and measles, owing to the absence of any returns of non-fatal cases. It is evident, however, from the above table that, although the mortality from measles is also very variable, and thus may for a short time exceed that from scarlatina, in a long series of years the latter disease is far the more fatal. Thus the number of deaths from measles in this city, during the past sixty years, amounts to but 2279.

MM. Guersant and Blache (*Dict. de Méd.*, t. 28, p. 173) state that it is less frequent than measles or variola. They added together the cases of the eruptive fevers collected in 1838 and 1839, by MM. Roger, Rilliet and Barthez, and Barrier, in the Children's Hospital at Paris, and found that there had only been 157 of scarlet fever; whilst there were 267 of measles, and 213 of variola and varioloid.

The *forms* of the disease generally enumerated are the *simple*, *anginose*, and *malignant*. Authors differ widely in their descriptions of these three forms. Many of the English authors include in the simple form only the cases in which there is no affection of the fauces, while the anginose form includes all in which there is any throat affection whatever. M. Rayer, on the contrary, describes under the head of the simple form the cases in which the throat affection is mild, while he considers the anginose form to be that in which a pseudo-membranous angina occurs. Again, the descriptions of the malignant form are vague and uncertain, some including under this term only the rapidly fatal cases in which cerebral symptoms are present, while others include those also which are rendered malignant by the occurrence of pseudo-membranous angina.

We believe this division of scarlet fever into distinct forms and varieties to be, for several reasons, a faulty arrangement. It is not, it appears to us, in the first place, consonant with the nature of the disease. Scarlet fever is, in fact, with all its degrees of severity, and apparent differences, a single and distinct fever, produced by one cause, determining similar effects, howsoever much they may vary in degree, and requiring no more than does typhoid fever to be divided into the variety of different forms, which it has been customary to ascribe to it. Again, the above mode of division is not, we are sure, a good one for practical purposes. It is impossible, indeed, as we have often found it, to refer many cases we meet with in practice, clearly and satisfactorily to any one of the forms of the disease described in books. The simple form of some of the English writers, or that in which there is no anginose affection, has no existence whatever, so far as we have been able to discover. We believe that inflammation of the mucous membrane of the fauces constitutes an essential element of the disease, for we have never yet seen a case of scarlatina in which it was not present to a greater or less extent. It is often very slight, so slight, indeed, as to be unaccompanied by any evidence of pain in the part, but in all that we have examined, it has been decided and

obvious. This supposed form of the disease does not, therefore, in our opinion, exist.

The two other forms usually described, the anginose and malignant, are also of little value practically, since we have found that in all severe or grave cases, in which the patient did not die with violent nervous symptoms under the first shock of the scarlatinous poison, there has been developed a severe and dangerous anginose inflammation about the third or fourth day; so that it is fair to say that we cannot imagine any malignant case, lasting over the third or fourth day, which is not anginose, nor any severe anginose case, which might not also be styled, from its dangerous character, malignant. We have found it impossible, in our experience, to draw the distinction clearly and indubitably between the anginose and malignant varieties, because all severe cases partake more or less of the features of both.

Feeling this difficulty of describing the disease according to the mode that had before that time been generally followed, and believing it also to be insufficient for practical purposes, we were led to attempt, in the first edition of this work, a different arrangement.

We made, accordingly, two forms or degrees of the disease, which we designated by the terms *regular* and *grave*. In the first form or degree we included all the cases in which the angina was simple and the eruption regular in all respects; in which there was no predominance of one set of symptoms over another, but in which all held a due relation to each other. In this form was embraced all the cases of scarlatina simplex of writers, and many of those of scarlatina anginosa of the English authors. In the second form we included the cases which departed from the regular course of the disease, and which were rendered dangerous by the occurrence of severe symptoms not belonging in the same degree to the simple affection. This form we subdivided into two varieties, the *grave anginose*, which contained all the cases accompanied by pseudo-membranous, ulcerative, or gangrenous angina; and the *grave cerebral*, which comprised all those marked by the early occurrence of dangerous cerebral symptoms. The grave form comprehended, therefore, some of the cases of scarlatina anginosa, and all those of scarlatina maligna of writers, dividing, however, those in which a pseudo-membranous, ulcerative, or gangrenous angina determined the type of the attack, from those in which the cerebral or nervous symptoms gave to the case its stamp.

More extended observation and more patient reflection have taught us that this division also is incorrect,—that it does not afford a good classification for the purposes of description, and that it is defective as a guide in practice.

We adopted, therefore, in the third edition, and shall follow in the present one, a different method of considering the disease, one which we believe to be more consistent with its nature, more suitable for the purpose of description, and much more likely to prove useful in practice. We shall follow the same arrangement in regard to scarlet fever as that now generally employed for typhoid fever. We shall consider it as a single and distinct disease, and not as made up of a number of uncertain

and imperfectly separated forms or varieties, since these so run into each other, as to make it absolutely impossible to draw the line clearly and palpably between them. The only division we shall make will be into *mild* and *grave* cases, since the only real difference between the cases is a difference in the degree of severity they exhibit.

CAUSES.—It has been abundantly proved by long and reiterated observation that scarlatina is propagated by two causes, *contagion*, and *epidemic* influence. Of these two modes of propagation, we have not the least doubt ourselves that the latter is by far the most active. It is only necessary to look over the results afforded by the tables of mortality for this city, as quoted in the early part of this article, and to observe that in some years the disease caused a heavy mortality, in others a very small one, and that in others again not a single death from it is reported, to be convinced that it is of a highly *epidemic* nature.

The *contagious* character of scarlatina has been doubted by some few persons, but seems to us clearly proved by the evidence adduced by various writers. Our own experience also convinces us that it is a contagious disease, though much less so, we are sure, than either small-pox, measles, hooping-cough, or chicken-pox. We have quite frequently, indeed, known children exposed directly and for a considerable length of time to the infection to escape entirely, while it is extremely rare for us to meet with children, unprotected by previous attacks, who can resist the contagion of measles, hooping-cough, or varicella. But, though we believe it to be much less highly contagious than has been generally supposed, and than the other contagious diseases just named, we are also well convinced, as was stated above, that it is propagated to a considerable extent by a direct contagion. We have, in a number of instances, known one child in a family to contract the disease from direct exposure to it, or from the epidemic constitution of the atmosphere, and a second, third, and even a fourth, to take the disease from the first, in five, seven, or nine days after the latter had fallen sick. In other instances, on the contrary, it would seem that either several children in one family contract the disease nearly simultaneously from the epidemic influence, or else that the period of incubation is sometimes very short. For example, during the winter season, a child five months old, who had never been out of the house, was seized with it. On the second day after the eruption appeared on this child, her sister, between four and five years old, fell sick, and on the third day another sister, the only remaining child, between two and three years of age. In the first of these cases it must have been contracted through the epidemic influence which was at that time prevalent in the city, since the child had in no way been directly exposed to it. In the other two, we must either suppose the cause to have been the same, or else that the period of incubation was only two and three days in the respective cases.

The period of incubation is shorter than in other contagious eruptive diseases. It may be stated to vary between twenty-four hours and two or three weeks. MM. Guersant and Blache are of opinion that in the majority of cases, it is from three to seven days. MM. Rilliet and Barthez

found that of 38 cases in which the time was recorded, it was between 2 and 7 days in 16, between 8 and 13 in 15, and 15 and 40 in 8 cases. Our own observation would fix it at from 9 to 15 days in the majority of cases.

Occasionally, however, it is very short; thus Trousseau mentions a case in which the evidence is almost conclusive that the period of incubation was less than twenty-four hours. Murchison also states that this latent period varies from a few minutes to five days, rarely, if ever, exceeding six days.

It is impossible to state with any certainty the length of time during which the power of imparting the contagion continues in the patient. M. Cazenave (*Abrégé Prat. des Mal. de la Peau*, p. 54), states that it lasts throughout the period of desquamation, and that it would even seem to be most active at that time.

Whatever may be the duration of this period, it is certain that the virus may attach itself to clothing, bedding, or furniture, and that the disease may thus be transmitted by one who is not himself attacked. We also learn from some remarkable instances, as for example, from a case related by Richardson in "*The Asclepiad*," that when the virus is thus attached to fomites, it may retain its activity for many months.

In regard to the essential nature of the poison, it appears probable, in the first place, that it is contained in the secretions of the skin and fauces.

The distance to which it may be carried by the air does not appear to exceed a few feet, and in those cases where prompt isolation does not prevent the communication of the disease, the virus has either been previously imbibed or is carried by fomites. It is probably of material nature, and is admitted to the system either through the skin, the respiratory, or, perhaps, the gastric mucous membrane.

As we have seen, it retains its activity for a long time; but is rendered inert by a temperature somewhat below 212° F.

Scarlatina is stated to be also inoculable, by the blood, the secretion from the fauces, and the fluid from the miliary vesicles which occasionally form on the skin. The resulting disease appears in some instances to have been favorably modified, but the operation has been comparatively rarely practiced.

The epidemics of scarlet fever vary exceedingly in their extent and violence. During the years 1842 and 1843, the disease prevailed very extensively in this city, and assumed a malignant type, so that in a considerable number of families, two, three, and even four children, died within a very short period.

During the winter of 1856–7, and throughout the spring of 1857, we had one of the most prevalent epidemics that ever visited this city, and yet the proportion of deaths to the whole number of cases in our own practice and that of our friends, was such as to seem to show that the type of the epidemic was mild.

The disease prevails at all seasons, but is most frequent in the spring and summer, and next in the autumn. It rarely occurs more than once in the same individual, but that it does so sometimes, is proved by facts brought forward by different authors. It has been asserted that second

attacks of scarlet fever occur in the same person not more than once in a thousand cases. Of the truth of this assertion we are, however, very doubtful, since it has occurred to us to see no less than three examples of second attacks in our own experience. We attended in this city one child with perfectly well-marked scarlet fever, attested by subsequent anasarca, who had had the disease two years previously under the care of the late Prof. C. D. Meigs. In the winter of 1852, we attended two children in one family with the disease, one of whom died, and both of whom had had the disease four years and a half before. They were attended in the first attack by one of ourselves, and as it chanced, owing to our absence from town during one day, they were seen also by one of our friends, who made no exception whatever to the diagnosis of scarlet fever. The only doubt as to these cases having been veritable examples of double attacks of the disease, must rest of course upon the diagnosis. In the first example, the diagnosis was made by Prof. Meigs in the first attack, and by one of ourselves in the second. In the two latter it was made by one of ourselves in both, accidentally confirmed in the first attack, in both children, by the opinion of a competent professional friend. The first attacks in the latter cases were both mild, but well marked; the second were both severe, and one proved fatal on the sixth day. We have not the least doubt ourselves that all of the three were cases of true scarlet fever. If they were not, the two latter must have been cases of roseola, so closely resembling scarlatina as to oblige us to confess ourselves incompetent to distinguish between the two diseases. What adds to the certainty that the two which came under our own observation were examples of scarlet fever, is the fact that they occurred simultaneously with a third case in the same family. Now, roseola is not apt, so far as we know, to occur epidemically in a household. Most of the cases of that disease that we have seen, have been solitary ones. Again, in the spring of 1857, one of us saw a well-marked attack of the disease in a boy nearly four years old, who had had it one year before, under the charge of a perfectly competent practitioner.

Dr. Richardson (*loc. cit.*) asserts that he has known the disease to occur twice in the same patient, and also states that he himself has suffered from it three times.

Age.—MM. Rilliet and Barthez state that it is most common from six to ten years of age. Of 251 cases that we have seen, in which the age was noted, 64 occurred under 3 years of age, 78 between 3 and 5 years, 51 between 5 and 7, 47 between 7 and 10, and 11 between 10 and 15. From this it would appear to be more common in the first five years than between the ages of five and ten, since of the 251 cases, 142 occurred in the former, and only 98 in the latter period. By uniting the statistical tables of Dr. Emerson with those of Dr. Condie (*Dis. of Child.*, 2d ed., note, p. 86), we obtain the deaths from scarlatina in this city at different ages for a period of thirty years. These tables show clearly that the disease is most common between the ages of one and five years. The total mortality from scarlatina under ten years, during the time stated, was 2171, of which 132 were under one year of age, 411 between 1 and 2, 1130 between 2 and 5, and 510 between 5 and 10.

Of 148,829 cases collected by Dr. Murchison from the death returns of Great Britain, 9999, or about 7 per cent., were under 1 year; 30,974, or 20 per cent., under 2 years; 95,070, or 64 per cent., under 5 years; 38,591, or 26 per cent., between 5 and 10; and but 13,168, or about 9 per cent., at all ages above 10.

This agrees quite closely with the averages calculated from the extensive statistics collected by Dr. Richardson, which show the following percentage at different ages:

Under 5 years,	67.63
From 5 to 10,	24.33
" 10 to 20,	5.52
" 20 to 40,	1.73
" 40 upwards,	0.66

Out of 12,962 deaths under 5 years, 1289, or 9.9 per cent., were under 1 year; 2874, or 22 per cent., between 1 and 2; so that 4163, or 31.4 per cent., were under 2 years.

The earliest age at which we have seen it perfectly well marked, was twenty-one days. We saw it once also in a child five months of age, and twice at the age of six months. It is not nearly so common in the first year of life as it is afterwards. The largest number of cases occur, according to our experience, in the third, fourth, and fifth years of life.

The influence of *sex* seems not to have been determined with certainty. Dr. Tweedie (*Cyclop. of Prac. Med.*, art. Scarlatina), says it is most common in girls. MM. Rilliet and Barthez, on the contrary, state it to be more common in boys. Of 262 cases under 15 years of age that we have seen, in which the sex was noted, 133 occurred in males, and 129 in females. The truth is, probably, that under puberty it attacks the two sexes with about equal frequency, while after that age it is most common in females.

It occasionally happens, that patients, both adults and children, who have undergone surgical operations, are attacked with a scarlatinous rash, with mild constitutional symptoms (Hillier, Gee). The disease, according to these authorities, is true scarlatina; and its occurrence at that time probably depends upon the system being in an unusually favorable condition for the reception of the virus.

Symptoms; Course; Duration.—As has already been stated, we intend, in our description of the symptoms of scarlet fever, to depart from the ordinary mode of arrangement of the subject. We shall discard the old division of the disease into three forms or degrees, scarlatina simplex, anginosa, and maligna, and substitute, for reasons already given, the simple division into mild and grave cases. We shall class as mild cases those which pursue an even and regular course, without being accompanied by dangerous or malignant symptoms, in which there occur neither violent nervous, nor threatening anginose symptoms; while among the grave cases we shall place those in which there occur severe nervous symptoms, in the form of violent delirium, coma, or convulsions, dangerous symptoms in the form of diphtheritic, ulcerative, or gangrenous inflammation of the mucous

membrane of the fauces, and finally, those in which the general symptoms assume a low and typhoid character. When it seems convenient, we shall follow the usual division of the course of the disease into the three stages of invasion, eruption, and desquamation.

Mild Cases.—Stage of Invasion.—The following description of the symptoms of scarlet fever in its mild form is drawn partly from books, but much more from our own observation of several hundred mild cases of the disease, of 213 of which we have kept a faithful record, and, when there was anything peculiar or important, full notes.

The onset of mild cases of scarlet fever is generally sudden. A child is well, or so slightly ailing on one day, as that the change from its usual condition is not noticed at the time, though it may be recollected afterwards, and on the following day, or often within twelve hours or even less, the symptoms of the disease become marked and characteristic. In a large majority of the cases that we have seen, the eruption was already visible at our first visit. Frequently the patient has been put to bed well in the evening, and, becoming restless and feverish in the night, is found on the following morning with fever, sore throat, and very considerable eruption; or, as happened in one of our cases, a child gets up in the morning apparently well, breakfasts as usual, goes to church, and falling sick while there, comes home and, a few hours later, shows the eruption over the neck and upper part of the trunk, and has fever and sore throat. In another case, a boy between seven and eight years old was perfectly well in the morning. At 2 P.M., his mother, a most sensible and accurate person, observed him playing in the garden, and remarked upon his healthy looks. Fifteen minutes after this he felt sick at his stomach; he came into the house and went up to the nursery, looking pale and pinched, with a cold skin, and nearly fainted in the nurse's arms. He had then in the course of an hour three copious and watery stools, each one accompanied with vomiting. We saw him one hour after this, dozing, very pale, with pinched features, sunken and half-closed eyes, cool surface, and with the pulse at 128, and rather feeble. There was no eruption. At 6 P.M., we found him with a hot and dry skin, with the tongue heavily coated, the fauces swollen and showing flecks of exudation upon the tonsils, a pulse at 128, and with a well-marked scarlatinous eruption coming out abundantly. The case pursued a very regular course, without dangerous or malignant symptoms of any kind.

But the invasion, though sudden in nearly all cases, is not always so precipitate as we have just described. When we come to analyze the early symptoms, we find that the first one observed in most of the cases is fever, marked by considerable acceleration of the pulse and heat of skin. In some few cases the fever is preceded by the ordinary prodromes of febrile diseases, languor, lassitude, pains in the back and limbs, and slight rigors. Simultaneously with the fever there is in nearly all cases more or less soreness of the throat. In all that we have examined, even those in which no pain was complained of, there has been redness, or redness with swelling of the fauces. In a majority of the cases vomiting occurs, or if not vomiting, some degree of nausea. There is complete anorexia; the thirst is

acute; the bowels are usually in their natural condition, or slightly constipated. The child is quiet and dull, or else restless and irritable, and sometimes there is delirium; the face is generally flushed, and the eyes often slightly injected. The duration of these symptoms is irregular. They are said to last generally about a day, but they may continue either a shorter or longer period. We are very sure, from our own observation, as we have already stated, that these preparatory symptoms rarely precede the eruption more than twelve hours, and very often the time is even less, so that the eruption may even be the first symptom noticed.

Stage of Eruption.—The eruption generally appears first on the face and neck, whence it extends rapidly over the whole surface. It continues to increase in extent and intensity, so as to reach its maximum about the third or fourth day. It appears first in minute dark-red points dotted upon a rose-colored surface, forming patches of irregular shape, of considerable size, level with the skin, disappearing under pressure, divided at first by portions of healthy skin, but running rapidly together, and giving to large portions of the surface a uniform scarlet color. The eruption is not generally equally diffused over the whole body, but is more marked upon one portion than another. It is often most intense on the back, and is there of a deeper color than elsewhere, not unfrequently assuming a purple hue. It is generally very well marked on the abdomen and thighs, and about the articulations, and assumes in those regions a particularly bright tint.

It does not always cover the whole surface, but in some very mild cases, and, as we shall find when treating of the grave cases, in these latter, also, it may occur only in patches of moderate extent upon different portions of the body, leaving us at times in some doubt as to the real nature of the rash.

The surface of the eruption is smooth and even to the touch, unless, as not unfrequently happens, it is accompanied by the development of miliary vesicles, or crops of minute pimples or pustules. A certain degree of roughness is sometimes occasioned also by enlargement of the papillæ of the skin in various parts of the body, particularly on the extensor surface of the limbs; but these are evidently independent of the characteristic eruption. The skin upon some parts of the body, especially the face, hands, and feet, often presents a swollen appearance, rendering the movements somewhat stiff. There is in most cases a feeling of burning, irritation, and itching in the skin, the latter of which symptoms increases as the malady progresses.

If the nail be drawn firmly over the skin where the eruption exists, a white line is produced, which lasts for a short time and then passes away; if the pressure be more firm, a central red line with a white streak on either side is developed. This was originally pointed out by Bouchut as pathognomonic of scarlatina, the peculiarity, according to him, consisting in the great duration of the white line so caused. It does not appear, however, to have any positive value in distinguishing this affection from many forms of erythema.

The eruption generally reaches its height about the fourth day, and

then remains stationary for one, or less frequently two days, after which it begins to decline. Its decline is marked by a diminution in the intensity of the color, which, from scarlet, becomes red, then rose-colored, and growing paler and paler, finally disappears entirely about the sixth, seventh, or eighth day. In some very mild cases, however, the whole duration of the eruption is not over two or three days, and in such the color it imparts to the skin is never very bright nor very deep, nor is it accompanied by intense heat, or by much irritation or itching.

The symptoms which preceded the eruption do not subside on its appearance, but persist or are augmented. The febrile movement continues unabated; the pulse is full, strong, and frequent, running up very soon after the onset to 120, 140, 150, and often to 160. This frequency of the pulse is, in fact, one of the most marked symptoms of the disease. We have rarely, even in very mild cases, found it less than 140, and in not a few it has been in the first few days, and in children of four or six years old, even as high as 168 or 170. Occasionally, however, it has been lower, and in a case that occurred to one of us, in a boy five years old, it was 96 on the second day, and only 88 on the third, though there was still a good deal of rash upon the skin. The skin is burning hot and dry, as a general rule, and loses its usual softness and suppleness. The expression of the face is usually natural. The eye is often animated, and slightly injected. The respiration is generally easy and natural, though sometimes, when the fever is violent, it becomes quickened. The auscultation and percussion signs are natural, unless some complication exists. There is often a rather frequent cough, which is dry, and evidently depends on the guttural inflammation, and not on any bronchial or pulmonary affection; it exists during the early period of the eruption, and declines with the inflammation of the fauces. The voice is seldom altered beyond having a nasal sound, so long as the disease continues simple and regular. If the voice becomes hoarse or whispering, it indicates an extension of the inflammation from the pharynx to the larynx. The anorexia continues until the eruption begins to decline, and the thirst is acute up to the same period, when it moderates. At first the dorsum of the tongue is covered with a whitish or yellowish-white fur of variable thickness, while its tip and edges are of a deep red color. After two or three days, and during the course of the eruption, the coating just described disappears from the tongue, and its whole surface assumes a deep red tint and a shining appearance, which makes it look like raw flesh. At the same time it is often much diminished in size from contraction of its tissues, and its papillæ become enlarged and projecting; this condition generally lasts from six to ten days, after which it returns to its natural state; it is commonly moist throughout the attack. Vomiting is rarely troublesome in mild cases, though it often occurs; the bowels continue nearly in their natural condition; in some few cases slight diarrhœa occurs, but more frequently there is very moderate constipation. The abdomen is natural in most of the cases; sometimes, however, there is slight distension and pain for a few days, which coincide generally with enlargement of the liver, or more rarely of the spleen.

The urine during this stage usually presents the ordinary febrile characters; it is diminished in quantity, often of high color, though the pigment is not necessarily increased. The urea is not increased, which Ringer regards as indicating that the kidneys are affected from the beginning of the attack. The chlorides are always more or less diminished. The phosphoric acid, according to Dr. Gee, is about normal for the first three or four days; it then diminishes, and remains for a few days at a half or a third of its normal amount. Uric acid appears to be retained during the pyrexia, and excreted in excess so soon as it begins to subside. According to Holder's examination of 17 cases, there is bile pigment present during the first six days.

Early in the second, or even in the first stage, the fauces present the signs of inflammatory action; the pharynx is reddened, and in some instances swelled; the tonsils enlarge and become red; the submaxillary and lymphatic glands are somewhat tumefied and tender to the touch, and when the case is at all severe, deglutition is generally painful, and in some instances extremely so. The absence of complaints of sore throat in a child, or the fact of its swallowing without hesitation or apparent difficulty, is no proof that angina does not exist, since we have always found upon examination in a good light much greater redness than natural, and in many instances redness and swelling combined. As the eruption progresses, and the tongue loses its coat and becomes red, the inflammation of the pharynx usually augments; the redness becomes deeper, and the tonsils are more swelled and painful, and, in a good many, but not by any means all the cases, are dotted over with small white spots, or with thin, whitish, and soft false membranes. The throat-affection, however, is rarely severe enough to constitute a serious danger in mild scarlatina, while in many of the malignant cases it is a frequent cause of a fatal termination. During the eruption, the nostrils are either dry and incrusted, or there is some coryza. The strength of the child is reduced for the time, but there are no signs of prostration, and the decubitus is indifferent. There is almost always more or less disorder of the nervous system, sometimes amounting only to headache and restlessness, while in other instances there is great irritability, wakefulness, and occasional delirium, especially at night.

Stage of Decline and Desquamation.—The eruption reaches its height, as already stated, about the third or fourth day, then remains stationary for one or two days, and afterwards declines gradually, so that no traces are left on the sixth, usually, or at most, in rare cases, on the ninth or tenth day. In some very mild attacks, the whole duration of the eruption is not over two or three days. By the third day it has disappeared entirely. Such cases are not, however, very common. The other symptoms, both general and local, decline with the eruption: the pulse loses its frequency, and falls to the natural standard; the heat of the surface first subsides and then disappears, but the skin remains somewhat harsh; the redness and swelling of the tonsils and pharynx diminish; the spots of false membrane, if these be present, are thrown off; the deglutition becomes easy if it have been difficult, and soon all signs of throat-affection vanish; the tongue

cleans off, becomes reddish and glossy, and after a time returns to its natural state.

At the time that the subsidence of all the symptoms takes place, *desquamation* begins. It dates, therefore, in most cases from about the sixth day, though it may be either earlier or later. According to Hiller, the date of commencement varies from the sixth to the twenty-fifth day. It commences in most of the cases on the face and neck, though in a few instances it appears first on the abdomen. It then extends gradually over the body and becomes general. About the thorax and abdomen it occurs in the form of minute points, like those which result from the desiccation of sudamina; on the face it is in the form of thin light scales or squamæ, while on the extremities large flakes of the epidermis become separated from the derm, and are removed by the child, or rubbed off by his movements in bed. The whole process usually occupies some ten or twelve days, but may be prolonged into the third week, or even until the middle of the second month. It is generally accompanied by roughness and dryness, and some itching and irritation of the skin. Not unfrequently, the surface beneath the exfoliation is left tender and irritable for some time afterwards.

During this period, dating from the sixth or eighth day, the urine becomes abundant, pale, of neutral or faintly acid reaction, and, according to Gee, deficient in phosphoric acid.

Albuminuria is also frequently observed during desquamation, very much more so than during the eruptive stage. It is usually transient, but may continue until dropsy occurs. Sometimes the albumen totally disappears, and reappears when dropsy comes on a fortnight or three weeks later. The proportion of cases in which this form of albuminuria is present varies in different epidemics, from twenty-five or thirty to ninety per cent.

Temperature.—The fiery redness of the surface and the pungent character of the heat, have led to much exaggeration in the description of the pyrexia in this disease. The range of temperature is indeed from 100° to 105°, and only in rare cases does it reach 106°.

In 30 cases reported by Ringer (*Med. Times and Gaz.*, Feb. 15th, 1862), the temperature remained at the same point throughout the day in the more severe attacks; in slighter ones, it fell in the morning and rose during the day, being most frequently at its highest point between 2 and 8 P.M. When the morning remission was marked, it indicated the approach of a favorable termination. The first decided fall of temperature, coinciding with a diminution in the eruption, occurred in the majority of cases on the fifth day, or if not on this day, it usually was deferred until the tenth or fifteenth. In these latter cases, however, a fall of varying extent had occurred on the preceding fifth days. After the marked fall on the fifth, tenth, or fifteenth day, the temperature remains from 99° to 101° for a variable time, coinciding when persistent with continuance of the angina, or some of the other lesions of the disease. If at any time after the complete fall of the temperature, there is any considerable elevation again, it indicates the development of some sequel, either an affection of the kidneys,

throat, or one of the serous membranes. It is thus seen that the temperature in scarlatina tends to form arcs or cycles, usually of five days' duration.

Before quitting this part of our subject, we must remark that, though the above is a correct description of the usual symptoms of mild cases of this disease, the reader would be greatly deceived should he expect always, and invariably, to find this exact train of morbid phenomena. On the contrary, the mild and the grave cases both vary so much, that it is impossible to describe them accurately by one or two portraits. Taking the above sketch as a standard of the mild cases, the observer will find that many fall short of it in all their features, while others deepen gradually in their shades, so to speak, until they pass into the grave type. Those that are milder in their type than the above sketch, may be so in such a degree as to make it very difficult, and in some cases impossible, to determine positively whether the child has had the disease or not. Indeed, we doubt not ourselves that children sometimes have the disease so slightly, that it is not discovered by either the physician or parents, and, being protected by the attack, are in after-life classed amongst those insusceptible to the disease. Our grounds for asserting this are the facts that some cases we have seen have been so very mild that, but for the existence of the disease amongst other members of the family, they might have passed unobserved; and that in one instance we were sent for to see a patient, who had had the eruption for three days, and yet who was so slightly sick that he was sent for from school, to which he had gone, for us to see. It was a well-marked case, and the child had no troublesome symptoms afterwards, notwithstanding the exposure he had undergone.

A still more remarkable case occurred to one of us two years since, which shows clearly how a child may take scarlet fever without its being recognized by the family.

Case.—The mother of one of the families we attend consulted us about one of her sons, a sturdy boy of seventeen years of age. She stated that he had not been well for two days; that he had a severe sore throat, was restless and feverish at night, could eat nothing, and complained of debility, but, as he was then going through his examination at the High School of this city, he refused obstinately to remain at home. It was agreed that he should call at our office the next morning, on his way to the school. When he arrived, which he did on foot, as usual, we found him covered with a copious, dark-red, perfectly characteristic scarlatinous eruption; his throat was very red, swollen, and quite painful; the pulse was over 120, active and full, and the skin hot. He was, of course, ordered home, there to remain until perfectly well. He recovered and had no drawback. The distance from this boy's home to his school was not less than a mile and a half, and he had walked this distance twice a day.

Grave cases.—The following description of the symptoms of grave cases of scarlet fever is, like that which has just been given of the mild cases, drawn partly from books, and partly from our own observation of the disease. We have had the opportunity of carefully observing a very large number of grave cases of scarlatina, but we find that we have preserved a more or less complete record of but 61 such cases. We shall include under this division of the subject, as already stated, most of the

cases usually classed by writers under the title of scarlatina anginosa, and all those generally described under the title of scarlatina maligna.

The symptoms which mark the *invasion* of grave cases of scarlet fever, though sufficiently alike in all to show the unity of the disease, differ very materially as to their degree of severity in different cases. In one set (rather less than a third, or 18 in 61, of our cases) they are most violent and dangerous, or, indeed, appalling in their character. From the first, they declare the imminent danger of the attack. In the second set (rather more than two-thirds, or 43 in 61, of our cases), they may be either evidently severe and dangerous, though not appalling, as in the first, or they may be much milder, more like those which mark the invasion of mild cases; but even under these circumstances they soon put on their grave and dangerous character.

The first set of cases, or those in which the symptoms are the most severe of all, and which include most of the malignant cases ordinarily styled ataxic, usually begin with nervous symptoms. The onset is in some instantaneous. In one, the little patient, a girl two years old, whose brother and sister had been sick for some days with scarlatina, was put to bed in the evening in her usual health, which was strong and vigorous. She slept quietly through the night, but was found by the mother the next morning in a state of drowsiness, violent fever, and covered with a deep-red scarlatinous rash. She soon became comatose, and died on the third day. In another case, a boy eleven months old was a little fretful in the afternoon, but was put to bed in the evening as usual and went to sleep. About ten o'clock the nurse heard a rustling in the bed, and on going to it found him in a violent general convulsion. The next morning he was covered with a scarlet rash, which became deeper and deeper as the disease went on. On the second day he was nearly insensible, and had frequent attacks of convulsions; on the third day he had retraction of the neck, with spasmodic twitchings, and at the end of that day died in a state of coma. In a third case, a boy six years old, whose sister had been sick for a week with a mild attack, went to bed well. At three o'clock in the morning, he was seized with vomiting and purging, paleness and coolness of the skin, and great exhaustion. At nine o'olock he was drowsy and dull, the skin was pale and cool, and the pulse extremely rapid; the vomiting and purging had ceased; at 12 M. he was comatose and had a convulsion. From this time he continued comatose until he died at 6 P.M. of the same day, after an illness of fifteen hours. In a fourth instance, the invasion was that of croup; after a few hours came on coma and convulsions; patches of eruption then appeared on the trunk, and death occurred in twenty-four hours from the beginning. The subject of this case, a boy five years old, was thought to be so well in the afternoon of the day he was taken sick, that he had been sent out to visit a relation, and while there fell sick. In the fifth case the onset was sudden, with violent fever, drowsiness, deep suffusion of the skin, and in a few hours insensibility, general convulsions, and death in thirty-six hours. In a sixth, in a boy four years old, the attack came on with vomiting, paleness, drowsiness, and then a scarlet rash; after a few days, coryza and otorrhœa occurred;

the tongue and lips became cracked and dry; in the second week the child was comatose, with occasional attacks of extreme jactitation, and the most violent hydrocephalic cries, which condition lasted ten days. After this there was diarrhœa, extreme emaciation, loss of speech, and entire deafness. Gradually, however, the fever disappeared, the tongue cleaned off, and intelligence very slowly returned; in the sixth week convalescence was firmly established, and the child recovered perfectly with the exception of his hearing, which remained very dull in consequence of the perforation of both membranæ tympanorum. In a seventh, a girl eight years old, whose brother was then sick in the house with the disease, was in the morning well. At breakfast, she said she felt sick and soon went to bed. At 5 P.M. of that day she was attacked with a general convulsion, which lasted about fifteen minutes. The pulse, immediately after the convulsion, was 150. At 11 P.M. she had another convulsion. Through that night she was very restless and wandering. On the morning of the second day there was a third convulsion, which, however, was very short. The pulse was now 160, small, and feeble. The patient was very heavy and dull, answering questions slowly and with great difficulty, and during part of the day she was comatose. On the third day she was better, the pulse having fallen to 152, and she was less dull, though she still continued very heavy and inattentive unless aroused by persevering efforts. The limbs were cool, while the head and trunk were hot. The eruption was thick on the trunk and upper part of the extremities; elsewhere it was scanty. Wherever it existed, it was of a deep red or purplish color, and the capillary circulation was sluggish and imperfect. On the fourth day her intellectual condition continued better, but the extremities were still cold, and the lymphatic glands and subcutaneous tissues about the lower jaw and neck had begun to swell. On the fifth day, the swelling had become very great; the stupor had returned; a profuse and disgusting coryza and otorrhœa had set in; and the edges of the eyelids were inflamed and sore. On the sixth day the discharges from the mucous membranes of the head were very copious, and consisted of a thick, offensive, purulent fluid intermixed with dull whitish grumous particles. The patient was now comatose or very restless; she swallowed with great difficulty; the swelling under the lower jaw and about the throat was enormous; the pulse was rapid and small; the eruption was very dark in tint; the cutaneous circulation was slow; the extremities were cold, and death occurred about the middle of this day. In another case, the subject of which was a girl between three and four years old, the attack began with severe inflammation of the throat, causing great difficulty in swallowing. The rash on the first day was very extensive and of a deep-red color. The child was drowsy and heavy, or else delirious. On the second day she was comatose, and had strabismus and automatic movements of the limbs. On the third day the coma continued, and there were automatic movements of the extensor muscles, with retraction of the head. The eruption continued vivid, but was of a dark-red color. Death occurred in the middle of the fourth day, in a state of coma, without convulsions. In still another case, a boy, between eight and nine years old, was at-

tacked suddenly, while in good health, with vomiting, sore throat, and high fever. Twelve hours after the onset, he had a severe convulsion, which lasted fifteen minutes. He soon recovered from this, however, and remained perfectly intelligent. On the second day the rash was moderate; there was violent fever, and the child was heavy, but, when roused, still intelligent. Early in this day a severe fit occurred. This was most violent, as severe as the worst epileptic convulsion. It lasted one hour and three-quarters. The pulse, after this, was 145. On the third and fourth days, the symptoms improved very much, the pulse having fallen to 125 and 132, but he continued drowsy and heavy. The eruption came out most abundantly. The fauces were very much inflamed, and somewhat ulcerated, and the external lymphatic glands were enlarged, but still the swallowing was not difficult. On the fifth he was not so well, being more restless and heavy alternately. There had now come on much difficulty in breathing, and some croupal sound. The latter symptom increased through the day, until the dyspnœa became very great. Deglutition now became excessively difficult; the external swelling increased; attacks of suffocation attended with the most painful and distressing jactitation came on, and were renewed more and more frequently; and death occurred by asphyxia about the middle of the sixth day. In a tenth case, in a girl five months old, convulsions occurred on the second day. These were followed by coma lasting several days, and by enormous swelling of the lymphatic glands and subcutaneous tissues on the left side of the neck, and by a less degree of swelling on the right side of the neck. The glands of both sides suppurated and were opened, and the child finally recovered perfectly. In an eleventh case, in a boy seven years old, an attack of general convulsions took place on the third day, after which there were delirium and coma alternately for several days, with coryza, angina, and offensive otorrhœa, lasting in all six weeks. The child recovered, but remained deaf.

In this form of the disease, therefore, the symptoms are of the most virulent character. The onset is sudden. The child passes within a few hours from a state of apparent health, into one of the extremest danger. Most of the cases begin with violent fever, and great depression of the strength. The pulse soon becomes very rapid (140, 150, 180), or so frequent that it cannot be counted, and it is at the same time small and often irregular. The skin is dry and burning hot in some parts, in others cool or even cold. There is generally nausea or vomiting, and these may be violent and constant. These are accompanied in some cases, but in our experience, only in the severest of all, by colliquative diarrhœa and meteorism. Delirium often exists from the first, or else there is drowsiness and dulness of intelligence, verging gradually in coma. In the most violent cases, the stupor or coma alternate with convulsions, which may cause a fatal termination in eighteen, twenty-four, or thirty-six hours.

When a case of this kind lasts over three, or even two days, the violence of the nervous symptoms almost always subsides; the convulsions cease to recur; the delirium is less violent; the coma gives way to drowsiness, or the patient becomes again quite intelligent and observant; the

pulse often falls in frequency, and the heat of skin may diminish, and the eruption assume a more favorable appearance. All the symptoms seem, indeed, to be more promising, and very often both the physician and friends are greatly elated by the improvement in the patient's condition. Nor are these hopes always illusory, since children do recover occasionally even in cases that have exhibited the most threatening and malignant appearance at the moment of invasion. It happens, unfortunately, however, in a majority of such attacks, that the improvement which takes place on the third or fourth day is only momentary. The nervous symptoms subside, but new phenomena make their appearance in the shape of severe inflammation, membranous deposit, and perhaps ulceration of the fauces, and extensive swelling and induration of the lymphatic glands and subcutaneous tissues about the angles of the inferior jaw, and under the chin and throat. In connection with the throat-affection which develops itself in this way, it is very common to have abundant purulent or membranous coryza, and often also otorrhœa. The symptoms assume, in fact, the features of the cases usually described under the title of scarlatina anginosa. As we shall, however, describe them directly in our account of the second set of grave cases, it is unnecessary to pursue the description at the present moment. We will state, however, before proceeding further, that the anginose and general symptoms which occur in cases beginning with violent nervous phenomena, and especially with convulsions, are nearly always of the most dangerous and malignant character, and usually end fatally in two, three, or four days after their appearance.

The eruption in this class of cases varies according to the violence of the attack. In the severest one that we saw, that which proved fatal in fifteen hours, no eruption whatever was perceived, and we only knew it to be scarlatina by the character of the other symptoms, and by the fact that the sister of the boy had been sick in the same house with the disease for a week. In the case which terminated in twenty-four hours, the eruption showed itself in the form of scarlet patches about the face and upper parts of the body, twelve hours after the onset. In a third case the eruption was moderate, but perfectly well marked and general. In the other thirteen cases, which lasted, with one exception, not less than three days, the eruption was perfectly well marked. It covered the whole surface, was at first scarlet in color, soon ran into a deep red, and then became violet or purplish. The exceptional case was one which lasted thirty-six hours, and proved fatal in that time. In this also, the eruption was well marked and extensive. M. Gueretin (*Arch. de Méd.*, t. i, p. 292, 1842), in his account of the acute malignant form which he witnessed, states that the eruption was nearly constant. In all our cases it occurred within twenty-four hours from the invasion, while in those of M. Gueretin, it appeared within twenty-four or forty-eight hours, or, as more frequently happened, not until the fourth or fifth day.

If no favorable change takes place in these severe cases, and when they do not prove fatal at once, the patient grows weaker and weaker; the delirium continues, or is replaced by coma; subsultus tendinum, rigidity of the limbs, spasmodic twitchings or general convulsions, make their appear-

ance; the eruption becomes more and more livid; the pulse grows smaller, more frequent, and irregular; the respiration is excessively embarrassed; deglutition becomes impossible; and the patient dies in from three to seven or nine days. In some few instances, the child struggles on for several weeks, and dies in a state of utter exhaustion, or having a constitution of great powers of endurance, at last surmounts the disease and recovers.

The invasion of grave cases is not always, as we have stated above, so violent as in those which have just been described. In rather more than two-thirds (43) of the 61 grave case of which we have preserved notes, the onset was less threatening than in the other third, though the symptoms were severe and dangerous in most of these also, and when not so at the very start, very soon assumed the serious characters which make it necessary to class the cases in which they occurred as grave. The chief difference between the symptoms that mark the onset of grave cases of this kind, and of those in which the symptoms are still more violent, which latter we have thus far been describing, lies in the character of the nervous phenomena—in the latter most severe, threatening, and dangerous, consisting of stupor, coma, or convulsions, and in the former, merely excessive agitation, restlessness, heaviness, or stupor. In one well-marked case of the kind now under consideration, the patient, a boy between seven and eight years old, was attacked in the evening with headache, fever, and vomiting. On the following morning a faint rash was perceptible, which, by the afternoon of that day, was distinct, though not very full. The case now rapidly assumed unpleasant features. The pulse rose to 150. There was much drowsiness and delirium, and on the fourth day constant picking at the bed-clothes and at the fingers. In another case, in a boy between four and five years old, the first sign of sickness was slight languor after dinner, which was followed by fever in the evening, and the development in the course of the night of a scarlatinous rash. On the following day, there was some pain in the throat, with redness; the pulse was 140, and the skin hot and dry; there were no nervous symptoms, except slight drowsiness. On the third day the pulse was 136, the rash was well out, and there were no unpleasant symptoms whatever. From this time, however, the symptoms gradually grew worse; the throat-affection increasing, the cervical lymphatic glands becoming very much swelled, and the child growing more uneasy and restless, though retaining perfectly its intelligence. By the sixth day, the grave character of the case was fully developed, the eruption being intense, and of a deep brick-red, verging towards a purple color. There was at the same time very great drowsiness, abundant discharges from the nasal passages of thick sero-mucous and purulent fluids, membranous exudation in the fauces, with gurgling and great difficulty in swallowing, and an utter loss of appetite. In a third case, a boy between one and two years old was a little fretful in the morning, and was seized in the evening with vomiting and fever, and very considerable restlessness. On the next day he was covered with a scarlet rash from head to foot, and the skin was fiery hot. The pulse was 160, regular, not large. The child was very drowsy, dozing nearly all the time, but quite intelligent when

aroused. The fauces were intensely red and rough, and the tonsils much swelled; there was very little external swelling. On the third day he was still very drowsy, and, when roused, less observant than before, though he still recognized persons. The pulse was 168, small, difficult to count, very hard and corded. The skin, especially that of the limbs, was scarlet, very hot, and dry; the cutaneous capillary circulation was good. After this the symptoms grew rapidly worse; the pulse continued at from 148 to 168 on the fourth and fifth days, and on the sixth rose to 172, at which it stood a few hours before death. On the fourth and fifth days, he was still very heavy and drowsy, and so much so on the former as to take no notice whatever except when moved. On the fifth day, an abundant sero-mucous discharge took place from the nostrils; the cervical lymphatic glands, which had begun to swell before, now increased in size; there was some loud faucial gurgling, and the swallowing became difficult. On the morning of the sixth day, some of the symptoms improved so much as to flatter very greatly some of his attendants, who were unacquainted with the treacherous character of the disease. He roused up from his state of stupor, and noticed several things that were shown him, even taking them into his hand; but the breathing continued bad, the lymphatic glands were swelling rapidly, and had already become very large, so that they formed great projections on either side of the neck. The pulse was 155, and small. In the middle of the day the breathing became difficult, from the internal and external swelling, and from the collection in the fauces of thick and viscid phlegm. The surface had now become pale. The tumefaction about the neck was immense. Down the front of the neck and along its sides to the clavicles, a kind of œdematous swelling of great size had come on, and was rapidly increasing. The pulse was 160, small and feeble. The legs and arms were of a dark, congested tint. Deglutition was excessively difficult. In the evening the pulse was 172, and death took place just before midnight with slight convulsive movements.

The mode of invasion is different, therefore, in different examples of the kind of grave cases now under consideration. In some it is even milder than in any of those that have just been detailed; and it is not until the third, fourth, or fifth day, or even later, that the severity of the attack shows itself fully and unmistakably.

After the disease is once established, it will be found upon examination that the fauces are of a deeper red color, and that they are more swelled, than in mild cases. At the same time there is more difficulty and pain in deglutition; these are complained of by older children, and are shown in those who are younger by their refusal to swallow, by their crying upon making the attempt, and in some instances, especially at a later period of the sickness, by a positive inability to perform the movement. In nearly all of these cases, false membrane is formed upon the mucous membrane of the throat. This is never, or very rarely, present on the first day of the attack. In most cases it is not found until the second or third, and often not before the fifth or sixth day. MM. Rilliet and Barthez state that they have known it not to appear until the tenth and eleventh days. It appears first in small, thin, whitish, yellowish, or ash-colored points or

patches, on one or both tonsils, or on the soft palate only, where it remains limited, or from whence it extends to the pharynx, which it may cover in whole or in part. The patches are of variable thickness and consistence, and adhere sometimes very slightly, and sometimes with considerable tenacity to the mucous membrane beneath. They may remain for a day, and then be thrown off not to be again produced; or they may form in several successive crops, until the case is terminated; or, as most frequently happens, they last three or four days or more, and are then detached. The mucous membrane upon which they are seated is found in various conditions. It may present the redness and swelling indicative of severe inflammation, or it may be softened, ulcerated, and, according to MM. Guersant and Blache, gangrenous, though as a general rule, what have been supposed to be sloughs are in fact portions of altered false membrane. There is more or less fetor of the breath, sometimes amounting to a gangrenous odor, after the appearance of the pseudo-membrane. The severity of the symptoms is in proportion to the extent and thickness of the false membrane.

We have already seen that it is not uncommon to find ulcerations beneath the false membranes. In other cases of this kind the throat affection assumes very great violence without the presence of any exudation whatever. In some the mucous membrane is of a deep red or even purplish hue, its consistence is softened, and it is swelled and covered with a layer of grayish or sanious pus. The tonsils are enlarged, infiltrated with pus, softened, and break down easily under the finger. In other cases, in addition to the redness and softening, ulcerations are present. These may be superficial, amounting only to erosions, or they may extend through the mucous, and even submucous tissue to the muscles beneath. They are seated generally in the pharynx, but may exist also on the tonsils, and in some rare cases they extend into the larynx. In still more malignant attacks of the disease, we find evidences of gangrene of the pharynx. It is important to distinguish between those in which the pseudo-membrane becomes so changed as to assume the appearance of sloughs, and those in which the tissues of the pharynx are really gangrenous. The former constitute by far the greater number of the cases which have been generally regarded as instances of gangrene of the throat. That gangrene of these tissues does actually occur in some few cases, is proved, however, by the evidence of Dr. Tweedie, who says (*loc. cit.*, p. 650), that in malignant scarlatina "the membrane of the pharnyx is sometimes of a dark, livid color, and occasionally in a sloughing state," and by that of MM. Guersant and Blache, who state that they met with several instances of gangrene of the pharynx in the pseudo-membranous angina which prevailed in 1841.

An almost constant accompaniment of cases of this kind is inflammation and swelling of the submaxillary lymphatic glands and surrounding cellular tissue. The tumefaction is generally confined at first to the glands beneath the jaw, which become painful to the touch. After a short time it extends to the parts behind the angle of the jaw, and beneath that bone, until at last the sides of the neck and the throat are largely dis-

tended, so as to interfere with, or even prevent in great measure, the opening of the mouth, and by the pressure exerted on the internal parts of the throat, to add to the difficulty of deglutition which already exists. In some cases the pressure is so considerable as to embarrass the respiration of the child. This swelling has been generally supposed to depend on inflammation of the parotid glands; but MM. Bretonneau, Guersant and Blache, and Rilliet and Barthez, all state that parotitis is of exceedingly rare occurrence, and that the swelling in question depends nearly always on the causes just described. The last-named writers state, moreover, that the tumefaction of the cellular tissue is often of the nature of active œdema. The swelling of the cervical lymphatic glands, and of the cellular tissue of the sides of the neck, and that under the throat and chin, seldom takes place to any considerable extent, according to our experience, prior to the third or fourth day. During the first two or three days, the chief symptoms are the fever, the eruption, and the nervous phenomena, which latter consists, in this class of cases, of either excessive agitation and restlessness, or of drowsiness or stupor. Very often, after a child has seemed to be very ill for two, three, or four days, from the violence of the febrile reaction and the severity of the nervous symptoms, it will appear to improve very decidedly on the third or fourth day, and elevate greatly the hopes of those interested in it. It is just at this time, however, that the throat affection is apt to set in severely; and, moreover, it rarely fails to come in children who have presented violent symptoms during the first three days. The enlargement generally disappears, in favorable cases, in from three to twelve days, by resolution, while in others it terminates by suppuration of the glands and surrounding parts.

In the form of the disease we are now considering, it is common to observe violent *coryza*, which may be either purulent or pseudo-membranous. It may appear from the very first, or not for several days after the eruption has commenced. The discharge is yellowish, granular, thin at first, and afterwards thick; it contains often flakes and shreds of exudation, and becomes sometimes very offensive, and highly acrid, so as to excoriate very much the upper lip. It often flows in surprising quantities, and generally continues up to the moment of death, or until all the symptoms have moderated.

Otorrhœa is another symptom of this form. It generally occurs simultaneously with coryza. The discharge is at first thin and watery, like that from the nostrils, but becomes gradually thicker as the case advances. The quantity is extremely variable. In some cases we have known it to fill the meatus and concha of each ear, and then to flow out and make large stains upon the pillow, or to collect very rapidly after being wiped away. It is, like the coryza, an unfavorable symptom, as it is a mark of the grave form of the disease, and because, if the child recovers, it is very apt to result in deafness, which is but too often permanent.

These symptoms, coryza and otorrhœa, sometimes exist also in mild cases, but they do not then assume the peculiar characters which they present in grave cases. The discharges are much less abundant, and the mucus or pus is healthy, and scarcely offensive to the smell; they last but

a short time, and are very rarely accompanied at the time or followed by more than a slight degree of deafness.

The eruption is generally stated to appear later than in mild cases, and often to be less vivid and less extensive. It is also said to occupy only portions and not the whole of the body, to occur in irregular patches, or to appear and disappear alternately. This has not been the case in the instances which we have seen. In all but two of the forty-one, the eruption occurred early, generally within twenty-four hours from the onset. It was of a deep brick-red or livid color, and covered the whole surface. In one of the exceptional cases it did not take place until the seventh day, when it appeared in patches on the wrists and knees. On the eighth day, it extended to the rest of the extremities and abdomen, and on the ninth was general and of a rather dark hue. In the second exceptional case the eruption did not appear until the second day. It then came out over the whole trunk, and to a moderate extent upon the limbs also. In this, as in the previous one, it was dark in its tint. In three other cases it was quite moderate in amount, but general and well-marked.

The *general symptoms* are more severe in grave than in mild cases. It sometimes happens that for one or two days, or even longer, the case promises to be mild, but then suddenly assumes the threatening features of the form under consideration. The fever is usually intense, the pulse being full and strong, and rising very soon after the onset to 140, 150, or 170; the skin is very hot and dry; there is more restlessness and irritability than in the mild form, and after one, two, or three days, appears a strong disposition to delirium and stupor, not unfrequently merging into coma. The respiration is accelerated, and in many instances, owing to the throat-affection, labored and difficult. In most of the cases, a loud gurgling, which is very characteristic, is heard in the throat, particularly when the child is asleep or dozing. This depends in part upon the collection of viscid and tenacious secretions in the fauces,—which sometimes embarrass the respiration so much as to make it necessary to remove them with a mop,—and in part upon the existence of the coryza of which we have spoken. The coryza is a symptom of very serious consequence at all ages, but especially in young children. There is generally some cough, which may be frequent and troublesome, though not usually so unless there be a disposition to laryngeal complication. The voice is hoarse, guttural, and sometimes whispering. When the cough is very frequent, and still more, when it becomes hoarse and croupal, in connection with hoarse or whispering voice, or aphonia, there is great reason to fear the extension of the exudation into the larynx, which constitutes an almost necessarily fatal accident. The face is deeply flushed at first, and the expression anxious. If no improvement take place, the case assumes in four or five days, or even less, a still more threatening aspect. The pulse becomes very rapid and small; the restlessness and delirium pass into drowsiness or coma; the tongue becomes brown and dry; the teeth are covered with sordes; the lips are dry, cracked, and bleeding; diarrhœa is apt to occur; and the patient dies in from three to ten days, in a well-marked typhous condition. In other instances, on the contrary, the case

runs on from week to week, and at last, after an illness of four, five, or six weeks, the child either dies or recovers after all chances for life seem to have been lost.

In order to show, in their natural connection, the different symptoms that have just been described, we will cite the following abstract of three of our cases. The first occurred in a boy between seven and eight years old. On the fourth day of the attack the pulse was at 150, and the fauces presented flakes of false membrane. The fauces were very much swelled, and deglutition became difficult; faucial gurgling came on, and the throat was filled with viscid and tenacious secretions. The nasal passages now became occluded by constant discharges, at first mucous and then muco-purulent, with admixture of membranous particles. From the fifth to the ninth day there was an excessive fetor from the nose and mouth. The lymphatic ganglions just beneath the ear swelled very greatly, so as to extend much beyond the line of the inferior maxilla. The tongue and lips became dry and cracked, the teeth were covered with sordes, and the angles of the eyelids inflamed and then ulcerated. On the sixth, seventh, eighth, and ninth days, there were taken away from the mouth and throat of the child, with a mop, hard and most offensive masses of dried-up mucus and incrusted epithelium, enveloped in thick, gluey, dark-colored mucus. These masses stuck to the fauces, tongue, and lips, so tenaciously that they could be removed only by means of a mop, the boy himself being quite unable to detach them. On the seventh, eighth, and ninth days, though the cervical lymphatic glands were very much swelled, the patient was better. The pulse came down gradually from 152 to 132, 128, and 112, and the swallowing improved so much that the child could take liquids with less convulsive effort, and could drink continuously. The drowsiness diminished, and the delirium ceased. On the eighth day a slight erythematous redness appeared on the bridge of the nose, and extended towards the malar bones. The skin of the face and eyelids became somewhat swollen and puffed by an œdematous effusion. On the ninth day the pulse was down to 104, and the skin was nearly natural as to temperature. The swelling was very great on both sides of the neck and the glands on the right side were red on the surface, very hard, and quite painful. The swallowing was much easier for drinks, but as yet no solid, not even of the softest kind, could be taken. On the fourteenth day from the onset we opened a very large abscess on the left side of the neck, which discharged abundantly a healthy and laudable pus. On the fifteenth day we opened a still larger abscess on the right side, and, after this, perfect recovery took place.

In another example, which has been alluded to already, occurring in a boy between four and five years old, the gravity of the case did not show itself clearly until the sixth day. On the evening of that day the pulse was 128, the skin very hot and dry, and there was an intense eruption of a brick-red color. There was, at the same time, great drowsiness, and utter loss of appetite. Deglutition was difficult, and there was a loud faucial gurgling during sleep. There was now also a considerable amount of membranous exudation in the fauces. During the seventh and eighth

days, the boy continued very sick. He was drowsy, almost comatose; the eyes were half open and the conjunctivæ minutely injected; there was an abundant coryza, the discharges being composed of offensive mucous and sero-mucous fluid, with an admixture of pus and of flocculent or grumous particles, the latter consisting evidently of broken-down membranous exudation. There was no otorrhœa. The pulse rose from 120 to 128. During the night of the seventh day the anginose affection was so severe that the child could swallow nothing from 10 P.M. to 3 A.M.; fluids poured into the mouth ran out again in part, and were in part returned through the nostrils. On the tenth day there was still no decided improvement, except that the pulse had fallen to 112. The coryza continued as before; the fauces were covered thickly with whitish exudation; the deglutition was a little easier. The drowsiness continued, as the child dozed nearly all the time, merely rousing from time to time to take drinks, and then, in spite of all solicitation, sinking into sleep again. The abdomen was tympanitic. The urine was rather free, more so than it had been before, and it was also clearer and of a lighter color. By the twelfth day there was a decided improvement; the pulse had fallen to 106, and the child was not quite so heavy. The act of swallowing was easier, and the fauces showed less of the plastic exudation, but they were still very much coated with tenacious mucus. On the thirteenth and fourteenth days the patient continued to mend. The pulse fell to 98 and 92; the fauces had become clear of the exudation, and presented instead an excoriated and ulcerated appearance. The secretions into the fauces were less viscid and less copious. The coryza had diminished, and the discharges had become first muco-purulent and then mucous. The drowsiness had diminished, so that he waked spontaneously and began to ask for his toys. He now began to demand food, but refused to eat when things were brought to him. On the fifteenth day he was extremely irritable, screaming most violently for the slightest causes. On the sixteenth day the pulse was 92, and the skin nearly natural as to temperature. He was now exceedingly emaciated and very weak. The orifices of the nasal passages were very much irritated and incrusted, but there was scarcely any coryza. The tongue was clean, pink in color, and moist, the thirst not too great, and there was a little appetite. The temper was improving. From this time forward the child improved steadily but slowly, so that he sat up for the first time on the twenty-seventh day. He was as much emaciated at that time as after violent typhoid fever.

The reader must not, however, suppose that all grave cases present throughout their whole course, symptoms so dangerous as those which marked the two examples that have just been detailed. In some, on the contrary, the symptoms, though of such a character as to deserve and require the title of grave, are of a much milder kind. In order to make this part of our description of the disease as clear as may be, we will relate the following as an example of a grave case in which the symptoms, though severe, were neither malignant, nor at any one time very dangerous to life. A girl between seven and eight years old was well at breakfast. In the course of the morning she complained of sore throat, and of not feeling

well, and at 4 P.M., when we saw her, was quite feverish, with a frequent pulse and hot skin, and showed already a well-marked but rather faint scarlet rash upon the trunk of the body, and about the elbows. On the following day the trunk and upper parts of the limbs were covered thickly with an intense eruption, of a bright scarlet color. The fauces were very red, somewhat roughened and a good deal swelled. The only nervous symptom present was severe frontal headache. There was no unusual agitation, no drowsiness, and nothing like convulsive movement. On the evening of this day, the pulse had run up to 168, and was rather full, but not hard. The skin was exceedingly hot and burning; during the night there was great restlessness, and the child was wakeful and occasionally delirious. On the third day the symptoms continued much the same, except that the pulse was down in the morning to 152, that the rash had extended to the hands and feet, and that some small spots of whitish exudation were now visible on each tonsil. On the night of this day the fever again increased very much, and the child was again delirious. On the fourth day the pulse was 148; the exudation had increased so much as to cover a good portion of both tonsils, and it had extended also in a slight degree to the posterior wall of the pharynx. There was now a considerable enlargement of the lymphatic glands situated at the angle of the jaw on the left side, and a smaller one on the right side. Deglutition was somewhat painful, and a little difficult, but not seriously so. The case continued in much the same way until the seventh day, when the pulse had fallen to 132, and the eruption had faded very much on the trunk of the body, and, to a considerable extent, upon the limbs also. The fauces now exhibited the false membrane over the whole of both tonsils, over the half-arches, the sides of the uvula, and upon the upper portion of the posterior wall of the pharynx. Instead of being whitish and clean-looking as at first, however, the false membranes now looked exactly like sloughing portions of the mucous membrane. They were of a dirty brown color, softened, and seemed to be detaching themselves like sloughs from the tissues beneath. On the ninth day the patient was much better, the pulse having fallen to 116; the eruption had almost wholly disappeared; the heat of skin was very much reduced; the dark-colored portions of false membrane had disappeared from the fauces, leaving the mucous membrane beneath red, excoriated, and in parts ulcerated. On the thirteenth day, the child was convalescent, the pulse having fallen to 96, the heat of skin having disappeared, and the throat being nearly well. The appetite had returned, the temper was serene and cheerful, and the patient was, in fact, well, with the exception of weakness, and some remaining soreness of the throat.

Laryngitis has been supposed by some persons to be of frequent occurrence in the course of the disease, while others assert that it rarely, if ever, occurs. M. Bretonneau has never met with it. M. Rayer says he does not know that the exudation has ever been found in the larynx or trachea. Tweedie (*Cyclop. Pract. Med.*, Art. Scarlatina, p. 640) states that in the dissections he has made he has not seen an instance of the membranous exudation extending into the larynx. That it does sometimes occur, is proved nevertheless, beyond a doubt, by the evidence of MM. Guersant

and Blache, Rilliet and Barthez, and others, and by our own observation. MM. Rilliet and Barthez report three cases in which it was found in the larynx after death. These gentlemen state, however, that they have never observed the peculiar symptoms of croup. This does not accord with our own experience; for in several cases that we have seen, all the peculiar symptoms of that malady were present during life. The subject of one of these cases was a boy two years of age. A few days after the invasion of the disease, a severe and extensive pseudo-membranous angina was developed. This was soon followed by all the symptoms of croup—hoarse cough, stridulous respiration, weak, feeble cry, dyspnœa, and whispering voice, which lasted about five days, when the angina and croupal symptoms both diminished very much, and the child seemed in a fair way to recover: suddenly, however, extensive tumefaction of one side of the neck took place, and he died in twenty-four hours. Unfortunately no examination could be made. In another case, in a child between six and seven years old, who had a most violent attack of the disease, severe croupal symptoms set in on the eighth day. They consisted of harsh, croupal cough, stridulous respiration, and great difficulty in swallowing, and the act of swallowing occasioned much harsh cough and strangling. The symptoms continued on the ninth day, after which they moderated, and the child finally recovered entirely. In a third case, also a violent one, in a boy between eight and nine years old, and in which general convulsions occurred on the first and second days, the symptoms had improved a good deal on the third or fourth day. On the fifth day he was not so well, being more restless and heavy, and having much difficulty in breathing, with some croupiness of sound. These symptoms increased rapidly until they gave rise to most violent fits of suffocation, and caused a fatal termination on the sixth day. In a fourth case, in a child nine months old, death occurred on the thirteenth day from laryngitis, occurring in connection with membranous angina. The fatal termination was preceded by hard, dry, and croupal cough, stridulous respiration, and great difficulty of deglutition. In a fifth, in a child under a year old, croupal symptoms made their appearance on the sixth day, the fauces being at that time covered with membranous exudation, and they caused or assisted to cause a fatal termination on the eighth day. In yet another case, the subject of which was between one and two years old, a grave attack of scarlet fever was entirely recovered from. At the end of the second week the child was seized, owing to improper exposure in a cold house, against which the parents had been properly warned, with anasarca. This also was recovered from, and again the parents were warned against improper exposure. On the very day after our last visit, however, the child was taken down stairs into a room with the windows open, and this on a mild day in the month of February. The child was seized now with diphtheritic angina, and died, after a few days, of croup. This was in the fourth week from the onset of the scarlet fever. In a seventh case, severe from the beginning, the patient recovered so as to be apparently out of danger, but, owing to the room being very cold from the fact that it was large, with wide rattling windows down to the floor, and from the fire being too small, the child

took cold, and, at the end of the third week, was seized with severe croup, which had many of the features of membranous croup, but which was, in all probability, spasmodic croup, dependent on ulcerative laryngitis. The case continued seven days, during which time the patient was violently ill, but finally, after a most dangerous struggle, it ended favorably.

The symptoms which indicate a disposition to implication of the larynx are frequent, hoarse, and croupal cough, hoarse and whispering voice or cry, aphonia, and dyspnœa with stridulous respiration.

The *duration* of grave cases of scarlet fever is very uncertain. In some the disease runs its course with frightful rapidity, destroying life within a few hours or days. In others, though the symptoms of the early stage may seem to be as violent as in those where death occurs in a very short space of time, the patient either lingers for several days or two or three weeks, and then dies, worn out by the violence or malignancy of the attack, or else, after a most dangerous and apparently desperate illness, he finally struggles through and recovers.

In the most violent of the grave cases, those which we described first as forming a separate group, 18 in number, of which 13 proved fatal, the duration in the fatal cases was between eighteen hours and six days. Of the 13, 2 proved fatal in eighteen hours, 1 in twenty-four hours, 2 in thirty-six hours, 4 in three days, 1 in four days, 1 in five days, and 2 in six days. Of the 5 favorable cases, 1 lasted three weeks, 1 four weeks, 2 six weeks, and 1 two months.

Of the less violent of the grave cases, 43 in number, 15 died, and 28 recovered. Of the 15 fatal cases, 1 died in four days, 2 in five days, 2 in seven days, 3 in eight days, 2 in thirteen days, 1 in fourteen days, 1 in fifteen days, 2 in four weeks, and 1 in five weeks. Of the 28 favorable cases, the duration of the shortest was seven days. The remainder lasted from twelve days to six weeks, the most common period being between three and four weeks.

Complications and Sequelæ.—*Dropsy.*—This is one of the most frequent and important sequelæ of the disease. We have already remarked that in a considerable proportion of cases, the exact number apparently varying somewhat in different epidemics, the urine becomes albuminous during the stage of desquamation. This, however, is usually transitory, and probably depends partly on the condition of the blood itself, and partly on renal congestion. But in some cases, owing to one of the causes to be mentioned hereafter, the albuminuria persists, or if it has not been present or has disappeared, again makes its appearance; and the symptoms of acute nephritis develop themselves. Among these the most striking one is dropsy, and, indeed, so prominent is it, as to have alone attracted attention for a long time, and only to have comparatively lately been associated with a lesion of the kidneys.

Certainly, in the vast majority of cases, when dropsy appears as a sequel to scarlatina, the urine will be found to present all the characters present in acute Bright's disease; and yet there are some high authorities (Simon, Becquerel, Philippe, Rayer) who assert that marked dropsy may occur without the slightest albuminuria. It is possible that some of these cases

may be explicable by the fact that the urine has only been occasionally examined, and that albumen may have been temporarily present but have been overlooked; but it at present seems undeniable, that, in some instances also, dropsy may appear without any abnormal condition of the urine whatever. It is probable that, in these cases, the dropsy depends upon an anæmic state of the blood, developed during the course of the disease.

The frequency with which dropsy is developed, varies greatly in different epidemics and in different forms of scarlatina. It occurred in a fifth of the cases of MM. Rilliet and Barthez, and in 31 of the 274, or in about a ninth, of those observed by ourselves of which we have kept notes. It occurs generally in the course of the second or third week of the disease, and during the process of desquamation. It is thought to follow cases of moderate severity much more frequently than those of a grave character. Dr. Tweedie states that it has never been observed to succeed a malignant attack. This does not, however, accord with our own experience, since of the 31 examples that we have seen, 8 occurred in grave cases of the disease. Still it may be said on the whole, that the susceptibility to renal disease bears an inverse proportion to the activity and complete development of the symptoms of scarlatina. The effusion may attack any one of the cavities or the cellular tissue of the body, or all at once. The most common form in which it appears is anasarca, after which the most frequent are, in the order in which they are mentioned, œdema of the lung, hydrothorax, ascites, and hydropericardium.

The *exciting cause* of the dropsy is generally believed to be cold, contracted usually by exposure to air and moisture at too early a period. We have rarely known it to occur when the patient has been confined to the chamber or house until after the twenty-first day; while, on the other hand, we have seen it to follow immediately upon a ride in cool weather on the fourteenth day, the child having apparently been convalescent for several days before. We have known it to occur also when the child has been allowed to run through the house exposed to draughts from open doors and windows.

We have been able, in a number of instances, to trace it directly and obviously to cold. Thus, in one very marked example, a boy between six and seven years old had had a mild attack of the disease, and was so entirely recovered that we ceased our visits on the tenth day, leaving strict injunctions with the mother as to the necessity of confining the child to the house for at least ten days longer. On the fourteenth day, he was allowed to sit for fifteen minutes, late in the afternoon of a cool April day, on the marble front-door step. He was seized that night with fever and vomiting, had anasarca next day, and, during an illness of two weeks, had dropsy of the pericardium, effusion into the right pleural sac, ascites, and some signs of uræmia. In another case, a boy eleven years old had recovered entirely of a mild attack. He slept in a room heated by a stove. On the nineteenth day, the weather being cold, he got up early in the morning to light the fire, which had gone out accidentally. He was attacked that day with bronchitis, and was, on the following day, anasarcous. In another instance, anasarca was produced at the end of the third week, the child

being quite well previously, by his being taken into a cold room to sleep. We could cite other instances of the same kind, but these are enough. It is sufficient to say that in a large majority of the cases that we have seen, it has manifestly and obviously followed improper exposure during the second or third week. In a few cases, however, it has come on without any imprudence whatever, and we have been entirely unable to ascertain the cause.

Nor can it yet be asserted positively that the action of cold will frequently cause dropsy unless the urine have been previously albuminous: although it is undoubted that when albuminuria is present, any imprudent exposure will insure the occurrence of dropsy.

We are in the habit now of always directing the mother or nurse to keep the patient confined to the chamber for four weeks from the onset of the disease, or, if it be allowed to run through the house, to take care to have it well clothed, and to keep the windows and doors carefully closed should the weather be cold or cloudy. This direction is one of the most important to be given in the course of the disease. It ought to be insisted upon in all and every case, occurring in the cool season of the year.

The question was formerly much discussed, whether the condition of the kidney which accompanies scarlatinal dropsy was one of the forms of renal disease known as Bright's disease. Dr. Johnson suggested that it was a peculiar affection of these organs, characterized by a desquamation of the epithelium of the tubules, for which he proposed the name of desquamative nephritis. Recent observations have, however, shown that there is in reality nothing specific in the lesion, but that it is identical with other cases of renal catarrh or tubal nephritis, to use the excellent name bestowed by Dickinson, occurring from whatsoever cause. Indeed, it may be said that in almost 75 per cent. of all cases of chronic renal disease in children, the cause of the affection has been scarlatina, and the form of the lesion is that which we have above mentioned.

Various causes have been assigned for the frequent development of tubal nephritis in the course of scarlatina. Thus it has been supposed that the affection of the kidneys resulted from inaction of the skin, owing to the intense congestion which attends the eruption; but clinical experience shows that it is precisely in the cases where the affection of the skin is most intense that the kidneys are least disposed to disease. It would rather appear that when the action of the virus is not fully determined to the surface, there is violent congestion of the kidneys established, which, especially when the patient is exposed to the action of cold, may result in the development of tubal nephritis.

Morbid Anatomy of the Kidneys.—When death occurs in the acute stage of the renal disease, the kidneys are found enlarged and very heavy. The surface is smooth and injected; on section, the organ drips with blood; the Malpighian bodies are congested, and appear as red dots; and the vessels of the cortex and cones are gorged with blood. The tubules are distended with granular epithelium, granular matter, or fibrinous plugs. The cortex appears coarse-grained, and presents intermingled dots or

streaks of red and buff color. In the more chronic form of the disease, the kidney is also much enlarged and very heavy; its surface smooth, and pale, or dotted with congested stellate vessels. The capsule is not thickened, and is readily removed. On section, very little blood escapes; the cones retain their pinkish or red color; while the cortex is coarse-grained, thickened, and of a peculiar opaque white color. The Malpighian bodies may be distended, owing to obstruction to the escape of the blood. The principal lesion, however, is still found within the tubules, which are stuffed with epithelial cells, or with granular matter resulting from their disintegration; occasionally, clear fibrinous plugs are also seen occupying their calibre. It frequently happens that the epithelium undergoes fatty degeneration, and when this is marked, the cortex acquires a yellowish tint. According to Dickinson, there is less tendency to this change in cases of tubal nephritis following scarlatina than after other causes; a circumstance which he thinks may possibly account for the comparatively curable nature of scarlatinal dropsy.

The *dropsical symptoms* usually show themselves in the third or fourth week of the disease, and are generally preceded for a few days by albuminuria. In most of the cases that we have seen they occurred in the third week, but they sometimes appear at the end of the second, and sometimes not until the fourth week. In one case they showed themselves first on the thirtieth day, after the child had been exposed to too cool a temperature in an insufficiently warmed room. They occur, therefore, as a general rule, during the stage of desquamation. The attack is sometimes very sudden, but in most instances it is slow and gradual. The effusion is not commonly the first symptom observed. On the contrary, the dropsy is almost always preceded for one or two days by the signs of a more or less considerable constitutional disturbance. The patient has usually passed safely through the eruptive stage of the fever, and has been considered for several days as convalescent, for, as we have already remarked, the dropsical affection is much more rare after grave than after mild cases. The child has perhaps been running about the house, or it has even been out, the parents supposing, unless warned by the physician, from the disappearance of the fever and other symptoms of illness, and from the return of appetite and gayety, that complete recovery has taken place. But, either after some exposure, or sometimes without any appreciable cause, the child becomes drooping, languid, and irritable, or uneasy, peevish, and restless. Simultaneously with or very soon after these symptoms, fever sets in; the skin becomes dry and heated, and there is usually an elevation of the temperature to the extent of 4° or 5°; the pulse is frequent and hard, or it is frequent and jerking; the appetite is diminished or lost, and there is more or less thirst; the bowels are generally constipated; the urine is usually diminished; and there is not unfrequently some nausea or vomiting, and complaints of headache.

The symptoms which precede the appearance of the effusion are not always, however, so marked, while in other instances they are scarcely noticeable, and yet the effusion may take place suddenly, and, affecting

the subcutaneous cellular tissue and different internal organs simultaneously, may cause a fatal termination with frightful rapidity.

The effusion usually commences in the face, which becomes slightly swollen. The amount of the effusion is sometimes very slight, leaving us in doubt even whether there is really any or not. The swelling is most marked about the eyelids, which look puffed, and it may be confined entirely to them, or, at least, it may be only in them that we can feel sure of its existence. From the face it extends to the hands and feet, and either remains limited to these parts, or spreads over the whole surface, and gradually or rapidly to the internal organs. The skin over the parts in which the effusion has taken place is firm, hard, and elastic to the touch; it does not generally pit, at least not in the early stage, and it is of a dull white color.

In very mild cases the constitutional disturbance is usually but slight, and the effusion may be so small in such instances, as to leave us in doubt as to the cause of the sickness. Generally, however, we have been able to determine the cause of the fever by a careful examination of the face, and particularly of the eyelids, which look a little swelled and distended, and by the presence of a slight puffiness or cushiony appearance of the backs of the hands and feet. In such cases the general symptoms usually pass away after a few days; the urinary secretion, which had been diminished in quantity and of a deeper color than natural, becomes again healthy; the anasarca disappears, and the child returns to its ordinary condition. In more severe cases the general symptoms are all more marked; the anasarca is more extensive and the swelling more considerable; the child, if old enough to describe its sensations, complains of pain in the back, and the lumbar region is tender to the touch; the urine exhibits much more marked changes in its character; but still, unless some important internal cavity be attacked, the symptoms diminish after a week or ten days, and the child recovers gradually. In still more violent cases, the amount of the effusion is very large indeed, the face is disfigured by the swelling, the limbs are largely distended, the cellular tissue of the trunk of the body is infiltrated, the quantity of urine discharged is very small or the secretion is arrested entirely for one or several days, and the fever is high. If the disease is not removed, the effusion may extend to the internal organs: to the lung, producing œdema of that organ, to the pleural sac, causing hydrothorax, to the pericardium, to the peritoneal cavity, or to the brain. Death may occur in these violent cases from asphyxia occasioned by œdema of the lung, by hydrothorax, or by the obstacle to the circulation caused by the presence of the effusion in the pericardium; from hydrocephalus, or, finally, the patient may sink into a comatose state like that which often precedes the fatal termination of Bright's disease in the adult, and due, like that, to uræmia.

It sometimes happens, as was stated above, that death occurs with very great rapidity. MM. Guersant and Blache have known it to end fatally in twelve, fourteen, and thirty-six hours. In a case that came under our own observation in consultation, a child between one and two years old, who had had a very mild attack of scarlet fever, was seized suddenly

towards the end of the third week, after it was supposed to be quite well, and after exposure to draughts of cold air in the lower room of a small house, with vomiting, and shortly afterwards with convulsions and coma, which terminated fatally in thirty-six hours. In another case, in a boy between thirteen and fourteen years old, who had had a mild but well-marked attack, and who had convalesced, and been out of bed for a few days, fever with slight headache, and diminution of the urine, came on at the end of the second week. After two days of slight ailment, without any signs of anasarca, he suddenly without any warning, fell into violent convulsions, which were repeated frequently, with lulls of imperfect consciousness, for a few hours. After twelve hours he became completely comatose, with occasional convulsive seizures, and died at the end of eight hours more.

According to Gee (*loc. cit.*), uræmic convulsions and coma are not frequent in the course of scarlatinal dropsy, nor are they of such fatal import as in acute Bright's disease in the adult.

The symptoms which mark the occurrence of internal effusion will depend of course upon the part attacked. In one case they will be those of œdema of the lung, in another those of hydrothorax, and in another those of hydropericardium or ascites.

Urine.—The particular condition of the urinary function is next to be described. It has already been stated that the amount of urine secreted is less than natural during the early period of the dropsical attack. But, while this is true, it ought to be observed that the patient often voids the secretion more frequently than usual. There is in fact micturition, a symptom occasioned no doubt by the irritating character of the urine, which causes the bladder to contract and expel that fluid so soon as even a small quantity collects. The diminution in the amount of the secretion is usually a very marked symptom. It is sometimes almost or even entirely suppressed for a considerable period. In one case that occurred to one of ourselves, in a boy between one and two years old, there was no discharge whatever for a periord of thirty-six hours. During this time there was no distension of the bladder, as we ascertained this point by careful palpation and percussion. In another case, which occurred in a girl between three and four years old, and who was nursed by the grandmother, one of the most accurate, reliable, and experienced nurses in the city, we were assured that there was no discharge whatever of urine for five days in succession. During this suppression there was no accumulation in the bladder. On the contrary, the hypogastric region was flat, depressible, and sonorous on percussion. The patient was very ill during all this time. She was feverish and passed nearly the whole time in a semi-comatose state, but could be roused with much effort, so as to show some intelligence; she rejected by vomiting almost everything that was given her, and complained when aroused of severe headache. She had no convulsions nor any convulsive movements, and finally recovered as the kidneys regained gradually their secretory function. In many other cases that have come under our observation, especially those which we have seen in latter years, when we have watched this symptom more carefully, the

diminution of the urine has been very great, so much so as to constitute a most marked and reliable symptom.

In mild cases, when the diminution is not very marked, the urine is of a deeper color than natural, but retains its transparency when first voided. It is apt, however, to become turbid on cooling, and to deposit a more or less abundant precipitate of urates. Its reaction is acid; its specific gravity increased in proportion to the concentration; and urea and the chlorides are much diminished. Albumen is present, and microscopic examination shows epithelial or hyaline casts of the renal tubules, renal epithelium, and blood-globules. In more severe cases, the urine is very much diminished in quantity, the color is either a very dark red, or has a blackish or brownish tint, or is like smoke or soot; the specific gravity is very high; the amount of albumen large, and the precipitate contains many casts and blood-globules, mixed with abundant urates.

The amounts of albumen and blood bear no definite relation to each other; in some cases, the albumen may be abundant without any blood being present; while in other cases, with a large precipitate of blood-globules, the urine may contain but a moderate amount of albumen.

Basham calls attention to the occasional development of a bluish-green, and subsequently greenish-black color, on the addition of nitric acid to the heated urine, as a sign of very grave augury, being associated with extensive and advanced renal disease.

The duration of this stage of diminution of urine varies greatly in different instances, and is, to a certain extent, indicative of the future progress of the case. It is succeeded by a stage in which the urine becomes abundant, even exceeding the normal amount, the specific gravity falls, and the urea and chlorides return to the normal figure, but albumen is still present, the smoky color is apt to persist, and the precipitate which forms on standing contains renal epithelium, blood-globules, and granular or epithelial casts.

In favorable cases, the smokiness and albumen now gradually disappear, the urine often continuing for a little while to be secreted in excessive quantity; but in other cases, and unfortunately they are but too frequent, the albumen persists, and the urine assumes the characters indicative of chronic Bright's disease.

The form which the dropsy takes varies greatly in different cases, and seems to depend on inappreciable causes. Of the 29 cases that we have met with, in which its distribution was noted, anasarca alone was present in 22. In 1, there was extensive anasarca, hydrothorax of the right side, hydropericardium, and ascites. In 5, grave cerebral symptoms, probably uræmic in character, were present; and in 4 of these anasarca also existed. In 1 there were also hydrocephaloid symptoms, but of much less violent form.

Recent researches have established the fact that most of the cases formerly regarded as acute hydrocephalus are in reality due to the poisoned state of the blood, the so-called uræmia, so familiar to all, that it is merely necessary to allude to it in this place.

The degree of danger to be apprehended from this dropsical complica-

tion depends upon the form which it assumes. M. Cazenave (*loc. cit.*, p. 52) says that there is no danger from it so long as it remains confined to the subcutaneous cellular tissue; and this is probably true. When, however, it attacks the serous cavities, or becomes associated with cerebral symptoms, due to the retention of urea and other excrementitious matters in the system, it is exceedingly dangerous. Dr. Wood (*Pract. of Med.*, vol. i, p. 403) says that he has seen but one fatal case of scarlatinal dropsy, and in that the heart was diseased. Of the 29 cases that we have had under charge of which we have preserved notes, 6 were fatal. Of the 22 cases in which the effusion was anasarcous alone, but 1 was fatal. All of the 5 in which well-marked hydrocephaloid symptoms, due to uræmia, occurred in connection with anasarca, ended fatally. In one other case, which ended favorably, there were mild uræmic symptoms present. In the case above adverted to, in which hydrothorax, hydropericardium, and ascites were added to the anasarca, the patient recovered after a long and severe illness.

In addition to the cases of dropsy and uræmia just referred to, and which all occurred in our own practice, we have seen quite numerous examples of scarlatinous dropsy with uræmic symptoms in consultation or in hospital practice. In one instance, uræmic symptoms came on very suddenly in a young child, and proved fatal in thirty-six hours, while in other cases, they have run a more gradual course, either ending fatally or terminating favorably after a severe illness of from several days to several weeks. In one case where recovery followed, the patient, a girl, between three and four years old, was in a semi-comatose state for a week, with fever, excessive irritability of the stomach, and complaints of headache. For a period of five days the urine was entirely suppressed, not a drop having been voided during all that time, at least with the knowledge of the nurse, who was a most accurate and competent person. It would seem to be much more dangerous in the Parisian hospitals than in private practice in this country, since MM. Guersant and Blache speak of having seen it prove fatal in twelve, fourteen, and thirty-six hours, after one or two weeks, or even two or three months; and MM. Rilliet and Barthez refer to it as often proving fatal.

Diarrhœa is not an uncommon accident in the disease. It generally depends on simple functional derangement of the bowels. In some cases, however, it is so severe or long-continued as to constitute a serious complication. Under these circumstances, it depends on follicular entero-colitis, or slight erythematous inflammation of the intestinal mucous membrane.

In some cases, chronic angina remains after the subsidence of the disease; so, too, coryza may persist, even taking the form of ozæna.

Otorrhœa is a not infrequent sequel, and when following angina, and due to the extension of inflammation up the Eustachian tube, may be associated with permanent deafness, necrosis of the temporal bone, facial palsy, and even abscess of the brain.

Occasionally during the desquamative period, a painful swelling of the joints appears, attended with a renewal of the fever and, frequently, with sweating. This form of rheumatism is in all probability connected with the imperfect excretion of some excrementitious substance, owing to the

state of the various emunctories. In rather rare cases, the inflammation of the joint runs on to fatal suppuration.

Bronchitis and pneumonia are rare. *Inflammation of the serous membranes* is more common, occasioning in some cases the dropsical effusions which have already been treated of. It is in most cases connected either with renal disease or with the form of rheumatism above described. The pleura is more frequently affected than any other of the serous membranes; and not rarely the effusion becomes purulent.

Inflammation of the investing or lining membrane of the heart also occasionally occurs. Thus, of 39 cases of endo- or pericarditis mentioned by Dr. West, 6 could be traced to an attack of scarlatina.

Peritonitis is much more rare, and the effusion here also is especially apt to be purulent.

Scarlatina may be coincident with variola or measles. We have never seen it in connection with the former, but in two cases which came under our observation it was complicated with measles.

Diphtheria has also been observed not very rarely, usually appearing during convalescence. In a considerable number of cases, scarlatina has been noticed in the course of typhoid fever.

In some rare cases, as in the one detailed under the head of prognosis, more or less complete paralysis ensues during the convalescence from scarlatina.

Tuberculosis is not nearly so apt to be developed after scarlatina as after either rubeola or typhoid fever.

Anatomical Lesions.—The eruption sometimes disappears entirely after death, and on other occasions assumes a deep livid or purple appearance. The epidermis is generally loosened upon the integument, so as to be peeled off with great facility. The most important lesions, and those which seem to belong to the nature of the disease independent of complications, are the altered condition of the blood, and congestions of different parts of the body, particularly the brain, serous membranes, kidneys, spleen, glands of Peyer, and intestinal follicles. We have already alluded to the fact that, even when the cerebral symptoms have been most severe, and we might expect to find evidences of violent inflammation of the brain, nothing is observed after death, in the majority of cases, but congestion of the large veins and sinuses of the brain, of the pia mater, or of the cerebral substance. There is rarely any unnatural amount of serous effusion into the ventricles, or meshes of the pia mater; and it is evident that the symptoms have been due entirely to the vitiated condition of the blood. Nevertheless, effusions within the cranium may exist, in some few cases, as has been already stated in the remarks upon hydrocephalus.

The respiratory organs are usually healthy, with the exception of congestion and serous engorgement.

According to the researches of Fenwick, Fox, and Murchison, it appears that the entire gastro-intestinal mucous membrane is affected in many cases of this disease. There is congestion of the subepithelial layers, with excessive formation and subsequent desquamation of the epithelium. The gastric tubules are greatly distended and obstructed by cells mixed

with granular and fatty matters, and casts of their calibres are frequently found in the matters vomited or in the contents of the stomach after death.

The condition of the skin resembles this closely, the rete mucosum being thickened, with a formation of numerous round nucleated cells, and the sudoriferous glands being often obstructed by the rapidly formed cells.

The glands of Brunner and Peyer are not unfrequently enlarged, and they are sometimes reddened or softened. In a smaller number of cases the mesenteric glands are slightly inflamed and increased in size, and the spleen is redder than usual or softened. These lesions have no necessary relation to the form of the disease, since they are often absent in typhoid cases, and present in those of a different type.

The kidneys are healthy, with the exception of some degree of congestion, unless the case has been complicated with dropsy. Under these circumstances they usually present the characteristic lesions of tubal nephritis, which we have already described.

The heart occasionally presents the results of inflammation of its lining or investing membrane; and in some cases its cavities contain firm white ante-mortem clots.

The blood exhibits very different appearances in different cases. It is viscid or serous, dark-colored or light, and fluid or coagulated, the clots being of variable color and density. The proportion of its constituent elements is changed. The fibrin maintains its usual relation to the mass of the fluid (3 parts in 1000), or it is very slightly augmented, while the quantity of the globules is increased to 136 or 146 parts, according to M. Andral, instead of 127, in 1000 parts. This increase in the proportion of fibrin may be in part the cause of the fibrinous depositions which occasionally are found in the cavities of the heart, and appear to have been instrumental in causing death.

In an article on "The Pathology of Scarlatina, and the Relation between Enteric and Scarlet Fevers" (*Med. Chirurg. Trans.*, vol. lv, p. 103), Dr. John Harley, of London, reports thirty-six cases of scarlet fever, to show that the anatomical lesions of that disease are the same as those of typhoid fever in its early period, and that not unfrequently scarlatina, when long continued, passes into enteric fever. After describing these lesions, he says (p. 125): "From this view *our general conclusion as to the connection of scarlet fever and enteric fever is inevitable, viz., that the pathological changes accompanying an attack of scarlatina, include all those of the first stage of enteric fever, and are so far identical with them.* And it follows, therefore, that the transition from the former disease to the latter is nothing more than a natural pathological sequence, readily determined by any cause which may increase the intestinal irritation." The italics are Dr. Harley's.

We have, on a few rare occasions, known cases of scarlet fever in our private practice, where the disease has been prolonged beyond its usual period, to assume some of the phenomena of typhoid fever, but this occurrence has been so infrequent that we doubt whether it ought to be regarded as the natural evolution of a pathological law connecting the two affections. That typhoid fever may attack a child just recovering from

scarlet fever, is as probable as that measles and scarlet fever may directly follow each other, or even coexist at the same moment. Of both of these accidental coincidences, we have seen a few well-marked examples. Several of the cases described by Dr. Harley, in which typhoid fever certainly followed scarlet fever, occurred in patients admitted to hospitals. Five occurred in the London Fever Hospital, and in some of these the attacks of enteric fever began after full convalescence from scarlet fever; in one on the 28th day of convalescence; in a second on the 31st day; in another on the 37th day; in another on the 32d day; and again on the 56th and 32d days. We would ask whether in such cases the sequent typhoid fever ought not to be explained as the result of fever poison imbibed during the residence in the wards of a fever hospital?

One very interesting fact observed by Dr. Harley, is the frequency with which he found fibrinous clots in the heart and great vessels "during a pyrexial state, at any period of the disease. This," he states, "is the commonest cause of death during the early stage of scarlatina; it is indicated during life by the reduction, often sudden, of a full pulse of about 120, to a dribble of 150 or 160 almost imperceptible impulses. The failure of the heart's action is commonly attended with orthopnœa and delirium from obstruction to the pulmonary and cerebral circulations. On opening the body before it has lost a degree of temperature, and while the hot blood is still fluid, the right heart will be found distended, partly with dark fluid blood, which coagulates on exposure; and partly, sometimes chiefly, by a large, firm, white, bifid clot continuous through the auriculo-ventricular opening. Each portion is interlaced with and firmly adherent to the tendinous cords and outstanding muscular bands of the cavity in which it lies, and sends outwards a rope-like continuation, the one into the pulmonary artery, and the other into the superior cava. These processes not only occupy a large portion of the area of these tubes, but extend with their branches upwards into the cranial cavity, and outwards into the lungs, whence they may often be withdrawn in ramifications up to the eighth degree, and eight or nine inches long.

"The left heart was generally empty and firmly contracted; in one case (1) each cavity was occupied by a large fibrinous clot, that in the ventricle spreading into the brachio-cephalic vessels of the arch of the aorta, and that in the auricle sending large ramifying branches into the pulmonary veins. In another case (12) the auricle was distended with dark softly-clotted blood."

We desire to call attention to these facts, since we doubt not that they explain many of the cases of early death in this disease, in which all medical treatment has proved so futile, and also on account of the great interest of these observations in connection with the similar results which have already been noted in diphtheria.

Diagnosis.—It is impossible to distinguish scarlatina from the other eruptive fevers by the symptoms which precede the eruption. The only signs upon which a diagnosis at that time might be grounded, are great frequency of pulse, which is characteristic of this disease, some soreness or redness of the fauces, and the prevalence of the disease in the com-

nunity. But these are all exceedingly fallacious, and the physician should be content to wait for the eruption before he ventures to speak with certainty. After the eruption has come out, it can scarcely be mistaken for anything else, except it be roseola.

From *measles* it may be distinguished by the differences in the prodromes, course, and eruption of the two affections. The prodromic stage of scarlatina rarely lasts more than twenty-four hours, and is very often much less; that of measles, on the contrary, is almost always from three to four days; in scarlatina the rash appears suddenly, and often spreads over the whole body in a single day; in measles it appears on the face first, and extends gradually to the rest of the surface, seldom reaching the hands and feet before the end of the second day; the eruption of measles occurs first in distinct papules, which coalesce and form patches of an irregular crescentic shape, while that of scarlatina is in the form of innumerable minute dots or punctations, placed so closely together as to give to large portions of the surface a uniform color, like that produced by blushing. The color of the two eruptions is different, that of measles being dark like raspberry-juice, and that of scarlatina of a more or less bright scarlet tint. The presence of catarrhal symptoms in measles, and their absence in scarlet fever; the absence of angina in the former disease, or its very slight character, and the severity of the throat affection in scarlatina; and lastly, the greater severity of the febrile symptoms, particularly the frequency of the pulse and the heat of skin in scarlatina, are other points of difference which will assist in making the diagnosis, rarely, it seems to us, difficult, still more certain. A very great frequency of the pulse is one of the most unfailing symptoms of the early stage of scarlet fever. It almost always runs up to 140, 150, or 160, in young children, within the first twelve or twenty-four hours, and to 120, 130, 140, or higher, in those who are older. Nevertheless, this, like all other symptoms, is sometimes wanting. We have lately seen a boy, between five and six years old, with a marked but very safe attack of the disease, whose pulse ranged between 80 and 90 throughout the sickness. This was, however, the only case we have ever met with, in which the pulse remained so little disturbed.

It is sometimes very difficult to determine with precision between *roseola* and scarlet fever. By the eruption alone, we believe it to be often impossible. We have seen quite a number of cases in which the eruption of roseola resembled so closely that of scarlet fever, that we should have been obliged to confess our inability to make the distinction had it not been for the other symptoms, and particularly the frequency of the circulation, the heat of the skin, and the throat symptoms. The most important differential symptoms are the tint of the eruption, which in roseola is rose-colored, in scarlet fever bright-red or scarlet; the characters of the patches of eruption, which are more regular in shape, but of much smaller size in roseola than in scarlet fever; the absence or very slight degree of pharyngose inflammation in roseola; and, what is decidedly the most important of all, the very much slighter degree of febrile reaction in roseola, in which the pulse, instead of being doubled in frequency as it is in scarlet

fever, is scarcely above its natural rate, and in which the heat of skin is but little above the standard of health. Moreover, roseola is generally of shorter duration, and is a milder affection, and therefore accompanied by far less fever and general disturbance of the constitution.

Diphtheria occasionally resembles scarlatina to so great an extent, as to have even led some observers to consider them identical. Thus, there is in diphtheria a pseudo-membranous angina, with swelling of the cervical glands, and at times albuminuria, and even an erythematous rash. We have elsewhere (see article on diphtheria) given at length the differential diagnosis between these affections, and will here merely call attention to the fact that the rash is a rare exception in diphtheria, and is a mere uniform erythematous redness; that even when albuminuria is present, the urine does not present the other characters noted in scarlatina; and that the condition of the fauces in the two diseases is somewhat different. There is, further, a wide difference in the sequelæ of the disease; and, finally, they do not exercise any protective power whatever against each other.

There is a form of disease known as rubeola notha, epidemic roseola, rosalia (Richardson), rötheln, in which there are some of the symptoms of both measles and scarlatina; the eruption appearing on the second or third day, at first resembling that of measles, but becoming soon more like that of scarlatina. Coryza and angina may both be present, and there is subsequent desquamation. Some authorities regard this as a union of the poisons of measles and scarlatina, while others consider it a separate disease, because epidemics of it occur when neither measles nor scarlatina are prevailing. Previous attacks of these latter do not protect against it. In an extensive epidemic in the lower part of this city, which appeared to be of this nature, not a single case, of the numbers which came under our observation, was followed by any of the sequelæ of either measles or scarlatina.

Prognosis.—It is impossible to obtain a useful average mortality of scarlet fever, since the disease varies so greatly in different epidemics, and under different hygienic conditions, that the results obtained during one period are inapplicable to cases observed at another. This is proved by the experience of almost every physician, and by the evidence of many writers. It is proved, also, by the following facts: M. Gueretin (*loc. cit.*, p. 283) states that the mortality in the epidemic observed by him was about 1 in 12; of 99 cases, 8 died. MM. Rilliet and Barthez lost a little more than half their cases; of 87, the total, 46 were fatal. These cases, let it be remarked, however, occurred in the Hospital for Children in Paris, which will account for the heavy fatality. The degree, however, to which the mortality may vary in the same place and under the same plan of treatment, is shown by the fact, mentioned by Hillier, that in the course of eleven years the annual mortality from scarlet fever in the London Fever Hospital, varied from 2.5 per cent. to 16.5 per cent.; and in the Hospital for Sick Children in London, from 9 to 31 per cent. Of the 274 cases that we have observed, 31, or rather more than one-ninth, were fatal. Of the 274 cases, 104 occurred between 1849 and 1853, and in

those the mortality was much smaller than in those which occurred prior to that year. Of 104, 11 were fatal, or about one in nine and a half. Seventy-eight cases occurred between 1853 and the spring of 1857. Of these 78, only 4, or 1 in 12, were fatal. Of 81 cases observed previous to 1849, 13, or about 1 in 6, proved fatal. Of 11 cases occurring in 1872–3, 3 proved fatal. The mortality met with by ourselves in private practice has greatly varied, therefore, in different series of years. In one series it was 1 in 6, in another 1 in 9½, and in a third 1 in 12. Lastly, to show the influence of the epidemic type upon the mortality still more clearly, we may state that of the last series of cases observed, 78 in number, 43 occurred during the epidemic which lasted from the summer of 1856 to the spring of 1857, and of these only 3, or 1 in 14, died.

The prognosis must be based, therefore, in part on the character of the epidemic prevailing at the time. It must depend, also, on the nature of the case. Mild and regular cases are rarely fatal. Of 206 mild cases that have been under our care, only three proved fatal. One of these would probably not have so terminated had it not been for the imprudence of the nurse. This was, in fact, the case of a young child who had recovered from the eruptive stage of the disease, but whom the nurse carried out of the room in the second week, notwithstanding express directions given her to the contrary. The child took cold and was seized with catarrh and slight anasarca; on the fifteenth day uræmic symptoms set in, and he died on the seventeenth day, comatose, and with convulsive movements of different parts of the body. The second case was that of the boy thirteen years old, already described, who died with sudden hydrocephaloid symptoms, at the end of the second week. The third fatal case occurred in a girl between eight and nine years old, who died suddenly at the end of six weeks. The patient had convalesced sufficiently to have been out several times, but remained very hydræmic and weak. After being much fatigued one afternoon by playing with some little friends, she was seized next day with vomiting, and soon after with great difficulty of breathing and extremely rapid and feeble action of the heart. These symptoms increased on the following day. The dyspnœa was most severe, and was attended with cyanotic color of the hands and face, and with cold colliquative sweats. The lungs were free, there was no cough, and auscultation revealed no pericardial lesion. Death occurred suddenly at the end of a day and a half. No post-mortem was made, owing to circumstances that could not be controlled. Our own opinion was, and is, that the death was caused by a coagulum in the heart.

Grave cases of scarlet fever are always, on the contrary, exceedingly dangerous: thus of 61 cases of this kind that we have had under charge, 29, or nearly a half, were fatal. In order to render the description of the symptoms of this class of cases more clear, we divided them into two groups; one, in which the onset of the disease is instantaneous and most violent, being characterized by excessive disturbance of the nervous system, taking the form usually of convulsions, but sometimes only of profound coma; and a second, in which the symptoms of the onset, though severe enough usually from the first to mark the character of the case as

grave, are less violent than in the first group, and especially not marked by the occurrence of convulsive phenomena. Of 18 cases belonging to the first group, 13 died; while of 43 belonging to the second, 15 died. Violent nervous symptoms occurring early in scarlet fever augur, therefore, great danger to the patient, since of 18 cases in which they were present, 13 died, whilst of 43 in which they were more moderate, though still marked and severe, only 15 died.

The character of the nervous symptoms is, therefore, all-important in the determination of the prognosis, as the probable termination of the case is to be foretold more certainly by a just appreciation of these particular phenomena of the disease, than by any other means. Excessive jactitation or irritability, delirium, coma, and the hydrocephalic cries, are all unfavorable symptoms, but not in the same degree as are those connected with the locomotor apparatus. MM. Rilliet and Barthez state that they have seen recoveries take place in cases in which the intelligence of the patient had been very much disordered, while of those who "*during the first fifteen days of scarlatina*, were taken with convulsions, convulsive movements, contractions, in a word, any symptoms affecting the locomotor apparatus, all, without exception, died." This does not accord exactly with our own experience, though nearly enough so to show how exceedingly dangerous are the symptoms just enumerated when they occur early in the disease. General convulsions occurred on the first day of the disease in 9 of the 61 grave cases observed by ourselves, and of these not one terminated fortunately; in four they occurred on the second day, and of these three recovered and one died; in one they occurred on the ninth day, and this patient also recovered; in another case there were no general convulsions, but on the first day there were automatic motions, with involuntary extensor motions of the arms and fingers, and on the second day strabismus, with a continuation of the automatic motions. This case proved fatal. Of the 15 cases, therefore, in which marked disturbances of the muscular system occurred, only 4 ended favorably. Of 10 subjects in which the convulsive phenomena occurred on the first day of the disease not one escaped. Of 5 subjects in whom these symptoms appeared on or after the second day, 4 escaped. One of the favorable cases occurred in a boy seven years old, who had a general convulsion, lasting several minutes, on the second day of the attack; this was followed by delirium and coma alternately, but no return of the convulsions. The case was a most violent one, and lasted six weeks, leaving the child at the termination very deaf, but otherwise in good health. The second case occurred in a child five months old. The convulsive symptoms appeared on the ninth day, and consisted of strabismus, spasmodic retraction of the head, and occasional slight spasms of the limbs. They alternated with coma, and disappeared on the tenth day, until the seventeenth and eighteenth, when the strabismus reappeared. The child recovered perfectly. The third was that of a very healthy and vigorous boy between eight and nine years old, who, on the second day of an attack which had begun like a severe cholera morbus, had, twice, fits of insensibility, with stiffening of the extensor muscles of the fingers, rigid contractions of the flexors of the arms, and spasms of the eyeballs. This case

proved afterwards very violent, so that the patient nearly died on the fifth day, with asphyctic symptoms caused by very great swelling of the tonsils and fauces, and enormous enlargement of the external cervical lymphatic glands, complicated moreover with extensive acute œdema about the chin and front of the neck. These symptoms were followed again by diphtheritic deposit covering the whole of the pharynx. He finally, however, recovered, perfectly. The fourth case was that of a boy between five and six years old, who, on the second day, had an attack of general convulsions, which were repeated frequently on the third day. This patient continued very ill for several days, and when, at last, he began to improve somewhat in the middle of the second week, it was found that he had lost entirely the power of speech, and all control over nearly the whole of the locomotor apparatus of the body. He could neither lift his head nor turn it; the legs were immovable; the hands were perfectly helpless. The only motion that remained was a jerking, apparently almost automatic, movement of the arms upon the shoulders, and the forearms upon the arms. But even these were most irregular, and badly co-ordinated. He was very much in the condition of a new-born child. It was very difficult to ascertain what the condition of his senses was; but after a short time we were able to satisfy ourselves that he saw and heard, and only after many weeks was he able to hold a very light object in his fingers, then to move his head from side to side, and at a still later period to hold it up. At the end of about two months, he could sit in a chair when once placed in it, but could not sit on the floor unsupported. At the end of three months he was learning to walk by being held up by the arms. He had never spoken a word. The only approach to anything like articulation was his ability to hum a low gentle musical note; his intellectual faculties, as exhibited by signs, had regained their natural condition at this time. At the end of ten months, he could speak intelligibly some three or four words. The fifth case was that of a male infant, nine months old, who, on the second day, had severe general convulsions, followed by very deep drowsiness. The eruption became intense, and, on the third day, the convulsive symptoms recurred from time to time, but with less violence. On the fourth day he seemed somewhat better, but on the fifth very severe anginose symptoms set in, and he died.

Again, in 20 of the 61 grave cases, severe and more or less prolonged delirium or coma occurred, and of these 14 died. We may conclude, therefore, that convulsive symptoms appearing early in scarlet fever indicate a highly dangerous and, in all probability, a fatal attack; while severe, and especially prolonged delirium or coma, are also extremely unfavorable symptoms, but somewhat less so than are those of a convulsive character.

Other unfavorable symptoms are: extremely frequent or very violent pulse; intense heat or unnatural coolness of the skin; persistently elevated temperature after deflorescence; deficiency or sudden disappearance of the eruption; a livid or purple tint of the eruption; slow and imperfect capillary circulation, as ascertained by pressure; the appearance of petechiæ, ecchymoses, or hæmorrhages; violent vomiting and colliquative diarrhœa;

great violence of the throat affection, whether from tumefaction, great abundance of pseudo-membranous exudation, or disposition to ulceration and sloughing; and lastly, severe coryza or otorrhœa. A disposition to a typhoid state, indicated by dulness of the intelligence, dusky hue of the skin, frequent and feeble pulse, dry, brown tongue, sordes on the teeth, meteorism, and disposition to diarrhœa, is always dangerous.

When, on the contrary, the fever is moderate, the cerebral symptoms absent or very slight, and the eruption regular, and of a bright tint; when there is no disposition to typhoid symptoms; when the throat affection is mild, and the disease pursues a regular, uniform course, we have every reason to expect a favorable termination in a large majority of the cases.

In addition to these remarks it may be said that neither age, sex, nor social position influence the prognosis. A delicate constitution does not seem to predispose to a violent attack of scarlatina, and indeed, many of the most malignant cases occur in very robust children; but, on the other hand, it has been noticed that in certain families there exists a strong tendency for the disease to assume a grave and fatal form.

Treatment.—*Hygienic treatment.*—In all cases of the disease, whether of the mild or grave kind, the strictest attention should be paid to the hygienic condition of the patient. The room in which the child is placed ought to be, if possible, large, and at all events well ventilated. The temperature in winter should be carefully attended to. We usually direct it to be kept at from 68° to 70° F., during the early stages of the disease, unless the fever is violent and the child complains of heat, in which case it may be allowed to fall to 66°, or even 62°. The clothing ought to be moderate, not enough to increase the heat of the skin, nor yet so little as to endanger chilliness. During the latter stages of the disease, when the fever has subsided, and particularly when the heat of the skin has fallen, the temperature of the chamber ought to be kept, as a general rule, at from 68° to 70°, and, when the child is pale, weak, and chilly, it may be maintained with great propriety at 72°.

One of the most important points in the treatment of scarlet fever is, undoubtedly, the management of the patient during the convalescence, and especially during the desquamative period. It is during this period that the child is liable, as we have already shown in our account of the different complications and sequelæ of the disease, to dropsy, which is the most frequent, and at the same time the most dangerous accident to which the patient is exposed. There can be no doubt, we think, from the opinions expressed by various writers, and also from our own experience, that the most common cause of this accident is exposure to cold. Chilling of the body, no matter how produced, is exceedingly apt, when it occurs within three, or, more rarely, four weeks from the invasion of scarlet fever, to be followed by a more or less marked attack of some form of dropsy. It is true, we are well aware, that dropsical effusions sometimes take place in subjects who have been guarded in the most careful possible manner, and in whom there has been no evident exposure to cold; but it is also true, that a much larger number of those who have been thus guarded, escape, than of those who are not thus taken care of. We have, therefore,

no doubt whatever, that it is most wise and prudent to confine the patient to well-warmed rooms, or at least to the house, for twenty-one or twenty-eight days from the outset of the disease. The fact that the attack has been a slight one only makes it the more necessary to carry out this regulation, as it has been found by experience that dropsy occurs more frequently after mild than after severe attacks. M. Legendre (*Recherches Anat.-Pathol.*, p. 311) is of opinion that the patient ought not to be allowed to leave the house until the skin, completely deprived of the old epidermis, shall have regained its suppleness, its smooth and polished appearance, and all its functions. When, therefore, after a mild case, the desquamation is completely terminated in three weeks, the patient, he thinks, may be allowed to go out. But, on the contrary, this period would be too short by one-half, if the eruption had been very intense, as the desquamation is, in such cases, scarcely finished on the hands and feet at that time. Our own opinion, as already stated, is, that in the cool seasons of the year, the patient ought to be restricted to the house during full four weeks.

Treatment of Mild Cases.—Mild cases of this disease, those in which the eruption is moderate in degree, the temperature but little above the normal point, even though the pulse be very frequent, in which neither delirium, stupor, nor unnatural jactitation betray threatening conditions of the nerve-centres, need but the simplest treatment. The child must be confined to a comfortable, well-ventilated room, and cooling drinks, as cold water, lemonade, or orangeade, should be allowed, and indeed they ought to be recommended, and the nurse should be made to understand that she is not to wait until a young child calls out for drink, but that she is to offer it frequently. Young children, or at least some, seem not to know when they are thirsty or hot or cold; they have not yet learned to express their sensations in words, and a wise nurse or physician will act for them.

In all cases in which there is heat of skin and frequent pulse, and these conditions attend all but a very small fraction of the whole number, the patient ought to be kept in bed whilst the fever lasts, and for two days afterwards. This point in the treatment of all fevers is a most important one, and is too often neglected. Cases so treated are apt to be shorter in their duration, milder in their symptoms, and less likely to be followed by any of the troublesome sequelæ so prone to occur, as inflammations of the cervical glands, of the ear, or of the kidneys.

In many mild cases no drug whatever is needed. If the bowels are positively costive, that is to say, if they are not moved every second or third day spontaneously, a simple enema, a dose of syrup of rhubarb, a baked apple, or stewed prunes, will suffice. If the temperature is high, the pulse active, and the patient restless and suffering, sweet spirits of nitre, solution of the acetate of ammonia, or two or three grains of the citrate of potash, with from a half to one drop of deodorized tincture of opium, every two or three hours, according to the age, will usually lessen the heat and promote quiet. We wish to repeat, however, our opinion that in a great many cases of this type, no drugs whatever are necessary. The time is fast coming when even the vulgar and illiterate will no longer

quarrel with the physician because he gives no drugs, not even in infinitesimal doses, and the time has come when the wise and educated trust the intelligent physician, so that he need no longer give placebos merely for the sake of seeming to earn his fee.

The diet in these cases should be, for the first five or six days, in great measure liquid. Milk, with or without some farinaceous substance, to suit the tastes or habits of the patient, or with bread and butter, beef or chicken soup, with rice or bread, are sufficient. After five or six days, when no severer symptoms have made their appearance, and the disease is on the decline, light meats, eggs, stewed fruits, or potatoes, may be added.

Baths, tepid or warm, or spongings with tepid or warm water, cloths wetted with cold or tepid water, applied to the forehead, may be used, according to the judgment of the physician. They are not necessary agents, but in certain cases, when the heat of skin tends upwards, when the patient is very restless from nervous irritation, and particularly if the child is in the habit of being bathed, they may be used with much advantage and comfort.

The throat, in mild cases, rarely needs any special treatment. If, however, the patient complains of pain, if there be some uneasiness in swallowing, or if decided patches of exudation make their appearance on the tonsils or pharynx, it will be well to let the child gargle, if it be old enough, with solution of chlorate of potash or alum or with flaxseed tea. An excellent gargle is one made of a wineglassful of table claret, two wineglassfuls of water, and forty grains of chlorate of potash. If the patient is too young to gargle, some chlorate of potash or alum can be mixed with powdered sugar, and a small pinch placed upon the tongue every two or three hours. One part of the chlorate or alum may be rubbed up with five or six parts of the sugar. There is no necessity for the application of strong agents of any kind to the throat. Even though patches of exudation of considerable size appear upon the fauces, they will disappear spontaneously in all cases of the kind we are discussing. We object to the forcible application of medicinal solutions to the throat in young children, unless they are absolutely necessary to clear the passages of obstructing viscid and offensive secretions. In children of a certain type—those of sensitive nerves and strong wills, in whom fear of pain on the one hand and will to resist on the other form a combination which prompts the child to resist such an operation to the last—even though we might hope some benefit from the application, the irritation and exhaustion caused by the struggle, and the agitation kept up by its expected renewal, will do more harm, we think, than the treatment can compensate for.

Inunction, as one of the means of treatment in scarlet fever, is now so well known that we suppose nearly all physicians use it. For our part, we order the ointment for external use just as regularly nowadays as we do cold drinks and proper food.

It was first proposed and strongly urged, we believe, upon the profession, by Dr. Schneeman, a German physician. Dr. Schneeman makes use of bacon fat. He takes a piece about as large as the hand, still covered with its rind, in order to obtain a firm grasp upon it. On the soft side of

the piece slits are made in various directions in order to allow the oozing out of the fat. The patient is to be rubbed with this as soon as we are aware of the nature of the case, from head to foot, excepting the face and scalp, every morning and evening. The rubbing is to be so performed that the skin may be regularly but not too quickly saturated with the fat. During the process only the part being rubbed is to be uncovered, or the whole can be done under the bed-clothes. (*Ranking's Abst.*, No. 12, p. 26.)

For our own part, we used the bacon fat but twice, soon finding how disagreeable an application it was, and not believing that the salt it contained could do any good whatever. We now always employ an ointment made by rubbing together a drachm of pure glycerin with an ounce of cold cream (untg. aq. rosæ). We have seen children smeared from head to foot with lard, and, what is worse, with goose-grease, with their clothing saturated, their pillows and sheets a mass of discolored grease, most offensive to the eyes and nostrils. This is quite unnecessary. Our own method is to explain to the mother or nurse that she must take a little of the ointment above recommended in the palm of the hand, and with this rub gently the various parts of the surface, first one limb, then another, and then the body. The ointment should be rubbed in with gentle pressure, and it is well, we think, to knead and squeeze lightly the various portions of the body being anointed, as is done in the use of the *massage* of the French, or by the "rubber" of the English. These manipulations assist, we think, the capillary circulation, which is often a good deal impeded. After applying a moderate amount of the ointment, while the skin is well softened and oiled, any excess of the material should be wiped off with a soft towel or handkerchief. In this way the anointing is thoroughly accomplished, and yet the clothing and bed linen are not so soaked and saturated with the oleaginous substance as to be disagreeable to the patient, nurse, or mother.

There can be no doubt, at the present time, that the employment of inunction in scarlet fever has proved a most useful addition to our former means of treatment. In our hands it has had the effect of allaying, in all cases, the violent irritation caused by the intense heat and inflammation of the skin. In nearly all cases, it sensibly diminishes the frequency of the pulse, and in many this effect is very strongly marked. It removes, of course, the dryness and harshness of the skin, keeping it, instead, soft and moist. It lessens or even removes the burning, irritation, and itching caused by the eruption. By these effects, to wit, lowering of the pulse, and alleviation of the external heat, dryness, itching, and irritation, it cannot but, and evidently does modify and diminish, most happily, the injurious effects of the disease upon the constitution at large. So great is the comfort it gives to the patient that we have several times had young children, still untaught to speak, to make signs and motions, at shorter or longer intervals, showing their desire to have the application renewed. The frequency of the application must depend upon the case. When the eruption is intense, the skin very hot, and the febrile symptoms marked, they should be made every two or four hours, or even oftener. In milder

cases they need to be repeated only three or four times in the twenty-four hours.

Treatment of Grave Cases.—The most dangerous cases of this disease are those of the type described at page 720, in which the attack is sudden, and in which disorders of the nervous system in the form of convulsions, tremors or rigidity, retraction of the head, delirium, stupor, or coma appear within a few hours of the onset. When this type of the disease attacks very young children, they, so far as we have seen, nearly always die in sixteen, twenty-four, or forty-eight hours. Older children have more chance of escape, but, even in them, the danger is extreme.

We have seen everything tried in these cases, from depletion by bleeding and leeching, many years since, to expectancy, and must confess that we have little faith in the power of human agency to contend against this particular array of symptoms. Depletion is no longer, we believe, thought of by any, and there is often no time for the action of drugs.

It is in such cases that the use of water at different temperatures, and applied in the form of baths, affusions, packings, ablutions, and ice has been recommended, and has seemed in some cases to do good. We shall give a rapid sketch of the opinions of those who have used these means, and then state our own views.

Dr. J. Currie, of Edinburgh, was the one who first and most prominently brought before the profession the use of cold water in this disease. It must be observed, however, that Dr. Currie limits its use to cases to which he applies the term anginose, many of which, we doubt not from his description, ought to be classed as mild cases. He mentions another class of cases which he thinks ought rather to be called "purpurata," characterized by "extreme feebleness and rapidity of the pulse, and great fetor of the breath. . . . . The heat does not rise much above the standard of health. Great debility, oppression, headache, pain in the back, vomiting, and sometimes purging, accompany its rapid progress; the patient sinks into the low delirium, and expires on the second, third, or fourth day. . . . . The cold affusion is scarcely applicable to it, and the tepid affusion makes little impression upon it. In my experience, indeed, all remedies have been equally unsuccessful. It outstrips in rapidity, and it equals in fatality, the purple confluent small-pox, to which it may be compared." (*Currie's Med. Reports*, Philada. ed., p. 277.) It is clear, therefore, that Dr. Currie, when he speaks of nearly invariable success in upwards of one hundred and fifty cases (p. 286), had to do, not with the malignant, or, at least, not with the most malignant forms, for which we are seeking a remedy, but with cases of a mild form, or at most with those of the severe anginose type. Indeed, at page 294, we find the following remarks: "It has come to my knowledge, that in two cases of scarlatina, of the most malignant nature, the patients have been taken out of bed, under the low delirium, with the skin cool and moist, and the pulse scarcely perceptible. In this state, supported by the attendants, several gallons of perfectly cold water were madly poured over them, on the supposed authority of this work! I need scarcely add that the effects were almost immediately fatal." We have been induced to enter thus much into detail,

in regard to the use of cold affusions, because of the intrinsic importance of the subject, and because of the remarks upon it in the work of MM. Rilliet and Barthez, who bring forward Currie's success as a strong argument in favor of their employment of them in that form of the disease in which cerebral symptoms predominate. Currie does not recommend them, however, except in cases in which the reaction is full and strong, as indicated by very great heat of skin, scarlet eruption, and rapid, but not feeble pulse. In the famous cases of his own two children, it is evident that the attacks were not malignant, for the skin was very hot (108° and 109° F.), and no mention is made either of stupor or delirium, much less of convulsive phenomena. Dr. George Gregory, of London, whose opinions upon all matters connected with the eruptive fevers are of course worthy of great weight, says (*Lect. on the Eruptive Fevers*, edited by Dr. Bulkley, New York, p. 190), in relation to the use of cold affusions: "Sanctioned by my uncle, the late Dr. Gregory, of Edinburgh, this plan has been amply tried in all parts of the world, but it has not realized the expectations of its proposer.

"The truth is that the cold affusion is applicable only to a small number of cases. It is adapted for young people with high anginose inflammation and a burning hot skin, without plethora, without depression of nervous energy; but it is inapplicable to the scarlatina of adults, accompanied with coma, phrenitis, or marked debility. It is wholly unfit for cases of cynanche maligna. It answers its purpose very well for the first day or two, but it is often impossible to continue its use. Lastly, it seems to increase the disposition to dropsy."

Dr. Currie's method of using water was by effusion. The child is undressed and placed erect or sitting in a tub, while four or five gallons of water, at from 60° to 70° F., are poured over the head and body. The good effects of the remedy are said to be an immediate reduction of the heat, a diminution in the rapidity of the pulse, which, in one of Dr. Gregory's children, fell in half an hour after the cold affusion from 160 to 120, a disposition to sleep and quiet, and, according to Dr. Gregory, a seeming arrest of the throat affection. These good effects of the affusions are transient, however, as the heat of skin and rapidity of the circulation return in the course of one or two hours. For this reason it is necessary to repeat them frequently, once in two or three hours at least, in order to render the effects permanent. Currie used fourteen affusions for one of his own children, and twelve for another, in thirty-two hours. These were not, however, all cold. Gregory used for his child five "good sousings," to use his own words, in twenty-four hours.

MM. Rilliet and Barthez give, in the following words, the conclusions of Henke in regard to the use of cold affusions: 1. Cold affusions are not adapted for a *general* method of treatment. 2. The slight, or simply inflammatory forms, do not all demand so energetic a treatment. 3. Their employment must be reserved for cases in which the disease is epidemic, and accompanied by intense heat and dryness of the skin, with smallness and acceleration of the pulse, and for those in which the cerebral symptoms are very violent and characterized by great restlessness, alternating

with drowsiness, commencing from an early period of the disease. Scarlet fever under these circumstances is so dangerous, they say, and so often mortal, that recourse ought to be had to all curative means, and in children the cold affusions are much more strongly indicated than bleeding (*op. cit.*, vol. ii, p. 653).

Dr. Hiram Corson, of Montgomery County, in this State, has, so far as we know, used cold externally more boldly than any one in this country. He began this treatment in 1844, and, in a report made by him to the Pennsylvania State Medical Society, "On the External Application of Ice to the Throat as a Remedy in Scarlet Fever and Diphtheria" (see *Transact. of the Med. Soc. of the State of Pennsylvania, for the year* 1864), declares his unabated faith in the excellence and safety of the treatment. He advises, in cases attended with convulsions, the pouring of cold water from a height of a few feet on the head for several minutes at a time,—this to be repeated every fifteen or twenty minutes until relief is obtained. At page 467, he says: "Hundreds of times have I had patients brought to the side of the bed and cold water poured freely over the head, until the stupid, almost comatose child, was yelling, and kicking, and striking to get rid of the falling water; and this I have repeated whenever the symptoms called for its repetition." He prefers in these cases the cold affusion to ice. He also applied pieces of ice wrapped in cloths, to the neck, when the anginose symptoms were severe, and, when the temperature was very high, washed the whole body with iced water, until the heat was reduced.

Dr. Corson, in this article, speaks with the greatest possible confidence of his treatment, and when others evince some dubitation as to the invariable success of the cold treatment, avers that they had used it imperfectly or with timidity. It is really unfortunate that his paper deals altogether in general assertions. At page 458, he says: "And now, after twenty years of experience in the use of it, and after treating scores and scores of cases, I am most happy to say that I have never seen the least injury produced by it, but, on the contrary, regard it as the means, above all others, of comfort and safety to the patient." He does not refer to a single fatal case during the twenty years he has been using this system. At page 453, however, he speaks of having "during the whole winter, in about one hundred cases, continued the treatment in degrees apportioned to their mildness or severity, and without the loss of a single patient thus treated."

Nevertheless his experience is valuable, for it shows that, in some cases, at least, the use of means which reduce rapidly the heightened temperature of the body in scarlet fever, acts as favorably as it has been found to do in the hyperpyrexia of sunstroke, rheumatic fever, and in continued fevers.

Hillier (*Dis. of Children*, p. 326) states that he has employed cold affusions with good effects in a few malignant cases. He used water from 70° to 75° F., wrapping the child immediately after the affusion in dry blankets. He adds that "in cases of collapse with cold extremities, it would not be prudent to resort to the operation."

Trousseau (*Clin. Med.*, Syd. Soc. ed., vol. ii), recommends cool or cold affusions when dangerous ataxic nervous symptoms make their appearance.

At page 198, he says: "I declare to you that I have never resorted to the employment of cold affusions without obtaining beneficial results. I am far from pretending that all my patients recovered: like my colleagues, I have lost the greater number, but even those who died experienced a temporary relief from suffering, and the affusion, so far from proving injurious to them, always moderated the symptoms, and also seemed always to retard the fatal termination." At page 206, he states that he does not use them indiscriminately in all cases, but only "to subdue serious nervous complications—formidable ataxic symptoms."

Dr. Gee (Reynolds's *Syst. of Med.*, vol. i) speaks of the cold affusion as being sometimes useful in the malignant form of the disease, attended with delirium, diarrhœa, vomiting, full pulse, and great heat of skin. He adds, however (p. 355), that in the "primary adynamic form, all treatment will be baffled. The cold affusion is the only means which has seemed to me to be of even momentary benefit."

We shall now refer to our own experience in the employment of external cold. We never use it to its full extent except in really dangerous cases. So long as the case is mild or moderate, or even severe, if there be no cerebral, and especially no locomotor disturbances, we deem it unnecessary, and rest content with more simple means; or we use simply ablutions with tepid or cool water, with cold applications to the head, so long as they are agreeable, and until the temperature is reduced. But, when the temperature rises very high (105°), or, as Currie states in one case 112°, and Dr. Woodman (Wunderlich on *Medical Thermometry*, Syd. Soc. ed., p. 204, footnote), 115° F., with nervous symptoms, the danger is extreme, and we have used, and shall use heareafter, means to reduce the heat. In one case we made repeated affusions upon the head with water at 70°, pouring at one time seven bucketfuls upon the part. This was a case attended with coma, strabismus, and spasmodic retraction of the head. In addition to the affusions, cloths dipped into iced water, were kept applied the greater part of the time. These means, especially the affusions, were evidently advantageous, and the child recovered.

We have made use of lotions with cool water (70° to 72°) in three grave cases. In two they were evidently useful; in one they did no good, and were perhaps injurious, as we believe now that the case might have been better treated with prolonged warm baths at a temperature of 92° to 95°, cold to the head, and internal stimulation. The latter case was one in which the patient had two convulsions on the first day, and one on the second. The pulse rose at once to between 160 and 170; the head and trunk were very hot, whilst the extremities were coolish; the child was either excessively dull or comatose. Cloths wet with iced water were kept constantly upon the head and the body, and occasionally the limbs were sponged with cold water. The internal remedies consisted of carbonate of ammonia and milk punch. The patient improved decidedly on the third day, so that the pulse came down to 152, the intelligence returned, though the child was still very drowsy and heavy, and the case looked quite promising. On the fourth and fifth days, the throat affection came on; the neck and throat swelled enormously, the cervical lymphatic glands became very

large, the nasal passages discharged streams of offensive grumous pus, the ears ran copiously, the fauces became pseudo-membranous, the deglutition grew worse and worse, until at last it was impossible, and the child died on the middle of the sixth day, a mass of the most disgusting and offensive disease. One of the grave cases in which the cool applications proved useful, occurred in a hearty, vigorous girl, twelve years of age. On the third day of the attack, the symptoms were as follows: the pulse was between 160 and 170, small and quick; skin intensely hot; eruption very copious and of a dark red color tending to violet; capillary circulation slow and languid; tongue black, and covered with a hard, dry crust; teeth and lips dry, and covered with dark incrustations. There was very great agitation and restlessness, with constant moaning and complaining, and total insomnia. Under these circumstances, we directed the nurse to sponge the head and extremities of the patient with water of the temperature of the room (68° to 70°). As the water became heated by contact with the skin, small pieces of ice were put into the basin so as to keep the temperature at the point mentioned. At the end of four hours, the washing having been continued all the time, we found the patient decidedly more comfortable. The pulse had fallen to 140, and increased in volume; the heat of skin was much reduced; the color of the eruption had improved, having become much more scarlet in tint; the capillary circulation was more active; the agitation and restlessness had very much moderated, and the child had slept somewhat at short intervals. This treatment, in conjunction with the internal administration of the solution of chlorinated soda, and small doses of spirit of turpentine, was continued for several days, the sponging being used whenever the heat and restlessness were great, and the pulse very rapid. The child convalesced about the end of the third week, but was unfortunately seized with uræmic symptoms on the twenty-fifth day, and died in twenty-three hours, after the most frightful convulsions we ever saw.

Since the publication of the last edition of this work we have seen but little grave scarlet fever, and our experience as to the exact value of cold has not been much increased. It was used by our advice in the following case, of the most violent type, to which we were called in consultation.

Case.—The patient was a girl, two years old, who, seized in the morning of one day with vomiting, fever, and restlessness, had, during the following night, hot fever, violent jactitation, and moaning. She refused all food. Next day, at 9 A.M., when we saw her, she was imminently ill. She knew no one, paid no attention to father or mother, tossed incessantly about the bed or in their arms, so that it was almost impossible to hold her; and at times had rigid contractions of the muscles, like those in tetanus. The features were drawn and rigid; the pulse running upwards of 180, very feeble and small; the skin very hot, but there was no eruption. The latter fact might throw some doubt on the diagnosis; but the character of the symptoms, the rapid fatality, and the fact that a few days afterwards two children were seized with distinct scarlet fever in the house opposite, leaves no doubt in our own mind. The prognosis was as bad as it could be, and so we announced, but added that external cold ought to be tried. The body temperature was very high, and we directed basins of water with ice in it, as used by Dr. Corson, to be prepared. Towels wrung out of this water were kept on the head, and the body and limbs sponged

with the same until the heat fell, when the washings were suspended temporarily, to be renewed when the heat rose again. The treatment was carried out very correctly, as there was a medical man present all the time, but it was of no use whatever. The child died at 12 M. of that day, in a little over twenty-four hours from the onset.

This case was not a fair test of the value of the treatment. The cold was applied too late to show clearly what may be its power. But we confess that its total failure, though used within twenty-four hours of the inception of the disease, is a melancholy proof of the extreme danger of such cases.

A second case, which occurred about the same time, also shows the violence of this form of the disease.

CASE.—A very healthy girl, within a few days of two years old, whose sister and two of whose cousins had been ill with scarlatina in the same house for some ten days, was seized at six in the morning with vomiting. She then slept for a time and vomited again. At 9 A.M. she had a convulsion, which lasted, with short lulls, during which she was comatose, until 6 P.M., when one of us saw her in consultation. She was then very hot, covered with a copious, dark, dingy eruption, and insensible. Despairing of any other treatment, we advised cold externally, and arranged for its use by a physician, with the thermometer as a guide. Before the treatment could be commenced, the child became again convulsed and died.

After thus stating the conditions under which we think external cold may be properly used, we must protest against its indiscriminate use in all cases of dangerous scarlet fever. If the reader will glance back at page 748, he will see what Currie thought of the rash use of his cold affusions, and what Dr. Gregory also states of the effects of cold.

When the body, instead of being hot, is cool—when a dingy and stagnant capillary circulation shows a feeble and struggling heart, it would be most dangerous to use cold. Here the warm or tepid bath or affusion should be used, or warm mustard foot-baths may be resorted to every two or three hours. If, even whilst the body and limbs are cool, the head is hot, it would be proper to apply cold by cloths or affusion to that part, whilst the body is immersed in warm water or wrapped in proper coverings.

The true guide as to the propriety or impropriety of using cold is, none can doubt now, to be found in the thermometer. The method followed by Drs. Wilson Fox and H. Weber in the cases of hyperpyrexia occurring in the course of rheumatic fever is the one which we propose to use ourselves and to recommend to others. It is the only scientific one, and therefore the one which can be accurately described and followed. If errors occur, they can be definitely stated and afterwards avoided. If successful, the exact means which led to success can be ascertained and communicated in precise language. Dr. Fox published his cases first in the London *Lancet*, and then presented them in a separate form as an essay, "On the Treatment of Hyperpyrexia, as Illustrated in Acute Articular Rheumatism, by Means of the External Application of Cold;" Macmillan & Co., London, 1871. Dr. H. Weber's case is to be found in the *Transactions of the Clinical Society of London*, vol. v, p. 136, under the title of "A Case of Hyperpyrexia

(Heatstroke) in Rheumatic Fever Successfully Treated by Cool Baths and Affusions."

The first point to be determined is the degree of temperature which becomes dangerous to life, and to prevent or reduce which we may and ought to resort to the application of cold externally. Of course there is but one certain guide to the temperature of the human body,—the thermometer. A practiced hand may be relied on when no thermometer is to be had; but no hand, however experienced, can give the certainty of the thermometer. Inasmuch, too, as the state of hyperpyrexia is always attended by concomitant phenomena of a peculiar kind, these, to the experienced physician, will assist in guiding him in his treatment. These phenomena constitute the group called ataxic or adynamic nervous symptoms. The patient is usually delirious and restless or comatose, and not unfrequently has local or general convulsive movements; the pulse is frequent and feeble, and sometimes so small as to be felt with difficulty, and the capillary circulation is sluggish and congested; the respiration is usually hurried and embarrassed, so that the patient is readily judged to be in extreme danger.

According to Dr. Fox, a temperature in rheumatic fever which rises suddenly from 103° or 104° to 107°, 108°, or 109°, has usually proved fatal within a very short time after the latter temperature (109°) has been reached. He, however, saved one patient, by external cold, in whom it reached 110° in the rectum. Dr. H. Weber thinks that until the cold treatment was used, a temperature of 108° had been nearly always fatal. Dr. Fox asks the question, After what degree of temperature attained by the human body in febrile states is recovery naturally possible without medical interference? He states that the highest recorded temperature he knows of after which recovery has taken place (with the exception of relapsing fever), was in a case of tubercular pneumonia, in which it rose suddenly from 105° to 108°, and then suddenly fell to 104°. He refers, of course, to cases not treated by cold, since, as stated above, he himself saved a case in which the temperature had reached 110° in the rectum.

It must not be forgotten that the axillary temperature is less than that of the mouth, under the tongue, and that this is less than that of the vagina or unloaded rectum. Wunderlich gives the averages in the adult as follows: For the axilla, 98.6° F.; for the mouth, 98.78° to 98.96°; and that of the vagina or unloaded rectum, 99.14° to 99.5° F. In children the temperature is more variable, but does not differ very greatly from that of the adult. M. Roger gives 98.97° as the average axillary temperature between 4 months and 6 years, and 99.15° between 6 and 14 years. Dr. Finlayson, in 21 children under 6 years, found the morning temperature in the rectum to be 99.41° F.

Such being the normal temperatures, we will now give those which have been observed in scarlet fever. Wunderlich (*Med. Thermometry*, Syd. Soc. ed., p. 348) says that the height reached by the temperature in scarlet fever is almost always above 104° F., very commonly over 104.9°, while in cases which terminate favorably it seldom exceeds 105.8° F. The translator of Wunderlich (Dr. Woodman, footnote, p. 221) gives the noon temperature

of typical non-malignant scarlatina in a good many cases as 105°, 104°, 103°, and 102°, on the first, second, third, and fourth days. In a note at page 204, he states that he has put on record (*Med. Mirror* for February, 1865) some fatal cases of scarlet fever in which the temperature reached 115°. "The observations were made with one of Negretti and Tambra's thermometers, divided into fifths, which had been recently compared with a standard."

From these facts we may assume that a temperature of 105° F. in scarlet fever is not necessarily very dangerous to life, but that from the moment it tends to rise above this point, the patient enters into a very dangerous period.

If, with a temperature of 105°, there appear any of the nervous phenomena so often alluded to, delirium, drowsiness, coma, vomiting or purging, and especially any locomotor disturbances, the time has come for the use of external cold; and should the temperature continue to rise after it has reached 105°, the cold treatment ought to be resorted to, even though these nervous phenomena have not shown themselves, since they will be almost certain to appear should the temperature go on rising.

And next as to the best mode of applying cold. It does not matter much how this is done, if only it be so managed as to reduce with certainty the heat of the body towards the normal point. Dr. Fox used baths at different temperatures, and in one case applied ice to the chest and along the spine in an ice-bag, whilst he reduced the temperature of the bath rapidly from 96° to 66°. At other moments in the same case he used the ice-bag applied to the spine for several hours at a time, and on still other occasions employed the cold pack, wrapping his patient in a sheet wrung out of ordinary cold water (probably 60°). Dr. H. Weber placed his patient (a boy of 16) in a bath at 71° F., keeping him there the first time thirty minutes, when the temperature under the tongue had fallen from 108.2° to 101.8°. Some hours afterwards, when the temperature had risen to 105.8°, the patient was again put into a bath at 72°, and water poured over the back of the head and neck. In twenty-five minutes the temperature fell to 101°.

Dr. Fox says, at page 34: "I believe, however, that the bath may be altogether dispensed with, and that for the future it will be sufficient to place a Mackintosh sheet under the patients, so arranged that the water may escape into a receptacle, and to pour cold water over them from time to time."

Dr. Corson uses affusions of cold water over the head of the child, which is held over a tub, as the most powerful means in cases of coma or convulsions, and, when the temperature is very high, washes the whole body with iced water, or even rubs it with ice.

The most convenient mode, it appears to us, in children, will be either the one proposed by Dr. Fox, the Mackintosh sheet on the bed, and affusions of cold water; or a bath-tub or common large wash-tub, containing water at a temperature proportioned to the heat of the body, 80° to 70°, with affusions of cold water upon the head, or the application of towels wrung out of cold or iced water to the head. So soon as the thermometer,

held in the rectum or under the tongue, shows that the temperature has fallen to 101° or 102°, it will be best to remove the patient to bed between two blankets. Not unfrequently, as the temperature falls, the patient becomes partially conscious, grows paler, and shivers, and these are signs which show that it is time to cease, at least temporarily, the use of the cold.

The physician, when he first uses this mode of treatment, should know that the temperature is apt to continue to fall, even after the use of the cold has been suspended. Thus, in one of Dr. Fox's patients it fell from 103° to 99.4° after the removal from the bath. The danger to be apprehended from these continued falls in the temperature is not so great as might be supposed. Thus, Dr. Fox says that it may be doubted whether, in future cases, any external warmth may be necessary to prevent too great a fall of temperature. "Even severe collapse produced by cold has been shown by F. Weber's, Bartel's, and Ziemssen's observations on the pneumonia of children to be less dangerous than it at first appears." And Dr. H. Weber says, "Although the duration of the bath will be influenced in some degree by the temperature of the water, we must be entirely guided by the condition of the patient while in the bath; the heat of the blood ought to be reduced, if possible, to almost its normal degree, and the nerve-centres ought to be reduced to a more healthy condition."

After the heat has been once reduced by the cold to near its normal state, the patient must be carefully watched by means of the thermometer, and if the heat rises again, the cold should be reapplied. This may have to be done several times a day at first, and less frequently afterwards, if the treatment prove successful. It is not always necessary to resort to the bath in every rise of the heat. Cold to the head, affusions upon the head alone, the application of an ice-bag to the spine, or the use of the cold bath, may suffice to keep the temperature within the safe limits.

While the cold is being used to reduce the temperature, we may employ certain internal remedies with advantage. If the patient is not very much exhausted, we may make use of the antiseptic salts of Polli, to which reference will presently be made. But if the exhaustion be very great, if the circulation is rapid, feeble, and uncertain, with a dusky and congested skin, we should use brandy with milk, beef or chicken tea, and wine-whey. Dr. Fox used in the two cases which recovered (adults) very large quantities of brandy, from twelve to eighteen, and even thirty-three, ounces in twenty-four hours. He gave also large amounts of beef tea, two to three pints, and as much milk as three and four pints. In such cases quinia and carbonate of ammonia would also be proper means until the vitality is restored.

In a former edition of this work it was stated that we had used the *hyposulphite of soda or magnesia* in 11 cases, of which 2 were malignant in type, 3 grave, and 6 moderate. All these recovered. It was then said that so small an experience was of little weight in determining their value. Since that time we have used the same salts in most of the cases that we have seen. Only 4 of these could be called grave. They were not of the convulsive form, but exhibited high fever, severe anginose symptoms,

tedious duration, and copious desquamation. They were severe, but not malignant cases, and they all did well. In two cases of the malignant form, with profound adynamic nervous symptoms from the very onset, they were also freely used, but without effect. On the whole, we think these salts deserve a further trial. The soda or magnesia salt ought to be selected according to the state of the bowels. When these are constipated, the magnesia is to be used. In the contrary case, or when the bowels are in a relaxed state, we use the soda salt. The dose of either is five or ten grains, every two hours, according to the age. They are best given in solution in water, with a little ginger syrup.

There are a class of cases which, though they do not exhibit the extreme severity of those we have just considered, well deserve the name of grave. The temperature is high, the pulse rapid, the nervous system shows disturbance by extreme agitation or by drowsiness; there may be muscular starting, or tremors, or a single slight convulsion; the eruption is very abundant, and vivid or dark in tint, and the anginose symptoms are marked and severe. Such cases are dangerous; seldom last less than two or three weeks, and require all the care of the practitioner and nurse.

In this second grade of the grave form the temperature ought to be reduced, using the thermometer as a guide, at the beginning by the careful use of the cool or tepid bath, or by cool or tepid ablutions, and by the use of cold water or ice to the head. Internally, the hyposulphite salts or an alkaline febrifuge ought to be administered for the first few days. In addition to this, we may employ with advantage full doses of quinia or salicylic acid; both of which, and especially the latter, possess the property of greatly reducing the degree of febrile heat.

The patient often, indeed generally, in this class of cases, sinks after a few days into a low ataxic condition. Here the best remedies, we think, are chlorate of potash with muriated tincture of iron, quinia with muriated tincture of iron, or muriated tincture of iron with solution of acetate of ammonia and dilute acetic acid. Hillier thinks that in such cases the best medicine is carbonate of ammonia, and Trousseau also advises it strongly. These medicines may be given in the following modes:

℞.—Potass. Chlorat.,	℥j.
Tr. Ferri Chlorid.,	f℥j.
Syrup. Zingiberis,	f℥vij.
Aquæ,	f℥ij.—M.

Dose, a teaspoonful every two hours at five years of age, and under that age, half a teaspoonful.

℞.—Quiniæ Sulphat.,	gr. xij.
Tr. Ferri Chlorid.,	f℥j.
Syrup. Zingib.,	f℥v.
Syrup. Simp.,	f℥ij.
Aquæ,	f℥ij.—M.

Dose, a teaspoonful every two hours at five years, and under that age, half the quantity.

℞.—Tr. Ferri Chlorid., ... fʒj.
Acid. Acet. Dil., ... fʒj.
Liq. Ammon. Acetat., ... fʒvj.
Syrup. Simp., ... fʒss.
Aquæ, ... fʒiss.—M.

Dose, a teaspoonful every two hours at five years of age, and under that age, half the quantity.

The dose of carbonate of ammonia is from two to three grains every two hours at five years, given in a mixture of syrup and gum, or in milk and water.

In all severe cases attention to the diet is highly important. At first only milk and broths should be allowed. After a few days bread or some other farinaceous substance may be added. Until the fever has disappeared in great measure, no other diet ought to be permitted. The cases are very uncertain in their course.

Under certain conditions alcohol must be used as has already been said. When the tongue is dry, the skin harsh, the pulse rapid and feeble, the cardiac impulse weak, the muscular force prostrated, we use brandy or whisky, or wine in the form of wine-whey, or mixed with water. The choice between these agents must depend on the degree of vital, and especially of circulatory, prostration present, and the fancy of the patient. We use brandy generally, giving it in milk or water. From ten to twenty drops at the age of one or two years; from twenty to forty drops between two and five years of age; and after these ages from half a teaspoonful to a teaspoonful every two or four hours, or three or four times a day, according to the effects produced upon the pulse and nervous symptoms, are the doses we have found best. When wine-whey is preferred, one or two teaspoonfuls every hour or two hours, at two years of age, and a tablespoonful at the age of four or five and upwards, may be given.

Treatment of the Angina.—The angina is seldom troublesome before the third day. It never becomes, we think, a source of danger in itself, in the cases destined to end fatally on the first, second, or third day. But, when the case begins with grave nervous symptoms, and the patient survives these, the throat almost always exhibits, on the third or fourth day, the conditions which have already been described, and which partake so much of the character of severe diphtheria. The general treatment ought to be steadily persevered in,—that by the hyposulphites, or by the muriated tincture of iron, with or without chlorate of potash and quinia, as has been described. The local treatment should consist, in the early stage, of cold applications, if the constitutional state of the patient will allow of it. When the circulation is active, and the temperature of the body high, there need be no fear as to the use of cold. When, on the contrary, the heat is not high, it should be used with caution, and, if the temperature falls rapidly under its use, it must be abandoned, or used only from time to time, and with great care. When the temperature continues rather low, warm poultices, inclosed in portions of thin, soft flannel, and secured by a light cravat round the neck, may be tried. They may prove comforting to the patient.

When the cold is to be used, pieces of ice wrapped in flannel, and applied behind the angle of the jaw, or cloths wetted with iced water, may be employed. We have used the cold several times, and in two cases with marked benefit. In one case, which we shall relate, the effects were most striking.

CASE.—The patient was a boy between eight and nine years of age, who had had slight convulsive movements and delirium on the first day, violent jactitation and unconsciousness on the second and third days, with very active pulse, profuse dark eruption, and very high temperature. There appeared on the third day threatening anginose symptoms. On the fourth these had increased, and, by the night of the fifth day, had reached such a height as to make us almost despair of the child's life. The violent pharyngeal inflammation was attended with excessive swelling of the tonsils, and with œdematous infiltration of the submucous tissue, while externally the cervical glands were enormously enlarged and as hard as paving-stones, and the subcutaneous tissues of the front and lateral regions of the neck were packed and hard with acute œdema. The general symptoms were most threatening. Owing to the swelling of all the parts composing the neck, the respiration was so much interfered with as to cause the development of dangerous asphyctic symptoms. The pulse, which for the three first days had been running at 168, had fallen on the fourth to 140, and on the fifth to 128; the skin was hot and dry, and, upon the face, had assumed a dark, bluish tint; there was almost constant muttering delirium and a degree of tossing and violent jactitation painful to witness. The swallowing was so much impeded that it was with great difficulty that the patient could take the thinnest liquids. Up to this time the case had been treated with inunctions, cold drinks, and a febrifuge containing spirit of Mindererus and sweet spirit of nitre. In the midst of these threatening symptoms, and when we had almost lost hope, the late Dr. Charles D. Meigs, who saw the case with us, proposed abandoning all drugs, and making use of cold applications externally, and giving stimuli. Accordingly a large towel was wrung out of iced water and wrapped around the neck, and weak wine and water was given as often as the child could take it. The cloth was dipped afresh into the water every few minutes. This treatment was commenced about 1 A.M., and carried on steadily all night. At 9 A.M., it was evident that the symptoms had somewhat improved, and by the afternoon of that day the patient was greatly better. The improvement consisted principally in a moderation of the pharyngeal swelling, so that both respiration and deglutition were much easier. The dark color of the face had lessened; the pulse had risen in frequency, and was stronger; and the delirium and excessive jactitation had almost disappeared. On the day after this the external cervical swelling continued very much the same, except that the œdema had notably diminished. The pharyngeal swelling had disappeared, the tonsils having regained their natural size, but the whole pharynx was covered with a thick mould of white exudation. The cold application, which of late had been used more sparingly, was now discontinued; the fauces were touched with a solution of nitrate of silver of ten grains to the ounce; broths, milk, wine-whey, and wine and water were given for nourishment, and the patient slowly recovered, after having had a large suppuration just above the inner end of the left clavicle.

It was at one time very much the custom to make various applications to the fauces. Nitrate of silver, pure, or in strong solution, muriatic acid, or capsicum, were deemed necessary and useful. They have been very much abandoned, and we think wisely. The agitation and terror caused by them in some children, and the violent resistance they often make, exhaust the patient, and we therefore avoid them wherever we can. Some-

times, however, and especially in young children, viscous secretions collect in the fauces in such quantity as to cause serious annoyance to the child and embarrass the respiration: they ought, therefore, to be removed by means of a sponge-mop or camel's-hair brush. This point in the treatment is a very important one, especially in young children. We believe that we have rescued more than one patient by going three or four times a day to make use ourselves of means by which to remove from the fauces, the viscid, glue-like secretions, the purulent fluids, and the masses of pseudo-membranous exudation which collect in and occlude those passages, and which the child often cannot, by any effort of its own, get rid of. The best mode of effecting this object is by the use of mops, made of sponge or rag, fastened to a stick or whalebone, or by the injection from a small syringe or elastic bottle of detergent washes or gargles into the throat, the mouth being held open and the tongue depressed by the handle of a spoon. One of the best washes for this purpose is made of a strong decoction of green tea containing alum; or we may employ sage tea and alum; or honey of roses and borax mixed with water; or lime-water; or, what is highly recommended by Dr. Watson as one of the best, a solution of common salt. Muriated tincture of iron, one part to five or six of water, or to one of glycerin and five of water, is an excellent local application. In older children, gargles of salt and water, alum and water, chlorate of potash, in claret and water, or plain water, may, and ought to be used, when possible. In many cases, even in young children, it is possible to secure the inhalation of fluids vaporized by the steam atomizer. It will be found that the frequent inhalation of lime-water exerts a very favorable effect on the condition of the throat. When coryza is present, the nasal passages should be cleansed by means of camel's-hair brushes, or by the injection of some of the mild washes just referred to, and then freely anointed with sweet oil or some mild ointment, or they may be touched with the wash used for the throat.

Diarrhœa, when present, probably depends on congestion and desquamation of the intestinal mucous membrane, and should be treated with bland demulcent drinks, and absorbent antacids, especially chalk mixture.

Rheumatism should be treated by opiates to allay the pain, and the swollen joints should be enveloped in bats of cotton. If suppuration should occur, either in connection with the rheumatic inflammation of the joints, or involving the glands or cellular tissue, and indicating a pyæmic tendency, large doses of quinia with stimulants should be given. The abscesses which may form should be opened so soon as fluctuation can be detected.

For the *otorrhœa* which sometimes occurs, it is seldom necessary to do more during the violence of the attack, than to cleanse the ears twice or three times a day, by syringing with warm water and castile soap, or with a weak solution of alum. After the violence of the attack has subsided, this complication should be treated as in idiopathic cases.

Treatment of Dropsy.—It is our habit, when directing the general treatment of a case of scarlet fever, always to explain to the mother or nurse, or both, that the most frequent and dangerous sequel to be apprehended

in this disease is dropsy, that this is even more apt to follow mild than grave cases, and that it usually occurs in the third or fourth week of the disorder, though it does occur, on very rare occasions, at a still later period. We also assert our belief that this consequence, or complication, or sequela, is apt to be produced by cold, and that subjects confined to bed through the third and fourth weeks, and those rigidly secluded in a warm room for four weeks from the onset of the disease, no matter how mild the case, are much less prone to dropsy than they who leave their beds or rooms at an early period to take the usual chances to which children are exposed. We know well that Hebra ridicules the stupidity of English physicians in ascribing so many disorders to cold. But, whilst we believe with him that in England and amongst ourselves the word "cold" is often used both by medical men and by the public as a mere scapegoat to bear the weight of their ignorance of the real causes of diseases, we also believe, most emphatically, that chilling of the human body below its natural standard of heat, if it be continued for any length of time, is very apt to be followed by some disturbance of the health. We are quite sure that we have on several occasions, traced a relation of cause and effect between exposure to cold in the third or fourth week of scarlet fever and a rapidly sequent dropsy. Several such cases are mentioned in the section on the symptoms and causes of dropsy, at page 731. We always, therefore, urge upon the mother or nurse not to allow the child, in the autumn, winter, or spring months, no matter how mild may have been the disease, to leave a well-warmed and well-ventilated room for four weeks, and, if there be any signs whatever of ailing health at the end of the fourth week, to continue the seclusion for one or two more weeks. One of the troubles of our private medical career has been the contentions we have had with people in their hurry to get children, who have been sick, out of the nursery. In summer weather, this may be all very well, but in the cool and cold months it is not very well, as the bills of mortality and the experience of any older physician or experienced mother, will show. Why a child should lie abed for two or three months for a broken bone, without fear for his general health, and yet be regarded as a suffering martyr, because some tyrannical doctor insists upon his remaining a few more days or weeks in a comfortable chamber, with all the household at his feet, to escape a disease like acute Bright's disease, passes our comprehension.

Before leaving this subject, we wish to say that we have known dropsy to follow scarlet fever in one case, and only in one, in which the child had not left the bed. Two children, brother and sister, seven and nine years of age respectively, had each a full attack of scarlet fever,—the boy rather a severe one. At the end of the third week the boy, being perfectly well, was allowed to leave the bed in a warm room. In two days he was seized with scanty, albuminous urine and moderate dropsy. The girl, who had fallen sick several days after the boy, and who was small and delicate, was kept in bed continuously, and yet she too was attacked with dropsy. Both these cases proved very obstinate, and it was several months before they were recovered.

It is important to recognize the renal disease early. The mother should

be warned to send for the physician again, if he had resigned the charge of the case, should there be any delay or irregularity in the convalescence, and especially should she observe any unusual scantiness in the quantity of urine discharged; should this assume a dark and especially a brownish or blackish tint; should there be any fulness of the eyelids, swelling of the cervical glands, or, indeed, any departure from a regularly progressive return to health.

In all cases of scarlatinous dropsy, the patient ought to be put to bed at once, and kept there throughout the acute period of the disease. The diet should be restricted to fluids. Milk and animal broths or farinaceous preparations alone ought to be allowed. The patient should be encouraged to drink freely and often of water, lemonade, or orangeade, or sweet spirit of nitre and water. A hot bath, used once or twice a day, is, we think, an excellent remedy in the early stage. It is best used in the following mode: A portable bath-tub should be brought into the bedroom, if possible. This can always be done in the cases of young children. The water ought to be warm—96° to 98° or 100°. The patient ought to be fully immersed and kept in the water from ten to thirty minutes, the time being regulated by the degree of willingness of the child to remain, and by the effect of the bath on the system at large, as shown by the countenance and circulation. A soft cotton sheet is to be heated at the fire, and in this, when the patient is removed from the bath, he is to be carefully wrapped. Over this is to be put a light blanket, and thus wrapped in the two coverings, the child is to be laid in bed, or held in the arms, for half an hour or an hour. By this procedure sweating is generally induced. When this is over, the sheet and blanket may be removed and the child dressed in warm bedclothes again. The bath, carefully used in this way, once a day in slight cases, and twice or even three times in severe ones, has proved in our hands a most useful and soothing remedy.

In mild cases, without fever, the bowels ought to be kept soluble, no medicine being needed if they are moved spontaneously. If they are not, a little syrup of rhubarb or Rochelle salts will be all-sufficient. If the amount of urine is scanty, a diuretic ought to be used. The following combination is excellent:

℞.—Potass. Bitart., ... ʒj.
Spts. Junip. Comp., ... fʒij.
Spts. Æther. Nitros., ... fʒj.
Syrup. Simp., ... fʒv.
Aq. Fluvial., ... fʒij —M.
Give a teaspoonful every two hours.

In more severe cases, when vomiting, fever, anorexia, restlessness, rapid anasarca, scanty and dark-colored urine with blood, blood and granular casts, and a large proportion of albumen, all demonstrate a serious and extensive catarrh of the renal tubules, it is proper to use dry cupping to the loins, or in subjects of vigorous constitution, uninjured by the previous scarlet fever, we may take three or four ounces of blood from the loins by wet cups. If the cupping cannot be used, hot cataplasms of Indian mush

or flaxseed or bags of hot sand should be applied from time to time over the loins. The bowels ought to be kept open by rhubarb, Rochelle salts, or Seidlitz powder. A febrifuge and diuretic, such as the following, must be used;

℞.—Potass. Acetat., ... ʒj.
Tinct. Digitalis, ... fʒss.
Syrup. Scillæ, ... fʒj vel fʒij.
" Zingib., ... fʒv.
Aquæ, ... ad fʒiij.—M.

Give a teaspoonful every two or three hours to children two or three years old. For those above that age the proportion of the active ingredients should be doubled.

By these means the case should be treated for several days, until the fever subsides and the patient is no longer in present danger. When the fever is over, it is best to continue the above mixture, or something of the same kind, at longer intervals, and to give also one of the preparations of iron. Our own favorite is the mixture of muriated tincture of iron with acetic acid and spirit of Mindererus, or the simple tincture itself, in doses of from two and a half to five drops, according to the age, three or four times a day. If from any cause the tincture cannot be taken, wine of iron, or ferrated elixir of Calisaya bark, may be substituted, in half-drachm or drachm doses.

As the fever disappears, the food ought to be increased. This is, of course, more important than drugs, and ought to be strictly attended to by the physician himself at each visit. In some instances the most perverse irritability of the stomach attends the case for several days, so that the patient may almost or actually die of exhaustion. In such cases it is worse than folly to give drugs which are resisted with loathing, and vomited the instant they enter the stomach. Something must be chosen which at least does not clearly cause vomiting by its smell or taste. A mixture of wine of iron with syrup of Tolu and some aromatic water, chocolate of iron lozenges, or powdered metallic iron with white sugar, can often be taken even in these cases. A weak cream of tartar lemonade, flavored with lemon-juice, sweet spirit of nitre in lemonade, watermelon-seed tea, and such remedies may be used. In regard to details, as to the best method of feeding in such cases—on which, we desire to say, much more depends than upon drugs—we must refer the reader to the remarks on diet in obstinate sick stomach in chronic diarrhœa. We venture to hope that we have seen lives saved in cases of this kind by constant attention to little details of food and medicine, which must have been lost by any less constant care. In one instance the child was almost comatose, with total suppression of urine for five days, and the stomach so irritable that no remedy scarcely could be borne. Finally, under small doses of watermelon-seed tea, given frequently, mustard foot-baths, blisters behind the ears, and feeding with lime-water, milk and brandy, wine whey, chicken tea, and such preparations, the patient recovered.

Prophylactic Treatment.—It was formerly asserted that *belladonna*, used by persons exposed to the contagion of scarlet fever, had the power

of imparting perfect or nearly perfect immunity from its attack. The evident difficulty of determining a question such as this, in reference to a disease so uncertain and irregular in its mode of extension as scarlatina, long maintained a certain degree of doubt as to the possibility of the truth of this most unlikely assertion. We believe, however, that by common consent, all belief in the supposed efficacy of belladonna for this purpose has now been abandoned.

Dr. Brakenridge (*Medical Times and Gazette*, July 24th, 1875, p. 92) has given sulphocarbolate of sodium in doses varying, according to age, from five to thirty grains three or four times a day, to those exposed to the poisons of scarlet fever, diphtheria, and measles; and, although not feeling that his observations have proved the power of this treatment to prevent attacks of these diseases, he is inclined to attribute some prophylactic power to it.

In order to purify articles which have been exposed to scarlatina, they should be either put in boiling water or exposed to a temperature of over 200°, as we have seen that a temperature somewhat below the boiling-point of water destroys the activity of the virus.

ARTICLE VII.

MEASLES, RUBEOLA, OR MORBILLI.

Definition; Frequency; Forms.—Measles are an epidemic and contagious exanthem, characterized by catarrhal symptoms, continued fever, and an eruption, generally on the fourth day, of a crimson rash, in the form of stigmatized dots, like flea-bites, slightly elevated, which coalesce into irregular circles or crescents. It ends about the seventh day by desquamation.

The frequency of the disease is very irregular in different years, because of its epidemic nature. Thus, according to the mortality tables of the Board of Health, there have been 2279 deaths from measles in this city during the sixty years ending with 1870. In five of these years, as will be seen by a reference to the table at page 702, there is not a death recorded from this cause, while, on the other hand, the annual mortality exceeds 100 in eleven years, and 200 in two. During the same period, the deaths from scarlatina in this city, as already stated, amounted to 13,016.

Measles are probably a more common though a less fatal disease, and attack a larger number of persons than scarlet fever; thus, during a period of fifteen years, during which we noted every case that occurred in our practice, we met with 314 cases of the former to 263 of the latter.

We shall describe two *forms* of the disease; the *regular* or *rubeola vulgaris;* and the *malignant* or *rubeola maligna*. We shall afterwards treat of its *irregularities* and *complications*.

Causes.—A chief cause of the disease is *epidemic* influence. Of this there can be no doubt, as it is proved by the evidence of all observers.

Contagion.—That it is a contagious disease is universally admitted. The contagious quality is thought to begin with the primary fever, and to continue up to the period of desquamation, though some authorities believe that it is also contagious during the stage of incubation. The precise period at which it ceases is not, however, known. The disease may be carried in fomites. It has been propagated also by inoculation with the blood taken from a patient, and with serum obtained from the vesicles which sometimes accompany the eruption.

The period of incubation is difficult to determine, but is usually stated as from five or six, to twenty days, or even longer. In the great majority of cases, however, the eruption appears in from twelve to fifteen days after exposure to the contagion, thus making the duration of the period of incubation from nine to twelve days. Thus, in 12 cases where we were able to determine with precision the interval between the exposure to contagion and the appearance of the rash, it was ten days in 1 case, eleven in 1, twelve in 3, thirteen in 5, fourteen in 1, and fifteen in 1. In 108 cases observed by M. Girard, of Marseilles (quoted in *Med. Times and Gaz.*, Aug. 21, 1869, p. 225), the eruption appeared as late as the sixteenth day only in 3 cases; in all the others it was developed on the thirteenth or fourteenth day, never before the thirteenth, and never after the sixteenth.

MM. Rilliet and Barthez conclude that measles are more frequent, less contagious, and have longer incubative and prodromic stages than scarlet fever.

The same authors are of opinion that variola is somewhat more rare, rather more contagious, and that its period of incubation and its prodromic stage are a little shorter than those of measles.

Measles, like other contagious diseases, rarely occur a second time in the same individual. We have, however, met with undoubted cases of second attacks; although unquestionably in a large proportion of the numerous cases in which we have been told that two attacks had occurred, one of them had been not of true measles, but of rötheln or roseola.

Age.—We find by uniting Dr. Emerson's tables with some given by Dr. Condie (*Dis. of Child.*, note, p. 100), that the disease appears to be most frequent between the age of one and two years, for while 395 deaths occurred in the second year, only 468 occurred between two and five years of age. This does not agree, however, with our own experience, since of 280 cases of the disease that have come under our own observation, in which the age was accurately recorded, only 36 occurred in the second year, while 84 occurred between the end of the second and the end of the fifth year. This discrepancy depends probably, in part at least, on the greater mortality of the disease during the earliest years of life, which would of course give a larger number of deaths for those attacked in the second, than for those in the third, fourth, and fifth years. The cases that have come under our own observation occurred as follows. They are stated in their order of frequency. In the sixth year, 37; in the second, 36; in the seventh, 35; in the fifth, 34; in the fourth, 30; in the eighth, 27; in the first, 19; in the ninth, 11; and then in the eleventh, tenth, thirteenth, twelfth, and fifteenth.

Sex.—It appears to be more common in the male than in the female sex. Of 290 cases that we have seen, in which the sex was noted, 156 occurred in males, and 134 in females.

Fungous origin.—In 1862, Dr. Salisbury, of Ohio (*Am. Jour. of Med. Sciences*, July and October, 1862), published two elaborate articles, in which he attributed measles to the action of the fungus developed on damp, mouldy straw. He reported the results of numerous cases in which this fungus had been inoculated, with the production of a modified form of rubeola, which, however, protects the system against a future attack of true measles; and also instances where measles had broken out in camps where damp straw was used for bedding.

A complete examination of this question, embodying the evidence of Dr. Woodward (*Camp Diseases of the U. S. Armies*, Philadelphia, 1863), and the experiments of Dr. C. E. Smith, and one of ourselves, will be found in a paper by Dr. H. C. Wood, Jr., in *The American Journal of the Medical Sciences*, October, 1868, p. 342.

The results of the inoculation of nearly 50 cases, prove that in nearly every instance, the introduction of the straw fungus into the system is entirely without effect; and that in the few cases where any symptoms have followed, they have not been those of true rubeola, nor have they protected the system from an attack of genuine measles.

In regard to the occurrence of camp measles also, Dr. Woodward remarks, that it prevailed almost exclusively in regiments raised in the rural districts, while those from cities and towns were more or less completely exempt; and that the inevitable inference from this, confirmed by personal inquiry, is that the recruits from the country had generally escaped the disease before their enlistment, while those from towns had usually suffered from it at some previous period; a condition of things entirely at variance with the idea that the straw fungus is the veritable cause of measles.

Symptoms; Course; Duration.—*Regular form of the disease.—Stage of invasion.*—Measles begin with languor, irritability, sometimes chilliness, anorexia, aching in the back and limbs, fever, thirst, headache, and various signs of irritation of the mucous membrane of the eyes, nose, fauces, and larynx.

The chilliness or horripilations which are mentioned by almost all writers are difficult to appreciate in children. We have seldom known the child itself to complain of them, but upon inquiry of the mother or nurse, have sometimes been told that they had observed some coolness of the hands or feet, or a disposition to keep near the fire, and a desire for additional clothing. These, therefore, are not important symptoms. Neither is the aching in the back and limbs, as it is seldom complained of, and can be ascertained in the older only by close questioning, or suspected in the younger by their complaining when they are moved. Fever is very rarely absent. It almost always comes on with, or very soon after the other prodromes, but in rare cases does not begin until the second day. It is almost invariably continued, after it once begins, except that it remits somewhat about daylight and in the early part of the morning, to become exacerbated again in the after-part of the day. Its intensity increases, and

the remissions become less distinct and shorter, as the time for the appearance of the eruption approaches. The pulse is increased in frequency, force, and volume, but rarely attains the same rapidity as in scarlet fever. At the same time the skin becomes warm and dry, the face is generally flushed, and there is considerable restlessness and irritability at first, often passing into quiet and drowsiness as the eruptive point approaches. The fever is accompanied by thirst, partial or complete anorexia, and generally by headache, which is frontal, and often complained of by children old enough to give an account of their sensations.

Vomiting occurs sometimes, but not as a general rule. The catarrhal symptoms commence with, or may even precede the fever. They constitute the most characteristic early symptoms of the disease, and indeed the only ones by which we are able to distinguish it with any certainty in the first stage. They consist of irritation and redness of the conjunctivæ, especially that of the eyelids, lachrymation, suffusion of the eyes, sensibility to light, stuffing of the nose, coryza, sneezing, slight soreness of the throat, cough, some constriction of the thorax, and slight dyspnœa. The state of the eyes and nose are very important as signs of the disease. The above symptoms are not always present in the same degree, being very strongly marked in some instances, in others less so, and in some rare cases, absent. They are important, because there are few cases of ordinary cold in which they are present to the same extent, or if so, the accompanying general symptoms are slight compared with those of measles. We have rarely known the faucial affection severe enough to elicit complaints, and never to produce difficulty of deglutition. It consists generally only of slight redness of the tonsils, soft palate, and pharynx, which is most strongly marked about the time that the eruption makes its appearance. The cough usually appears on the first day. Infrequent and slight at first, it becomes more troublesome as the case progresses, until it assumes, on the third or fourth day, a character which is peculiar, and which may often lead to a suspicion as to the true nature of the attack. It is laryngeal, hard, dry, rather hoarse, and occurs generally in short paroxysms. Expectoration, if present at all, is slight, and consists of a clear, viscid mucus. At the same time the voice is often hoarse.

The tongue is usually white and somewhat furred; the bowels remain in their natural condition, or there may be slight constipation or diarrhœa. Constipation is most frequent, according to our own experience. The drowsiness, to which we have already alluded, often exists during the first stage. We have noticed it in a great many cases. The child, if undisturbed, sleeps quietly for many hours, or for the greater part of one or two days, waking only from time to time to ask for drink, and then sinking off to sleep again. So common is this symptom that old nurses have a saying,—"The child is sleeping for the measles." The symptom is not alarming, unless it be connected with others which indicate local disease, or unless it pass into coma, or alternate with marked delirium. Other nervous symptoms which sometimes occur, especially when the fever is violent, are restlessness, irritability, occasionally delirium at night, and, in very rare cases, convulsions. Of 167 cases observed by Rilliet and Bar-

thez, the latter symptom appeared in the first stage only in one, and was then confined to the eyeballs. We have met with convulsions in 5 out of 314 cases, at the beginning of the eruption, and in one, of which we shall not now speak, at the close of the eruption. In one of the cases the convulsions occurred on the first day, in a boy five years of age, of nervous temperament, and who had had several convulsive attacks during the process of dentition. The convulsions were general, but slight; they lasted only a short time, and were not followed by any bad consequences. In the second case the sickness began with fever, drowsiness, tremulous movements of the hands, delirium, and in a few hours a slight general convulsion. On the second day there were two attacks of convulsions, both, however, slight. The other symptoms continued as before. On the third day the child was better, the fever having diminished, and the nervous symptoms in great measure disappeared. On the fourth, fifth, and sixth days, the fever returned, and on the middle of the sixth day, a full measles rash made its appearance. There was no recurrence of the nervous symptoms, and the case ended favorably. The third case occurred in a boy between seven and eight years old, of nervous and impressible temperament. The convulsive seizure took place just as the rash was coming out; it was very slight, and lasted not more than one or two minutes. In the fourth case, in a boy in the second year of life, who had already had three convulsive attacks from other causes, showing thereby a manifest predisposition to that kind of disorder, the convulsions occurred as in the previous case, just at the coming out of the eruption. In this case also the convulsions were slight, lasting only a few minutes. In neither of these two cases were the convulsions followed by dangerous symptoms. In the fifth and last case, the convulsions, as in the two preceding examples, occurred just as the rash was appearing; they were very slight, and were followed by no serious consequences. The subject of this case was a girl between seven and eight years old, who had previously had an attack of convulsions produced by a severe febrile reaction occasioned by simple angina, and another attack, caused by indigestion.

MM. Guersant and Blache (*Dict. de Méd.*, t. 27, p. 658) mention another initial symptom, which has sometimes enabled them to recognize the approach of measles before the eruption. This is a peculiar redness, a rose-colored punctation, of the roof of the mouth, soft palate, and uvula, differing from that of scarlatina. We have observed this symptom ourselves in quite a number of cases, and, as it not unfrequently appears twenty-four hours before the cutaneous eruption has come out, we think that it is of some value as a sign in the early stages.

M. Girard (*loc. cit.*) states that the early diagnosis may be aided by the fact, that a red papule appears near the free border of the velum palati several days before the appearance of the eruption.

The *duration* of the initial stage is generally from three to four days. In a large majority of the cases that we have seen, the eruption has begun to appear in the course of the fourth day. This stage may, however, last only one or two days, or be prolonged to five, six, or seven, and according to Guersant and Blache (*loc. cit.*, p. 659), it lasted in one case, with all the

characteristic symptoms, fifteen days. In a case that occurred to one of ourselves, the subject of which was a girl between one and two years old, the eruption, owing no doubt to the presence of severe general bronchitis, did not make its appearance until the ninth day of the sickness, and even then came out slowly aud with much difficulty. The disease was known to be approaching from the fact that another child in the house had just recovered from an attack. In another case, in a girl between twelve and thirteen years of age, the eruption began on the fourth day of the sickness, but was so faint and indistinct that we could not, until the sixth day, feel sure that it was a measles rash. Even after this, the eruption continued pale and insufficient until the seventh day of the eruption, when it was out fully and completely.

Second Stage, or that of Eruption.—The eruption generally appears some time in the course of the fourth day, showing itself first on the chin or cheeks, or some other part of the face, and extending gradually to the neck and trunk, and finally to the extremities. It is often completed in from twenty-four to forty-eight hours. It begins in the form of distinct spots, not unlike flea-bites, of a more or less bright rose or crimson color, verging sometimes towards a deep red, of a roundish shape, with irregular edges, and of different sizes, varying between half a line and three lines in diameter. When fully formed they constitute true papules, which are felt to be slightly elevated and firm to the touch, with broad flat summits. When pressed upon, their color disappears, to return rapidly when the pressure is removed. Distinct and scanty at first, the spots or stigmata soon become more numerous, and arrange themselves into clusters of an irregularly crescentic or semilunar shape. The number of these clusters and the consequent general tint of the skin, depend upon the amount and intensity of the eruption. In very mild cases, or when the eruption is imperfect, the clusters of papules are few in number, and they are separated by large portions of healthy skin. In severe cases, on the contrary, the patches are so numerous, and coalesce so closely, that the skin assumes a general deep-red tint. Occasionally in these severe cases minute vesicles form on the summit of the papules. Yet it ought to be remarked that it can be observed on close examination that the papules never run completely into each other, so as to form a continuous red surface, unless it be over very small spaces and on certain parts of the surface, more particularly the face.

The fever does not diminish when the eruption makes its appearance, and it sometimes augments, so that the highest temperature of the attack is usually attained soon after its full development. The skin retains its heat; the irritation of the eyes continues and is sometimes very severe; the nostrils are dry and incrusted, or there is coryza, and in some few cases epistaxis. The face is at the same time flushed, independently of the eruption, the red color of the skin being observable in the intervals between the papules, and it looks swelled and turgid, from tumefaction of the cheeks and particularly of the eyelids. The cough continues, and is loud, hoarse, and frequent in most cases, but in others short, scarcely

hoarse, and but slightly marked. The voice is usually but not always a little hoarse. The respiration is slightly quickened in regular cases, but generally very little beyond the natural rate. The pulse is accelerated, though to a less degree than in scarlatina; its frequency is usually found to be in direct proportion to the height of the temperature. The tongue is covered with a yellowish or whitish fur in its middle, while the edges and tip are clean and red. It remains moist and soft unless some complication occurs. The tonsils, soft palate, and pharynx, present considerable redness, without tumefaction. The abdomen commonly remains natural, though in some few cases there is slight soreness over its whole extent or in the iliac fossæ. Slight diarrhœa often occurs at this time. It seldom lasts more than from one to three days. In other cases the stools are natural, or there may be moderate constipation. The anorexia and thirst continue up to the stage of decline. About the time of the appearance of the rash there is often considerable restlessness, anxiety, starting and twitching in sleep, slight delirium, and in children old enough to describe their sensations, complaints of headache. The strength of the patient is not decidedly affected in most of the cases.

The urine during this stage is scanty, of dark-yellow color, and not rarely contains a trace of albumen.

Stage of Decline and Desquamation.—The disease having reached its height in the course of the sixth day, the second of the eruption, it remains nearly stationary for one or two days longer, and begins to subside about the seventh or eighth of the disease, or third or fourth of the eruption. The eruption fades first on the face and neck, and has often very much or wholly subsided on those parts while it is still vivid on the extremities. The papules lose some of their color, become less prominent, diminish in size, and when pressed upon do not disappear entirely as they did at first, but leave a dull or yellowish stain behind. A little later they assume a dirty yellow or copperish tint, which does not disappear under pressure, showing that a slight ecchymosis has taken place into the substance of the derm. These stains continue a variable length of time, and are finally removed by absorption. As the eruption disappears, a slight furfuraceous desquamation takes place in a considerable number of the cases, but not by any means in all. This begins usually about the face, and may either be limited to that part, or extend to other portions of the body. It is seldom general, however, and is often scarcely noticeable. It occurs between the eighth and eleventh days of the disease, or fourth and seventh of the rash.

From the moment the eruption passes its highest point of intensity, and begins to decline, the other symptoms do the same. The pulse fast loses in frequency, and regains its ordinary characters. The heat of skin passes away, often with considerable perspiration, but sometimes with gentle moisture only. The various catarrhal symptoms subside; the cough is less frequent, loses its hoarseness, becomes softer, and gradually ceases. The expectoration, if present, now becomes more copious and thinner, and presents nummular masses of muco-purulent matter floating in a clear, watery fluid. The tongue cleans off; appetite returns; thirst ceases; the restless

ness and irritability disappear; and the child returns to its ordinary condition of health.

Temperature.—According to the observations of Ringer (*Reynolds's Syst. of Med.*, vol. i, art. Measles), the highest temperature reached in ordinary cases is about 103° F. From the observations of Roger (*op. cit.*, p. 298) this would appear higher than is usually attained, the mean of his records having been only 101.5° F. If it rises above 102.5° it indicates a severe, if it continues below this, a mild attack. The temperature presents the diurnal variations usual in fevers, until the close of the disease, when it suddenly declines. The duration of measles, measured by the temperature, varies considerably; the decline of the fever occurring in some cases on the fourth day, in others not until the eighth or tenth day.

Irregularities of the Disease.—Under this term we shall describe only the anomalous symptoms of the disease, which occur independently of complications. Those which are produced by the latter causes will be fully treated of when we come to consider the subject of the complications.

In some cases, the symptoms of the prodromic stage are so slight that they pass almost unobserved, and the child is scarcely thought to be sick until the rash makes its appearance. In others, owing to some peculiarity of the temperament, or to the state of the constitution at the time, they are much more severe than usual, or some one symptom may be in excess. In one case that came under our own observation, in a girl seven years old, the nausea and vomiting were very distressing, and were accompanied by the most intense frontal headache. She complained precisely as children generally do with tubercular meningitis, and was, moreover, extremely restless, and at night delirious. Nevertheless, the eruption came out on the fourth day, and was perfectly regular in its characters and course; the unpleasant symptoms ceased from that moment, and the patient recovered without any further bad symptoms. We have already spoken of five cases accompanied by general convulsions at the commencement of the first stage. The course of the disease in the subsequent stages was regular in all respects. In two other cases, in girls, sisters, seven and nine years old respectively, of highly nervous temperament, the headache in the first stage was so intense as to require the application of leeches for its relief; yet the disease was regular in its other characters.

The eruption presents various irregularities which ought to be noticed. It has already been stated that the amount of the rash varies according to the severity of the case, although in other respects regular. Sometimes the papules are comparatively small in size and few in number, and consequently, the clusters in which they are arranged have considerable spaces of healthy skin between. When this is the case, the stigmata are usually rough, lighter in color, and from this circumstance and the fact that the spaces between the clusters are large, the general tint of the skin is much less deep than in severer cases, in which the opposite of these characters prevails. In some of the mildest cases, the amount of eruption upon the extremities has been very small, and after forming, it has very rapidly, in the space of a night, faded to such a degree as to seem almost a retrocession. But as this sudden disappearance has not been accompanied or fol-

lowed by dangerous symptoms, it is clear that it was dependent simply on the mildness of the attack. In such instances the general symptoms have always been slight, and the whole duration of the sickness shorter by two or three days than in severer cases. At times the order of appearance of the eruption is reversed, and the papules appear first on the trunk, thence spreading to the face.

We have already described the dull yellowish stains which remain after the papules have faded. These stains sometimes assume, in malignant cases, a livid or purplish hue, from the occurrence of passive hæmorrhage into the tissue of the derm. They may, however, assume a dark and purpureous appearance, without any malignant or dangerous symptoms whatever. This happened in a family in which one of us attended seven cases of the disease in 1845. In three of them (boys of 10, 5, and 1 year old, respectively), the eruption, which was copious and regular in all, became in a single night, at the moment of decline, of a dark-brown or light-purple hue. The spots did not disappear at all under pressure, and were evidently formed by true ecchymoses. The general symptoms were all favorable. The only peculiarity to be observed was that the fever had disappeared very suddenly, and that the extremities were slightly cooler than natural. The convalescence was as usual, except that the ecchymotic spots disappeared very slowly and gradually. We have, since the above-named period, seen a great many similar cases, but in none have the symptoms been attended or followed by any evil consequences.

Several authors describe a form of measles without eruption. They state that during the epidemic prevalence of the disease, some children present all the catarrhal and febrile symptoms, without the eruption, and that they are protected against future attacks. The last assertion, at least, must be very difficult to prove. For our own part, we have never met with such cases, and should we ever seem to do so, would certainly not call them measles, lest by so doing the parents might be induced, on future occasions, to expose the child unnecessarily to the disease, when, should any evil consequences follow, they might justly question the wisdom of the physician's advice.

Willan and other authors have described another variety of the disease, to which is applied the term *rubeola sine catarrho*, or measles without catarrhal symptoms. Such cases are said to present no catarrhal symptoms whatever, and little or no febrile reaction. They are stated, moreover, to occur generally during the epidemic prevalence of measles. Most authors agree that this form does not protect the constitution against the true disease, and some regard it only as an eruption resembling measles, dependent upon gastric disorder. Our own opinion is that such cases, of which we have seen a considerable number, are nothing more than examples of roseola. The entire absence of catarrhal symptoms and of fever, or their very slight character, the short duration of the cases, and the little constitutional disturbance exhibited by the patient, all serve to convince us that they cannot be attacks of true measles. We recollect three such cases in particular, which, had they been accompanied by cough and fever, we should certainly have called measles. They all occurred in infants.

The rash was preceded for two or three days by feverishness, uneasiness, restlessness during sleep, and slight diarrhœa, after which the eruption suddenly made its appearance and covered the whole integument within twenty-four hours. There were no catarrhal symptoms whatever. At the same time the febrile symptoms disappeared, and the children seemed quite well. The eruption never lasted over forty-eight hours, and disappeared without leaving a trace behind. They were, no doubt, cases of roseola.

Rubeola Maligna.—This form may occur either as an epidemic or sporadic affection. Generally, however, it prevails as an epidemic, and depends upon some peculiarity which it is impossible to understand. The few sporadic cases which are met with, may be traced generally to some vicious state of the constitution of the individual, or to the unfavorable hygienic conditions in which he is placed. The symptoms assume ataxic or adynamic characters, which give to the case the features of the typhoid type of disease. They may make their appearance in the prodromic, or, as happens more frequently, not before the eruptive stage. When they begin in the first stage, the case is marked by great frequency and feebleness of the pulse; by prostration; by unusual dyspnœa and oppression; and especially by greater violence of the nervous symptoms, as delirium or stupor. Sometimes, even in this stage, petechiæ make their appearance, and there is lividity and soreness of the fauces, with discharges of dark blood from the nostrils, and sometimes profuse and exhausting diarrhœa or dysenteric discharges. When the time for the eruption to appear arrives, this comes out slowly and imperfectly, or irregularly, and generally assumes a livid, purplish, or blackish color, owing to the passive exudation of blood into the papules, and hence the name sometimes given to such cases, of *Rubeola Nigra*, or *black measles*.

This form of the disease assumes, in fact, many of the features of purpura hæmorrhagica. The patient may die of exhaustion, of congestion of some important organ, as the brain or lungs, of the diarrhœa or dysentery which sometimes complicate the disease, or finally of the hæmorrhages which occur in consequence of the dissolved and fluid state of the blood; or he may, after a severe struggle with the disease, recover his health.

Complications and Sequelæ.—MM. Rilliet and Barthez begin their chapter on the complications of this disease with the following excellent remarks: "Rubeola manifests itself by an inflammation or inflammatory fluxion upon the skin and mucous membranes. The regular course of the disease depends upon the conservation of a due equilibrium between these two kinds of fluxions. That which is seated in the skin ought in general to predominate: if the equilibrium be destroyed by any cause whatever, whether accidental or inherent to the disease, and should the predominance of the inflammation take place in the mucous membranes, there will result a phlegmasia of some one of those tissues.

"It is easy to foresee, by attention to these circumstances, that the inflammatory complications of measles will be most apt to fall upon the mucous

membranes, and that broncho-pneumonia, pharyngo-laryngitis, and intestinal inflammations will be the most frequent of all."

Bronchitis and Pneumonia.—These constitute by far the most frequent and important complications of measles. In 167 cases, MM. Rilliet and Barthez met with 24 cases of bronchitis, 7 of pneumonia without bronchitis, and 58 of lobular broncho-pneumonia. This statement shows how very large a proportion of the cases of measles occurring in the Children's Hospital at Paris, became complicated in the course of the attack. The proportion in private practice is much smaller, since in 314 cases, we have met with only 24 of bronchitis, and 6 of lobar pneumonia. These are, however, in private practice, according to our experience, much the most important of the complications likely to occur. Of six deaths which occurred in the 314 cases that we have seen, 3 were caused by bronchitis.

The time at which these different complications make their appearance is important. They may occur during the initial stage, early in the eruptive stage, during the decline of the eruption, or after the eruption. The most common period for their occurrence is the initial stage. It is difficult or impossible to ascertain their causes in a great many cases. In some instances they depend evidently upon cold. Age has some influence upon their production, as bronchitis is most apt to occur in young children, whilst lobar pneumonia attacks those who are older.

The *physical signs* of these affections are the same as when they exist in the idiopathic form. The rational signs are increase of cough, which, instead of being merely laryngeal, becomes deeper and either pneumonic or catarrhal; and dyspnœa, which is sometimes excessive, the number of respirations mounting to 40, 50, and, in severe cases, to 60 and 80. The pulse is more frequent than in regular measles, and in very bad cases becomes rapid and small; the skin is hot and dry; the face is pale and anxious in severe cases, in which the eruption does not appear; and the child is generally restless and irritable, with broken irregular sleep, or, in the most violent cases, it is dull and soporose. In two of the fatal cases that came under our observation, convulsions occurred. It should be remarked, however, that in one, the patient, a boy only nine months old, was laboring under an attack of hooping-cough, and that it was in one of the paroxysms of that malady that death took place. In the other case, that of a boy eighteen months old, the convulsions occurred first on the day of eruption, and then ceased, to recur again the third day afterwards. The bronchitis dated from before the appearance of the eruption, and was no doubt the cause of the convulsions and death.

When a pulmonary complication begins in the prodromic stage, it almost always modifies the eruption in some manner, either retarding or rendering it irregular or imperfect. When it dates from the second stage, it may cause a partial or complete retrocession of the eruption. We have known the eruption to be retarded several days, so as not to come out until the fifth, sixth, or even ninth. When the rash does appear, whether at the usual period or later, it is evidently with difficulty. It is pale and scanty, or abundant on one part of the body, and scanty on another, or it appears and disappears alternately. At length it either comes out fully, and the

threatening symptoms pass away, or the eruption lasts the usual, or nearly the usual length of time, in its pale and imperfect condition, and the child recovers slowly and gradually from the complication, which has become the most important part of the sickness; or, in fatal cases, the symptoms grow worse and worse, and the child dies after a few days, or a longer time, according as the inflammation assumes the acute or chronic type.

Whenever it is observed in a case of measles, that there is more drowsiness or irritability than usual, or that the pulse is more frequent or stronger than it ought to be, it becomes important to ascertain carefully the state of the respiration. If this be accelerated, the thorax ought to be examined with strict attention, by auscultation and percussion, to discover whether there be not some pulmonic inflammation at work, likely to convert the disorder from a mild one, as it almost always is when uncomplicated, into one dangerous to life, which it will assuredly become, should any pulmonic complication be allowed to steal unawares upon the patient.

The prognosis of the pulmonic complications of measles would appear to be very unfavorable in hospitals for children, since Rilliet and Barthez state that scarcely one patient in four or five recovered. Of the 30 cases that we have seen, we have already stated that 3 died of bronchitis, and if we recollect that one of these was complicated also with pertussis and morbid dentition, it will be seen that the prognosis is, as might be expected, vastly more favorable in private than in hospital practice.

There is, however, a tendency, especially marked in delicate, strumous children, for the inflammation of the bronchial mucous membrane to become chronic, in which case the cough may persist for years, at times intermitting, but returning after the slightest exposure, and particularly in cold, damp seasons of the year.

Laryngitis is a common complication of the disease. The authors just quoted met with it in 35 of their 167 cases. It occurred in 8 of the 314 cases that came under our observation. It is often accompanied by pharyngitis.

Autopsies show that the laryngitis may be slight, severe, or accompanied with pseudo-membranous exudation. The inflammation may be simple, consisting merely of different degrees of redness, or of redness with thickening and softening of the mucous membrane; it may be more intense and accompanied by ulcerations or erosions; or, lastly, it may be associated with an exudation of false membrane.

The symptoms of this complication will depend upon the form the inflammation assumes. It is unnecessary to describe them here, as they are the same as those of the idiopathic affection, which has already been fully treated of.

The occurrence of laryngitis exerts but little influence on the rash, particularly as it almost always appears during the decline of the latter. It is seldom fatal, unless it assumes the pseudo-membranous form. The eight cases that came under our observation were attacks of the simple disease, and they all recovered.

Inflammation of the Intestines.—According to Rilliet and Barthez, lesions

of the intestinal mucous membrane are the most frequent complications, after pulmonary affections. About a third of their cases presented at the autopsy erythematous inflammation of the mucous membrane; a fifth offered follicular entero-colitis, a seventh ulcerative inflammation, and a fourth softening. Some presented several of the lesions united, and in a few no lesion was found, though the symptoms of entero-colitis had existed during life. We give these data from the above authors, not because they apply to private practice, but merely in order to show what are the tendencies of the disease, when disposed from unfavorable hygienic conditions to take on complications. We have met with only seven instances of intestinal inflammation in the 314 cases that have come under our own observation. Four of these occurred in the same family, in children of seven, five, three, and one year old respectively. They were cases of entero-colitis, accompanied in two, with dysenteric symptoms, and all made their appearance towards the close of the disease. The three remaining cases were attacks of dysentery, one of which was very severe, the stools amounting to twenty in the day, while the other two were much less so.

The intestinal complications may appear during the initial stage, or on the day of eruption, but if not at one of these periods, they are most apt to occur during the decline of the rash. The slight cases, constituting the common diarrhœa of the disease, generally begin early, whilst the grave cases usually date from a later period of the disease. The *causes* of these complications seem to be various exciting agents acting upon a mucous membrane predisposed, by the nature of the disease, to inflammatory action. These agents are said to be, generally, improper food, giving rise to indigestions; and the too early use of purgative remedies, and laxatives. In the cases observed by ourselves it was impossible to detect the causes.

The *symptoms* are more or less abundant diarrhœa, and in some, but not all the cases, sensibility with tumidity and tension of the abdomen. This complication does not exert much influence upon the measles, which usually pursue their regular course. Sometimes, however, it occasions an aggravation of the febrile symptoms, and, when of a grave character, may no doubt interfere with the regular progress of the eruptive disease.

According to Rilliet and Barthez, this complication was very seldom the only, or even chief cause of a fatal termination. Scarcely five or six of all that they observed could be considered as of that kind. It increases very much, however, the danger of the pulmonic attacks, for the latter are much less serious, so long as they exist alone, while so soon as intestinal inflammation is added to them, they become almost necessarily fatal. The seven cases that we met with recovered under simple treatment.

In a considerable number of cases, a slight diarrhœa, to which we have already referred as a common event in measles, occurred, but only in the seven above mentioned did it amount to a serious complication.

In one case that came under our observation, in a girl between five and six years old, fatal cerebral symptoms, due either to congestion of the brain or uræmia, occurred just as the rash was disappearing. There was no evident cause whatever for this accident. There had been no imprudence either as to diet or exposure. The child was, however, of a tubercular

family, the mother having at this very time tubercular disease of the lungs. The eruption had come out well and properly, and continued to do so on the second day without any irregular or threatening symptoms. On the third day of the eruption this began to decline, and the child had an attack of spontaneous vomiting, but continued through the day cheerful and pleasant. The night of that day she was restless and feverish, and wanted much drink. On the fourth day she was drowsy and heavy, and complained of her head. We saw her first in the evening of this day. She was then very dull and heavy, scarcely answering questions, and protruding the tongue slowly and after much urging. She had some little, but not a troublesome cough. Careful examination revealed no disease of the thoracic organs. The respiration was natural, and the pulse full and very frequent. On the morning of the fifth day the patient was comatose, neither answering questions nor protruding her tongue. In the course of the day there were some irregular convulsive movements. In the evening the right arm was rigidly flexed at the elbow, and the left one stiffly extended. The patient died that night. No autopsy could be obtained.

In another case death occurred from sudden *effusion of serum* into the internal cavities, caused apparently by the existence of an excessively hydræmic state of the blood, possibly connected with albuminuria, which had been allowed to come on gradually, without any attempt on the part of the parents to seek a remedy during the slow approach of this condition of the circulating fluid.

CASE.—The patient was a boy in the second year of his age, who had a phthisical mother. The attack of measles took place in the last week of January, 1852, and was regular, and not, according to the account of the parents, we not having seen the child, at all severe or dangerous in any respect. After the attack was over, however, and though he was running about the house as before, he continued to look more and more pale and sickly until the evening of February 25th, when suddenly after 11 P.M., he was seized with fever, and became very restless. On the following day, at 9 A.M., we saw him. He was then extremely pallid, and very drowsy and heavy; the breathing was rapid and oppressed, the pulse very frequent, and the skin hot and dry. He was evidently dropsical, as both the face and hands, and the feet also, were puffed, smooth, and doughy. The bowels had not been opened the previous night. In the evening the pulse was 170; the skin was still hot, and the breathing very rapid and much oppressed. There was scarcely any cough. The percussion was dull over too large a space in the præcordial region; the cardiac impulse was obscure, and the sounds indistinct and muffled; there was no bellows-murmur. The percussion was dull over the inferior dorsal regions. No râle whatever was heard. The child died on the following morning at 3½ o'clock. Ten minutes before his death he asked for a drink, lifted himself up in bed, drank freely, looked around intelligently, and then laid down and died. At the autopsy the subcutaneous cellular tissue was found to be infiltrated with serum. On puncturing the right pleural sac, there was an immediate escape of a clear, straw-yellow serum. There was considerable effusion in the left pleura also, but less than in the right. The pericardium contained at least two ounces of serum, so that it was pushed off to a considerable extent from the heart. There was a slight pleuritic adhesion of the upper lobe of the right lung to the ribs. This was, however, evidently of an ancient date. There was no other inflammation of the pleuræ, and none of the pericardium. Both lungs contained tubercles, which were not very numerous, but in the upper lobes of considerable size. There was no pneumonia, but both lungs

were somewhat congested. The heart was larger than usual. In the right auricle there was a rather large, and white, but soft concretion, and a smaller one in the right ventricle. The left cavities presented no concretions. The valves were healthy.

There are several other disorders which sometimes complicate or follow measles, but as we have already given as much space to this subject as the limits of the work will allow, we shall be satisfied with a simple enumeration of them. They are otitis, ophthalmia, hæmorrhages, gangrene of the cheek or vulva, anasarca, and different cerebral symptoms. We will merely add that measles appear to possess a special tendency to develop tubercular disease in the system, and that it is necessary, therefore, to treat a child showing any predisposition to that diathesis, or one born of tubercular parents, with particular caution, both at the time of the disease and during the convalescence. It is not uncommon for measles to be conjoined with other eruptive diseases. We have known it to coexist with scarlatina in two instances, and Dr. G. B. Wood has met with a fatal case of the same nature. It may be associated likewise with variola or with erysipelas; of the latter we have met with one instance. We will mention here that of the whole 314 cases of measles that we have observed, 257 were simple and 57 complicated. The complications were as follows: bronchitis, 24; pneumonia, 6; laryngitis, slight or severe, 8; dysentery, 7; pertussis, 7; scarlatina, 2; convulsions in the early stage of the disease, 5, and in the latter stage, 3; keratitis, 2; intermittent fever, 1; erysipelas, 1; meningitis, 1; congestion of the brain, 1; serous effusion into the internal cavities, 1. It ought to be observed, however, that in the above enumeration several cases are referred to twice, and one, a case in which pertussis, bronchitis, and convulsions occurred, three times.

Anatomical Lesions.—It is difficult to ascertain what are the characteristic lesions of measles, because of the fact that most of the fatal cases prove so in consequence of some complication. Some few fatal cases, however, of the regular form, and some in which the complication was so slight as not to be likely to change the morbid appearances much, have led to the following conclusions.

The lesions present in measles are the following: general congestion of different organs, which are colored red from the imbibition of blood and sometimes softened. The congestion affects the mucous membranes particularly, and imparts to them a reddish or slightly blackish color. In some of the cases there is morbid development of the intestinal follicles. The most important lesion, however, is that of the blood, which presents the appearances common to the class of pyrexiæ. These are normal proportion or diminution of the fibrinous, with increase of the globular element of the blood. Dr. Copland (*Dict. Prac. Med.*, vol. ii, p. 819) gives the appearances in a few fatal cases of malignant measles. They were, softening of the tissues and the facility with which they were torn; the presence, in some of the cases, of a turbid or sanguineous serous fluid in the serous cavities; general congestion of the lungs; dark appearance, and livid or purple ecchymoses of the bronchial mucous surface, of the

fauces, stomach, and cæcum; engorgement with dark and semifluid blood of the veins and sinuses of the brain, and of the auricles and large veins; and finally a livid and mottled appearance of some parts of the body, with petechiæ of a dark color.

Diagnosis.—It is impossible to diagnosticate measles in the first stage with any considerable certainty. The existence of the disease may be suspected in that period from the appearance of the eyes, from the coryza and sneezing, the frequent, hoarse, scraping cough, and the fever, headache, and thirst. If, in connection with these symptoms, it happens that an epidemic of measles be prevailing at the time, or that the child has been exposed to the contagion of the disease, the inference becomes still more plausible. Nevertheless, any opinion upon this point ought to be given with much reservation.

We have already alluded to the opinion of some authorities, that the diagnosis in the early stage is aided by the presence of punctated redness of the roof of the mouth, or of a red papule on the velum palati.

After the eruption has come out fully, it is not likely to be mistaken for any other disease, unless it be roseola or rötheln, the rash of which sometimes resembles that of measles very closely. It may be distinguished, however, by attention to the concomitant symptoms, by the slight degree of fever, the more rapid evolution of the rash, and the absence of the peculiar catarrhal symptoms in roseola. In the very early stage of the eruption, measles may be confounded with variola. A careful attention, however, to the size and shape of the papules, which in measles are much larger, flatter, less elevated, softer, and without the shotty feel peculiar to the papules in variola, and the presence of the catarrhal symptoms, will usually suffice to distinguish them, even in the earliest stage. In measles also the general symptoms persist, or even become aggravated after the appearance of the eruption, instead of abruptly subsiding as they do in variola. A little later, the appearance of vesicles on some of the papules about the face in variola, will show the difference still more strongly. The distinction between measles and scarlatina has already been drawn in the description of the latter disease. It rests chiefly on the much shorter duration of the prodromic stage, the greater violence of the anginose symptoms, the absence of the peculiar catarrhal symptoms, and the more rapid evolution of the eruption in scarlet fever; and lastly, on the differences in the two eruptions, observable especially at their first appearance.

The eruption of typhus fever appears nearly at the same time as that of measles, and in their earliest stage the two eruptions often resemble each other closely. In typhus, however, there is an entire absence of the characteristic catarrhal symptoms. The spots are less elevated; are isolated and round, instead of coalescing to form crescentic patches; do not appear first on the face, but on the trunk or wrists (Ringer); more frequently become petechial, and last a much longer time.

When measles are conjoined with some other eruption, the diagnosis is to be made out by a careful study of the initial symptoms, and of the eruption on different parts of the body, for we can generally find well-

marked patches of the rash peculiar to each on some portions of the surface. In one of the cases of measles and scarlatina that we saw, the latter disease was developed first. The eruption made its appearance in the usual form; on the second day of the eruption, the child was seized with hard, hoarse, laryngeal cough, and with redness of the eyes and lachrymation. These symptoms continued three days, at the end of which time the scarlatinous rash had disappeared from the face, but remained visible upon the trunk and extremities. Characteristic measly papules now made their appearance on the face, and pursued their regular course, while on the trunk and extremities the measly eruption was never well defined, being mixed with and disguised, as it were, by that of the scarlatina. In the other case, the measles appeared first and went on regularly until the eruption was declining and the general symptoms moderating, when suddenly the fever, heat of skin, restlessness, and irritability returned, and the child was very soon covered with the punctated scarlet rash of scarlatina.

Prognosis.—The prognosis of simple, uncomplicated measles is very favorable; the cases almost always recover without difficulty. This is shown to be true by the following facts: Rilliet and Barthez report 36 cases of simple measles, of which all but one recovered. Of 257 cases that we have seen, all terminated favorably. When, on the contrary, complications occur, the disease always becomes more or less dangerous, the degree of danger depending on the nature of the intercurrent affection, and on the hygienic conditions in which the patient is placed. Thus of 131 cases observed by the above authors, in which some form of complication occurred, 89 or about two-thirds proved fatal, while of the 53 complicated cases that we have seen, only 6 were fatal. It must be recollected that the cases of the French observers all occurred under the unfavorable hygienic conditions of a large hospital, in children of bad constitution from congenital or acqired causes, whilst ours were observed in private practice, where the hygienic conditions are favorable in the same degree as they are unfavorable in hospitals.

The six fatal cases that came under our observation, proved so from the circumstances we are about to mention. The first occurred in a child nine months old, who was laboring under pertussis when attacked with measles. Bronchitis supervened upon the measles, and proved fatal by convulsions, which came on during a paroxysm of hooping-cough, two weeks after the disappearance of the rubeola. The second case was that of a boy, eighteen months old, who was prescribed for by an apothecary from behind his counter, until we saw him. The eruption made its appearance imperfectly, we were told, and with a convulsion. After this he was very restless, and had rapid and difficult respiration and much cough. On the morning of the fourth day of the eruption, this had almost entirely disappeared, and the child was again attacked with convulsions. We saw him shortly after this for the first time, and found him comatose, with convulsive movements of the limbs, extreme dyspnœa, and all the symptoms of extensive bronchitis of both lungs. He died thirty-six hours from this, as was to be expected. The third was a case of pneumonia in a child between one and

two years of age, in which the inflammation came on as the eruption was fading, and proved fatal, in spite of all that could be done, on the eleventh day. The fourth occurred in a boy between four and five years old, who appeared to recover perfectly from the measles, but was attacked in ten days with meningitis, and died. The fifth was the case of congestion of the brain, already detailed in the remarks upon complications, as proving fatal shortly after the decline of the rash. The sixth was that of sudden dropsical effusion into the internal cavities, also described in the remarks upon complications.

To conclude, we may state that the prognosis is always highly favorable under the following circumstances: when the disease is primary; when the initial stage is of the proper duration; when the eruption begins upon the face and extends gradually to the rest of the body; when the febrile movement is moderate; when the eruption, after increasing for one, two, or three days, gradually decreases; when the cough and other concomitant symptoms diminish with the fever; when the cutaneous surface, after the fading of the rash, assumes a natural color, and is neither flushed nor pale; when the appetite returns, the disposition to be amused and take notice continues, and lastly when the sleep is natural.

On the contrary, the prognosis becomes unfavorable under the following circumstances: when the initial stage lasts longer than usual, and when it is accompanied by violent symptoms of any kind, as extreme jactitation, irritability, dyspnœa, much stupor, coma, or convulsions; when the eruption is irregular in its appearance or course; when the fever does not disappear with the eruption, whether it remains violent or assume the form of hectic; when, after the eruption, the face continues deeply flushed or becomes very pale; when the cough, dyspnœa, or diarrhœa persist; and, lastly, when the child remains weak, languid, dispirited, or irritable.

It may be stated, in conclusion, that the prognosis of measles is always favorable in proportion to the health of the child at the time of the invasion, and the regularity with which the disease passes through its different phases; while it becomes unfavorable, though far less so in private practice amongst people in easy circumstances, than in hospitals or amongst the poor and wretched, whenever it attacks a child already laboring under some disease, and when it becomes complicated with any other malady, either local or general.

Treatment of the Regular, Simple Form.—This form requires, in a large majority of the cases, little other treatment than strict attention to the hygienic condition of the patient, the use of simple diaphoretics, of mild cathartics occasionally, and the palliation of any of the symptoms that may chance to become somewhat more troublesome than usual.

The child ought to be confined as much as possible to bed in a large, well-ventilated chamber, the light in which should be somewhat softened. Every precaution should be observed to prevent chilling of the body, while at the same time it is nearly, if not quite as important, to avoid overheating the patient, either by excessive clothing, or by keeping the temperature of the room too high. In winter, it is well to direct the temperature to be maintained at between 68° and 70° F., night and day.

If this be done, the child is not apt to take cold, even though it be uncovered at times, and yet the warmth is not oppressive. We have often remarked that this temperature is just what it ought to be when the room is well ventilated, either by means of an open fireplace, or by communication with adjoining rooms; but when, on the contrary, the room is heated by a furnace-flue, and not ventilated at all, or very imperfectly, the same temperature, as indicated by the thermometer, becomes extremely close and oppressive. Under such circumstances, a door into an adjoining room, or if this cannot be, one into the entry, ought to be kept more or less open, with a screen of some kind between it and the child, in order to secure a good ventilation, which is assuredly of the very highest importance, and yet to prevent by the screen a current of cool air from chilling the patient. Miss Florence Nightingale remarks that doors are made to be shut and windows to open. There is much in this saying, and when the nurse is intelligent and observant, we much prefer to shut the door and open a window. In our winter temperatures in this city this must be done very carefully. One of the sashes raised an inch, or one or two inches, will make a large difference in the temperature and vitality of the air of the sick-room.

The *diet* during the febrile period ought to be very light. It may consist of milk and water, of arrowroot, sago, or tapioca, prepared with milk or water; or of crackers soaked in water, with salt, or some similar food. When the eruption and fever have in great measure disappeared, some light broth, either vegetable or animal, with dry toast or bread, plain boiled rice, a roasted potato, or ice cream, may be added; and after all the symptoms have ceased, the usual diet can be gradually resumed. The drinks may consist of simple water, of lemonade, orangeade, gum-water, or flaxseed tea, with the addition of a little sweet nitre; or of weak infusions of balm, sweet marjoram, or saffron, or cascarilla with a few drops of hydrochloric or nitric acids. They may be given in any reasonable quantity, at the temperature of the room. Some persons have a great dread of cold water in this disease. We have never seen small quantities (a wineglassful or two at a time) of cold water do any harm, and believe it to be most useful and necessary when the fever is violent, and the heat very great. We once, however, saw a boy, nine years old, attacked with violent colic and partial retrocession of the eruption, after swallowing suddenly a tumblerful of iced water. The unpleasant symptoms passed off in a few hours, and he had no difficulty afterwards.

The patient should not be permitted to leave the room until a few days after the entire disappearance of the disease. This precaution is necessary for all, but particularly for the delicate, and in the cold weather of these latitudes. He should be kept in the house until he has regained in some degree his usual health, and then sent out with due precautions.

Medical Treatment.—Many cases of measles—the mild, the moderate, the uncomplicated—need no other treatment than that just laid down in the paragraph on the hygiene of the disease. So long as the case goes on regularly, so long as the symptoms are moderate and such as to cause but little suffering, there is no necessity for drugs, or, at the most, a simple

diaphoretic, as sweet spirit of nitre or the solution of acetate of ammonia, with a little paregoric or laudanum once or twice in the evening, will be all that ought to be done.

The child does not require, and therefore ought not be made to take as a mere routine, *cathartics*. If the bowels are known to be costive, and not to have been moved for two or three days, a teaspoonful or dessertspoonful of castor oil, or, better still, a dessertspoonful to a tablespoonful of simple syrup of rhubarb, or a simple enema, will answer every purpose. We are sure that active purging is unnecessary, and apt to be hurtful.

When the case is a very decided one, and the eruption extensive and deep in color, the fever runs high, and the patient often suffers greatly from the fever-pains, and from the violence and frequency of the cough. Here medical treatment is necessary, since it lessens suffering, diminishes the violence of some of the symptoms, and so promotes the safety of the patient. In infants, under these conditions, we order five drops of sweet spirit of nitre, two or three of syrup of ipecacuanha, and two of paregoric, in a teaspoonful of sweetened water every two hours, at the age of six months. At one and two years, we double the proportions of the active ingredients. Should even these small doses of ipecacuanha cause any sickness of stomach, we lay that drug aside. One of the best combinations is the following:

℞.—Potass. Citrat, ... ʒj.
Spts. Ether. Nit., ... fʒij.
Tr. Opii Deodorat., ... ♏xij vel xxiv.
Syrup. Simp., ... fʒvj.
Aquæ, ... fʒij.—M.
Dose.—A tablespoonful every two or three hours, at five years of age.

In younger children, from two to five years, the same formula may be used, except that the laudanum should be reduced to six minims. When the cough is very dry, scraping, and, as it sometimes is, incessant, there should be added to the above mixture syrup of ipecacuanha, in the proportion of five to ten drops to every teaspoonful, according to the age of the child; and there may and ought to be given from time to time, if the patient be not too drowsy from the effects of the fever or the mixture, an extra dose of opium. We prefer nearly always the deodorized laudanum. Of this from two to four drops in a teaspoonful of water may be given two or three times a day, or, better still, once or twice in the evening, to children over five years of age. From one to five years of age, one or two drops are enough. In some few children paregoric may answer better, but this rarely happens. When it is given, ten to twenty drops at five years, five or ten at one year, and from half a teaspoonful to a teaspoonful over five years, may be used instead of the laudanum.

Depletion, except that which comes of the above treatment, is unnecessary. We did, in past years, use depletion in 2 cases out of 257 regular cases of which we kept notes. In one, a venesection to four ounces was used in a boy seven years old, on account of the great violence of the febrile movement; and in the second, leeches were applied to the temples

for an intense headache in a girl nine years old. For many years past we have used no general bleeding, but might be tempted to use leeches in a case of the same kind as that just mentioned, in which the pain in the head was something quite out of the usual way. Instead of venesection we should make use of a warm bath continued for fifteen to twenty minutes. If the temperature of the body be very high, it may be reduced by careful sponging with tepid or cool water.

Sometimes, when the cough is very troublesome, a mustard foot-bath used every three or four hours, and a mild liniment, as one composed of sweet oil and spirit of hartshorn, or of chloroform, camphor, and soap liniment, rubbed gently upon the front of the neck and over the upper part of the sternum, will assist materially in palliating this symptom.

When the conjunctival inflammation is acute and painful, it may be relieved by lotions with simple warm water, milk and water, or sassafras-pith mucilage, alone or mixed with rose-water. If the headache be very violent it can generally be relieved by the use of a laxative, by the occasional use of a mustard foot-bath, or of a sinapism to the nucha, and by the application of cold to the head.

If, at any time during the course of the case, symptoms of exhaustion appear, the most nourishing and concentrated food, with alcoholic stimulants in graduated doses, should be promptly resorted to.

The *malignant form* of the disease must be treated chiefly with stimulants and tonics. The most useful are wine and brandy, quinia, ammonia, capsicum, etc. Camphor and opium would be proper, were the case attended with severe nervous symptoms. The diet ought to be nutritious and digestible, and may consist of milk and bread, light broths, and beef tea or essence of beef.

When local inflammations occur, they may be treated by a few dry cups, or by means of counter-irritants, of which the most suitable are mustard, spirit of turpentine, or ammonia. Blisters ought to be avoided, as they are very apt to occasion dangerous and even fatal sloughing.

Treatment of the Complications.—*Bronchitis, Pneumonia.*—The mode of treatment of these complications must depend upon the stage at which they are developed, and upon the age and constitution of the subject. When they occur during the first stage, one of the most important points in the treatment is to endeavor to favor the appearance of the eruption, and when in the second stage, and the eruption has retroceded wholly or in part, the same indication applies with equal force. When they appear during the third stage, they are to be treated without any regard to the eruption, but always with reference to the fact that the patient has just passed through an acute febrile disease, which must have weakened in some degree the vital powers.

It may be stated in general terms, that the treatment proper for these local inflammations when they occur as primary affections, is proper also, with some reservations, under the circumstances we are now considering.

Thus even local depletion should be employed only with the greatest care, and, indeed, we should recommend in preference the application of dry cups, or of sinapisms.

Purgatives should also be used with caution, on account of the disposition to gastro-intestinal irritation which is always present in this disease. Our own practice is to employ moderate counter-irritation, in conjunction with minute doses of sulphuretted antimony and Dover's powder, or a mixture containing citrate of potash and syrup of ipecacuanha. When in these cases the skin is at all coolish, or bathed with too considerable a perspiration, we have found the liquor ammoniæ acetatis a very useful remedy.

It is universally acknowledged that it is exceedingly important to assist nature in throwing out the rash, whenever these complications either prevent its formation, or cause its retrocession. The true mode of doing this is to cure or alleviate the internal inflammation, which is the cause of the difficulty. To attain this end the above plan of treatment ought to be instituted at once. At the same time, we may greatly assist the appearance of the eruption by a persevering employment of counter-irritants. The best of these is, we believe, mustard, and in some cases a warm bath. The mustard may be used in the form of plasters, poultices, or baths. Our own plan in moderately severe cases, is to apply a mustard poultice to the interscapular space, and to make use of a mustard foot-bath, two or three times a day, while in severe and urgent attacks we direct the cataplasm and bath to be renewed every two or three hours, taking care, however, to apply the former alternately to the front and back of the chest, in order to avoid all possibility of too violent an action upon the skin; the feet and limbs also ought to be carefully watched, to avoid the same danger. We have had occasion to observe the great efficacy of this unremitting employment of revulsives, in several severe cases of bronchitis in young children. In some we have depended solely upon this treatment, and the use of small doses of ipecacuanha and spiritus Mindereri. In one particularly, which occurred in a child eight months old, the attack came on in the first stage. On the fourth, fifth, and sixth days, the dyspnœa was excessive, the respiration running up to 70 and 80; the pulse was frequent and small; the skin pale and rather cool; and the irritability and restlessness very great. For a period of twenty-four hours, we used the poultices and foot-baths every two hours regularly, and gave internally the spiritus Mindereri at the same intervals. Nothing else was done. On the sixth day, when one of the poultices was removed from the interscapular space, the integument beneath was observed to be covered with the measly stigmata, whilst there were none as yet on any other part of the surface. From this time the eruption came out freely, and the child recovered rapidly.

The warm bath may be used under the same circumstances. It should be given with great care, the child being wrapped in a warm blanket the moment it is removed from the water, to prevent the least sensation of chilliness. It may either lie for a short time in the blanket, or be wiped dry beneath it, and then dressed.

In some of the cases of bronchitis, there has been profuse secretion attended with extensive subcrepitant and mucous râles. In such instances

we have found the internal use of the syrup or infusion of polygala seneka, with an occasional revulsive, very effectual.

The *diarrhœa* which occurs so frequently seldom requires any treatment. Indeed, unless it indicates evident entero-colitis, or is accompanied by frequent mucous or bloody stools, and by pain and tenesmus, it is better not to interfere with it, beyond paying strict attention to the diet. When attended, however, with the symptoms just mentioned, it must be treated by astringents, by opium and ipecacuanha, and by the application of poultices to the abdomen. The seven cases that occurred to ourselves recovered under the use of laudanum enemata, given twice or three times a day, the strictest diet, and small doses of Dover's powder.

Laryngitis, as it occurs in most of the cases, needs but little treatment beyond careful avoidance of cold, the use of some mild nauseant, and revulsives to the neck. It is very seldom of a dangerous character. When, however, it assumes the character of pseudo-membranous croup, it must be treated with all activity, in the manner described in the article on that disease. In only two of the eight cases we have seen, did it appear at all threatening, and both of these recovered under the use of emetics and moderate leeching of the throat.

The *cerebral symptoms* which sometimes occur, must be treated differently in different periods of the disease. In the early stage, when they last but a short time and do not recur, they require nothing more than a warm bath and the use of revulsives. If they continue to recur, or are followed by stupor or other cerebral symptoms, more energetic treatment becomes necessary. If the child is strong and hearty we may apply dry cups to the back of the neck or temples, and resort to purgatives, revulsives, and cold applications to the head. When the symptoms are violent, and when the heat is intense, it has been proposed to use cold lotions in the manner recommended in scarlatina. The evidence upon this point is not very conclusive, and as we have never used them, nor seen them used, nor indeed seen any necessity for a resort to them, we can offer no opinion in regard to their value.

We have met with five cases of convulsions in the first stage. One occurred in a boy five years old; the convulsions were slight, lasted not more than ten or fifteen minutes, and were followed by no bad symptoms. The intelligence of the child returned very soon afterwards. The only remedy used was a warm bath. The other cases have already been described.

When convulsions occur in the second or third stages, it is very important to ascertain whether they are not the result of some local disease. Two of the three cases that came under our notice accompanied violent attacks of bronchitis. The third was caused by congestion of the brain. Here the treatment must be directed against the local disease, if that can be detected. When, on the contrary, the convulsions seem to depend on nervous irritation, they may be treated with baths, revulsives, purgatives, and the careful administration of opium, as recommended by Sydenham, Copland, Rilliet and Barthez, and other authors, or of bromide of potassium, camphor, assafœtida, musk, or hyoscyamus. If accompanied by

intense heat and great dryness of the skin, without local complications, cold or tepid lotions may also be tried.

The treatment suitable when any of the complications or sequelæ become chronic, will be found in the articles devoted to the respective diseases. Bearing in mind the tendency to the development of scrofula or tuberculosis after this disease, the most careful attention should be paid to all hygienic measures; and alteratives and tonics, as syr. ferri iodid., cod-liver oil, and quinia, should be administered.

ARTICLE VIII.

VARIOLA, OR SMALL-POX.

DEFINITION; FREQUENCY; FORMS.—Variola is an epidemic and contagious disease, characterized by an initial fever, lasting from three to four days, and followed by an eruption at first papular, then vesicular, and afterwards pustular; the eruption attains maturity in from six to nine days, after which the pustules are converted by desiccation into scabs, which fall off between the fifteenth and twenty-fifth days.

The *frequency* of the disease varies greatly in different years, because of its epidemic nature. It is far less common in childhood amongst the middle and upper classes of the community, than either measles or scarlatina, in consequence, no doubt, of the attention paid to vaccination. During the early months of 1865, one of us had the opportunity of studying a severe epidemic which occurred in portions of this city, and we have published elsewhere[1] an analysis of thirty cases in children under fifteen years of age, observed at that time. Apart from these cases, however, we had met with but two cases of the disease under fifteen years of age, during the fifteen years preceding 1871–72, whilst during the same period we had met with 263 of scarlatina, and upwards of 314 of measles. In the last-mentioned years, a severe epidemic occurred in this city, when we again saw numerous cases at all ages. It prevails to a greater extent amongst the poor and destitute classes, who neglect the attention to vaccination necessary to preserve children from the disease.

We abstract from the article already referred to, the following table, showing the entire annual mortality from variola in Philadelphia, together with the relative mortality during the early years of life, for the twenty-four years ending 1873.

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[1] Amer. Jour. of Med. Sci., October, 1869, p. 322.

MORTALITY FROM VARIOLA.

	Under 1 year.	Between 1 and 2 years.	Between 2 and 5 years.	Total of all ages.
1848,	21	13	17	100
1849,	25	20	34	152
1850,	13	8	4	40
1851,	40	30	54	216
1852,	89	54	100	427
1853,	22	9	9	57
1854,	12	4	6	49
1855,	57	39	85	275
1856,	86	44	88	390
1857,	19	17	11	65
1858,	1	2	1	7
1859,	0	0	1	2
1860,	14	10	16	57
1861,	159	105	200	758
1862,	52	44	66	264
1863,	33	24	28	171
1864,	57	31	61	260
1865,	104	50	112	524
1866,	32	17	27	144
1867,	16	4	11	48
1868,	0	0	0	1
1869,	1	3	0	6
1870,	3	0	3	9
1871,	203	112	292	1879
1872,	347	188	446	2585
Total,	1406	828	1672	8486

An inspection of this undoubtedly establishes the fact that whenever the contagious principle of variola, favored by some peculiar epidemic influence, is introduced into this community, it finds a large number of unprotected subjects who fall ready victims to its attack.

We shall, in our description of variola, refer to several forms which it may assume. These are merely degrees of severity of the same disease—types given to each case by several causes. Chief amongst these is the presence or absence in the person attacked, of the protective power of the vaccine disease, next is the type of the epidemic prevailing at the time, and last we must place the inexplicable and utterly uncertain influence of individual constitution. According to the degree of reaction of the variolous poison in the system of the patient, shall we have *distinct* or *discrete*, *confluent* or *hæmorrhagic* small-pox; or that form modified by vaccination, inoculation, or previous natural small-pox, called *varioloid*.

We shall also describe the *complications* of the disease.

Causes.—The principal causes of variola are contagion and epidemic influence.

It is not clearly ascertained at what period of its course the disease first acquires the property of infectiousness. Some assert that it is not until after suppuration is established. This is, however, to say the least, doubtful, and it is best, therefore, to take any precaution that may be necessary

to prevent the extension of the disease, from the moment that its real nature becomes apparent. There can be no doubt that the body may still impart the disease after death, and that clothes worn by the patient retain the contagious principle, unless freely exposed to the air, for days, months, and, it is said, even for years. It is also capable of infecting furniture or letters, and may thus propagate the disease at any distance, and for an indefinite period, by fomites.

One attack protects the constitution, in the great majority of cases, against subsequent contagion. When persons who have once had the disease contract it again, it almost always assumes a much milder and less dangerous form.

In the report of the Municipal Hospital of Philadelphia, made to the Board of Health of Philadelphia, for the year 1872, Dr. Wm. M. Welch, the physician in charge, states that out of the whole number of cases (2377) of variola admitted during the violent epidemic of 1871–2, 15 were said to have had a previous attack of the disease. Of these 15 cases, those which could not show a single scar as the result, he should classify as of doubtful authenticity; those which exhibited only a few scars, as of probable authenticity; and those which exhibited well-marked pitting as authentic. To the first class belonged 7 cases, of which 3 died; to the second class belonged 3 cases, all of which recovered; to the third class belonged 5 cases, all of which recovered, and in all of which the eruption was very light, so much so in one as to be characterized as doubtful.

The period of *incubation*, or the time elapsing between the reception of the poison and the onset of the malady, varies generally between nine and twelve days. It may, however, be seven or fifteen days.

Symptoms; Course; Duration.—We shall describe three stages of the disease: 1. That of the initial or eruptive fever; 2. That of the progress and maturation of the eruption; and, 3. That of decline or desiccation. In addition to these, some writers make another stage, that of incubation, which includes the period between the introduction of the poison into the system, and the appearance of the first symptoms. This stage is seldom marked by symptoms sufficiently characteristic to enable us to detect the approaching disease, and in many instances is probably entirely unnoticed by the patient.

The *first stage*, or that of initial fever, commences generally in children with pains in the bones and loins, and sometimes with rigors or chilliness, accompanied with headache, and soon followed by fever. Nausea and vomiting often exist from the first, or come on soon after the appearance of fever and headache. At the same time there is loss of appetite, thirst, and more or less obstinate constipation. The tongue is red at the point and edges. One of the characteristic symptoms of this stage is pain in the loins, which generally dates from the first or second day, and which, though varying much in degree, is usually severe. The patients often complain also of abdominal pains, which seem to be colicky, and are referred either to the epigastric or umbilical region.

Fever and headache are the most constant of all the initial symptoms. The chilliness and rigors which frequently exist in adults are not easily

ascertained in the cases of children, and are therefore much less important. The fever varies greatly as to degree; the heat of skin is generally considerable, the temperature rising to 104° or 105°, and may be accompanied either with dryness or moisture. The pulse is commonly full and frequent, rising to 120, 140, or 160 beats, according to the severity of the case and the age of the child. The headache is usually frontal and often very severe. In some cases there are strongly marked cerebral symptoms, consisting of excessive restlessness and irritability, insomnia or somnolence, delirium, and even convulsions.

The various symptoms just enumerated continue up to the moment when the eruption begins to make its appearance, which happens generally in the course of the third day, though it may occur as early as the second, or as late as the fifth, sixth, or even seventh. In severe and confluent attacks, the eruption, as a general rule, begins earlier than in mild and discrete cases.

Second Stage, or that of Eruption.—In the great majority of cases, the specific eruption makes its appearance in the course of the third day from the beginning of the fever. This is the law of the disease. Before, however, describing it, we must state that not rarely a more or less extensive roseolous rash precedes the specific eruption. So well known is this that it has been called roseola variolosa. It looks so like measles as to make a correct diagnosis difficult, since nothing could reveal its true character unless it were known that the subject had been exposed to variolous infection, in which event the unusual severity of the constitutional phenomena, compared with those generally attendant upon roseola, might well lead the practitioner to defer his opinion. This roseola occurs in all forms of small-pox. Dr. Welch thinks he has seen it most frequently and in greatest quantity in cases of mild varioloid.

The specific eruption appears, then, on the third day, in the form of small, isolated, and rounded red specks, which soon become projecting and solid, or in other words are converted into papules. The papules are from a third to two-thirds of a line in diameter, of a more or less vivid red color, which disappears under pressure, to return immediately when the pressure is removed. They are also hard, and feel almost like shot imbedded in the derm. The eruption shows itself first on the face, and generally about the chin and mouth, and then extends to the rest of the face, to the neck, trunk, limbs, feet, and hands. It sometimes happens, particularly in very young children, that the eruption appears first about the genital organs, whilst in other cases it is first observed on the lower part of the loins, or upon the thighs. The papules increase gradually in size and prominence for one, two, or three days, and, as a general rule, some time in the course of the second day of the eruption, begin to change into vesicles. This change takes place by the formation on the top of each papule of a little transparent elevation of the cuticle, beneath which is deposited a drop of serosity. The conversion of the papules into vesicles occurs first on the face, and then on the neck, trunk, and extremities. The vesicles are at first smaller than the papules, and acuminated in shape, but as they grow larger, become gradually flattened and depressed in the

centre; after a time they cover the whole papule, and before long exceed it in size. As these changes take place, the fluid they contain loses its transparency, becomes opaline, and by degrees the vesicles are transformed into pustules, and thus the third stage of the eruption or that of suppuration begins.

The pocks are more or less numerous, according to the extent and severity of the eruption. When scattered over the surface so as not to touch at their edges, the disease is said to be *distinct* or *discrete;* when, on the contrary, so numerous as to come into contact and run together, it is called *confluent*. Of these two varieties, the latter is necessarily more severe and dangerous than the former, in consequence of the greater extent of tegumentary surface inflamed. During the various changes the vesicles undergo, they are surrounded by small, inflamed areolæ, which differ in appearance according to the number of the vesicles. In cases of the discrete form, in which the eruption is sparse, so that the pocks are widely separated, the areolæ fade gradually into the natural color of the skin, at the distance of a third or two-thirds of a line or more from the base of the vesicles, whilst in those in which the eruption is more abundant, they run together, so that the spaces between the pocks are of a more or less bright-red color. In confluent attacks again, the areolæ are more or less imperfect, according to the manner in which the vesicles are grouped together.

The change of the vesicles into pustules takes place generally from the fourth to the sixth day of the eruption. During this process the fluid of the pocks becomes more and more opaque, whitish, and at length assumes a yellowish color, being in fact converted from serum into pus. At the same time the pocks become larger, begin to distend, and, as they approach complete maturation, gradually lose their umbilicated shape and become convex on the surface. The formation of the pustules follows the same course as did the vesicles, beginning on the face and extending thence to the neck, trunk, and extremities. The areolæ that have just been described as existing during the vesicular stage of the disease, continue during the early part of the stage of pustulation, but decline towards its termination, assuming as they disappear a purple tint. The number of pustules is in proportion, of course, to that of the vesicles, but from the increase in size of the pocks during the changes from papules into vesicles and pustules, the eruption, when at its height, seems to be greatly more extensive than would have seemed probable at the beginning of the first stage. As a general rule the pocks are most numerous on the face, and after that part on the neck and limbs. On the trunk the eruption is always much less abundant than on other parts of the body, and even when confluent in the highest degree on the face and neck, it is generally so only in patches on the limbs, while it is discrete on the thorax and abdomen.

Simultaneously with the eruption upon the skin, there occurs one also upon the mucous membranes, particularly those of the mouth, nasal passages, fauces, eyelids, and sometimes of the prepuce and vulva. It begins with more or less vivid redness of the membrane, which is followed by the production of little elevations, the real nature of which, whether

papular or vesicular, seems not to be clearly determined. About the second or third day these red elevations assume the appearance of small, whitish, rounded, and umbilicated pseudo-membranous points, which last generally about five days, and are then detached, leaving usually a little ulceration or erosion, which heals without leaving a cicatrix.

A short time after the appearance of the pustules in the mouth and throat, a true inflammation of the mucous membrane of those parts takes place. When the gums are inflamed they become swelled, red, and spongy, and are dotted over with white pseudo-membranous points of a rounded shape. Sometimes the velum pendulum, and more rarely the tongue, present the same white points, with redness and injection of the membrane between. In most of the cases there is also partial or general inflammation of the pharynx, which occurs subsequently to the formation of the variolous pustules. The existence of this inflammation is denoted by more or less severe sore throat, attended with difficulty of swallowing, and with swelling and tenderness of the submaxillary glands. When the mucous eruption extends to the larynx, as often happens, there is pain in that part; the voice becomes hoarse or whispering, and there is a hoarse, laryngeal, smothered cough. The pharyngo-laryngitis just described occurs generally between the third and sixth days of the eruption, and ceases about the eighth or thirteenth. In some instances it does not exist at all or only to a slight extent.

During the eruption there is more or less inflammation and swelling of the subcutaneous cellular tissue, the degree of which depends on the extent of the eruption. The skin becomes tense, red, shining, and elastic under the finger, and more or less hot and painful. The swelling is greatest upon the face, where it commences about the fourth or fifth day of the eruption, and goes on increasing for five or six days, occasioning much pain, stiffness, and inconvenience to the child. The swelling diminishes when desiccation begins, and ceases entirely as the latter is accomplished.

It is important to study carefully the general symptoms of the second stage. The fever which existed during the initial stage sometimes continues during the first day or two of the eruption. When, however, the papules are fully thrown out, the fever subsides or disappears entirely, so that the pulse falls from 100, 120, or 140 beats, to 100, 80, 76, or 74, and the heat of skin diminishes at the same time. The child remains without fever usually throughout the vesicular period of the eruption, that is to say, until the fourth, fifth, or sixth day; during which time the appetite sometimes returns, sleep is tranquil and quiet, and the patient is in most respects well and comfortable.

About the fifth or sixth day of the eruption, at which time the maturation of the pustules is nearly completed on the face, and that process is commencing on the extremities, a new fever, to which the technical term *secondary fever* is applied, makes its appearance. The pulse rises again to 88, 100, 120, and 140, and becomes strong, hard, and full, whilst the skin is hot and dry. After continuing for some days the secondary fever diminishes after the suppuration is fully established, and disappears about the time that desiccation is nearly completed on the face, and has commenced

upon the limbs. It ceases generally, therefore, about the ninth or eleventh day, having lasted between four and six days. This attack of fever is evidently the consequence of the suppurative stage of the disease, or of the conversion of the vesicles into pustules.

Towards the termination of the second stage, at the very height of the disease, when the pustules begin to break and discharge their contents, the patient exhales a peculiar, disagreeable, and fetid odor, which is characteristic of the disease.

The *third* or *declining stage* is that of the desiccation or drying of the pustules, and their desquamation. The desiccation commences generally between the sixth and ninth days, and terminates between the tenth and fourteenth. The formation of the crusts begins upon the face and extends thence to the neck and limbs. It does not reach the limbs usually until about two or four days after it has commenced on the face. The mode in which the drying of the pustules takes place is not the same in all. In some a dark point is formed in the centre which gradually extends and converts the whole pustule into a hard crust; in others the whole surface dries at the same time; while in others again, the epidermis gives way and allows the contained fluid to escape, which then hardens into yellowish, irregular crusts, which become brown before they fall off. Some of the pustules, particularly those upon the arms and legs, do not form scabs at all, but shrink away from the absorption of their fluid, leaving behind nothing but pellicles of cuticle, which fall off by desquamation.

The desquamation or falling of the crusts begins from the eleventh to the sixteenth, and ends somewhere between the nineteenth, twenty-fifth, and even fortieth days of the eruption. When the scabs fall off, the appearances presented by the skin beneath vary in different cases. In some a true ulceration and loss of substance of the derm has taken place, which gives all the characters of a suppurating ulcer when desquamation has begun early in the disease; when that process occurs at a later period, the ulcer is found to be dry and cicatrized. In both these forms of desquamation, the cicatrices form little pits or depressions, which remain during life. In other instances, the fall of the scabs leaves red and excoriated surfaces which are on a level with the surrounding skin, but which soon dry, leaving blotches of a reddish-brown color, that do not disappear entirely for months. No cicatrices remain when desquamation takes place in this manner. In a third series of cases the crusts do not fall until the surface beneath has completely cicatrized, and the only traces left behind are more or less deeply tinted reddish spots, with occasional slight furfuraceous exfoliation of the cuticle, all of which disappear entirely after a time without leaving pits or cicatrices.

To conclude the account of the symptoms of the disease, we have a few words to say in regard to the condition of some of the important organs throughout the course of the malady.

The *tongue* presents no appearances peculiar to the disease, other than the eruption already described. It is generally moist, more or less furred, and either pale or red in color. The *abdomen* usually remains soft and undistended, though in some instances it is slightly tumid and hard, with

occasional pains in the epigastric, umbilical, or iliac regions; in simple cases, the latter symptoms rarely last more than a short time, and when otherwise they are almost always the sign of some complication. The *constipation* which exists during the initiatory stage generally continues throughout the disease, though in some instances a slight diarrhœa occurs about the end of the first or second week, after which the bowels regain their natural condition. If severe diarrhœa should make its appearance, it is almost always the sign of a dangerous complication. The *nausea and vomiting* which are so often present during the initial stage, cease after the appearance of the eruption, and recur only in rare cases, or in consequence of some complication. The *appetite* is almost always lost during the course of the disease, though it sometimes returns in the period between the termination of the initial and the commencement of the secondary fever; *thirst* is acute as a general rule, and more or less so according to the violence of the fever.

The *urine* presents, during the course of the disease, the ordinary febrile characters of lessened quantity and heightened color. The urea, uric acid, and pigment are increased, and the chlorides much diminished. Albuminuria is occasionally present at the height of the disease; it is, however, temporary, and apparently not of very grave import. Casts of the renal tubules are also present in some cases. The frequency with which this condition exists probably varies in different epidemics, since we have detected it but rarely in our cases, while Parkes states that it is present in about 30 per cent. of all cases. After the subsidence of the secondary fever, the urine frequently becomes very abundant, of pale color, and of low sp. gr. Thus, in one of our cases, in a girl aged 18 years, the daily amount of urine passed from the tenth to the thirteenth day of the eruption was f℥clx, or ten pints, of sp. gr. 1001, as clear as spring-water, containing no albumen, but with a fair proportion of chlorides. In another case, in a young man aged 20 years, the patient also passed, on the eighteenth day, f℥clx of crystal-clear urine, of sp. gr. 1007, without albumen but containing abundant chlorides. In a third case, in a boy aged 13 years, the amount, on the twelfth day of the eruption, was f℥xlv.

The *strength* of the child is not, as a general rule, greatly diminished, except in severe and dangerous cases. *Restlessness, irritability, crying, and delirium*, which are of such frequent occurrence in the febrile diseases of children, are not usually very strongly marked in regular cases of variola. They exist, but it is to a moderate extent only.

We pass on now to the *confluent* forms of the disease.

It is not possible to predict from the character of the initial fever what is to be the type of eruption which is to follow, since in discrete variola, and even in varioloid, the precusory fever and other symptoms, often run alarmingly high, while, on the other hand, a case destined to be confluent, or even hæmorrhagic, does not always exhibit violent phenomena at the onset. As the time for the eruption approaches in confluent cases, the skin usually gives evidence of active inflammation of its deeper structures. It becomes thickened, swollen, hard, dark in tint, and as the eruption advances, the countless number of papules and vesicles, which cover all parts

of the body, increase the violence of this inflammatory action, and give rise to an earlier appearance of the secondary fever, which is marked by higher temperature, more active delirium, and greater disturbance of the circulation than in discrete or moderate small-pox. As the vesicles form upon the papules, they so crowd the surface that their edges run together, thus making the confluence, and no portions of natural skin remain on which to form the areolæ, which therefore are absent. As the pustules follow the vesicles they do not develop well, but remain flattish and sluggish, with a whitish, ill-concocted pus on some parts of the body, particularly the face and backs of the hands. They run together into large flat blebs or bullæ, of several inches or more in extent. Sometimes portions of the loosened cuticle are rubbed off by the movements in bed, or by scratching. The parts thus denuded look raw, and exude a sanious fluid.

In severe confluent cases the eruption extends to the mucous membrane of the nose, mouth, fauces, eyelids, and perhaps to the prepuce or vulva, as in the distinct form, but with very different severity and consequences. The inflammation produced by the eruption causes enlargement of the tongue, swelling of the fauces, pain, and often great difficulty of swallowing. The rawness and soreness of the passages, and an abundant and usually dark-colored viscid secretion, which clogs and clings to the parts, cause great distress, and add to the exhaustion of the patient. At the same time the laryngeal catarrh causes cough, hoarseness, partial or total loss of voice, and difficulty of breathing. Thus, as in violent anginose scarlet fever, and in some cases of diphtheria, the supply of air to the lungs is so diminished by the various causes of obstruction (swelling, collections of viscid phlegm, and spasm of the glottis) that the blood does not receive its due amount of oxygen, a venous stasis is established, the skin becomes dark-brown or purplish from capillary stagnation, and the patient dies, sometimes in great distress, though at others with very little apparent suffering, in a state of asphyxia and exhaustion.

In some cases the heart presents evidences of disease; the sounds become feeble and obscure, the impulse weak, and the action of the heart irregular and intermittent. These symptoms, to which special attention has been called by Desnos and Huchard,[1] are dependent upon grave inflammatory changes, either in the endo- or pericardium, or frequently in the muscular tissue of the heart. In cases where this latter lesion is present they have occasionally observed a want of agreement in frequency between the contractions of the heart and the radial pulse; and also, but as a much more constant sign, a murmur at the apex of the heart, soft, deep, diffuse, and inconstant, which differs in its character from the murmur which attends endocarditis of the valves. Undoubtedly in many cases of variola where death occurs suddenly, with signs of failure of cardiac power and pulmonary engorgement, the fatal event will be found to depend on the development of one of these cardiac lesions, and especially of myocarditis.

There is a form of confluent small-pox called superficial confluent, in

[1] Des complications cardiaques dans la variole, Paris, 1871.

which, though the eruption is really confluent, it runs through the stages of maturation, desiccation, and desquamation so rapidly that the constitution is not greatly tried, and the patient recovers without difficulty.

Even in the severe form, the patient may, if his constitution be good, pass safely through the disease.

The *hæmorrhagic, malignant,* or *petechial* form is happily rare. We had rarely seen it until the epidemic of 1871–72 showed it to us in all its terrible power. Our forefathers knew all about it. We, of the generation which has risen since the introduction of vaccination, had read of it, but took little heed of what the variolous poison might do when it exerted its malignant forces. In this form the patient is weak and feeble from the beginning. The surface assumes a singular reddish hue as the eruption comes out. The vesicles when they form upon the papules, instead of filling with lymph, and then pus, contain only a thin, sanguinolent liquid; they mature very imperfectly, or rather not at all, not acuminating but remaining flattish, or irregular in shape, and flabby. While the eruption is struggling along in this irregular mode, the vessels of the cutaneous tissues become gorged and partially stagnant, so as to give to the surface dark red, brown, blue or purplish, and livid tints. Extravasations take place amongst and beneath the eruptive points, the cuticle forming the bloody pocks breaks, blood exudes, and forms dark scabs, and the patient is so changed from his natural aspect that we may comprehend how in the olden time, people who had not the consolation which vaccination gives, may have been driven from the bed and even from the house of the sufferer in hopeless terror. Such cases look no longer human. The swollen face, purple or black, the dark or crimson-red eyeball, with the whitish cornea sunken into a pit formed by the projection of the blood-colored and œdematous conjunctival membrane, the eyelids thick and stiff and imperfectly closing, the gross body, changed from all its natural bright to blackish tints, the cuticle dissected from the skin by bloody exudations, which weep and stain the clothing and bed-linen. Such is the variola nigra or black small-pox of the old writers, and well does it deserve its name.

Varioloid, or Modified Small-pox.—This is a term now usually applied to the modified form of the disease, as it occurs in individuals who have been vaccinated, or who have already had the natural or inoculated disease.

Dr. Welch's rule is a very good one,—"to classify as variola all unvaccinated cases, no matter how mild, all malignant cases, and all the vaccinated cases in which the eruption does not reach maturity until after the sixth or seventh day from its first appearance." The true point of distinction here, when any uncertainty as to vaccination exists (and this is not rare amongst the poor), is the time of maturation of the eruption. This, in varioloid, ought to be matured and in the decline by the sixth or seventh day.

The initial symptoms of varioloid are of the same general kind as those of natural small-pox, differing merely in degree. But the physician ought to know that, in a few cases of even very mild varioloid, while the erup-

tion is destined to be sparse, to consist of but few pocks, and to run through its stages in five or six days, the initial fever may be very high, and the attendant phenomena of pain, nervous disturbances, loss of strength, etc., very marked. We once saw a girl nine years old, who was ill for three days with very high temperature, delirium, stupor, prostration of strength, violent headache, and rapid pulse, so that her case looked very threatening, and left the diagnosis in great doubt. On the third day a moderately abundant variolous eruption came out, when all the unpleasant symptoms rapidly abated and disappeared. The eruption ran through its stages in six days, and the patient recovered without a pit. She had been well and carefully vaccinated in infancy.

These severe initial symptoms are rare, however, in children as compared with adults. Usually the attack begins with slight fever, headache, languor, and sometimes constipation, which are followed in two or three days, by the eruption. The vomiting, lumbar pains, and different nervous symptoms which exist in regular variola, are not often present, or, if so, in a very slight degree. The eruption consists of papules like those of true small-pox, but usually they are few in number, and entirely discrete in their arrangement. The initial fever and other symptoms subside completely upon the appearance of the eruption, and the child often seems perfectly well.

The progress and character of the eruption are very similar to those of the regular form of the disease, with the exception that the changes are more rapidly effected, and, as a consequence, the duration of the attack is rendered by so much the shorter. The papules are converted into vesicles at a much earlier period—as early as the first or second day. The vesicles soon assume a whitish, opaline appearance, become umbilicated, and in the course of the second or third day begin to change into pustules. The suppurative stage of the eruption, or maturation, is seldom accompanied by any marked secondary fever, as in the regular disease. When the fever does occur, it is generally very moderate, consisting merely in slight acceleration of the pulse and a little increased heat of skin, and in one or two days it disappears entirely. The pustules do not fill usually so well as in regular variola, and not unfrequently their contents are rather sero-purulent, than purulent, in the proper sense of the term. The third stage occurs earlier and goes through its periods more rapidly than in true small-pox; desiccation soon takes place, is speedily finished, and the falling of the scabs, which begins as early as the eighth day of the eruption, is usually completed about the twelfth or fourteenth. After desquamation is completed, the only traces of the disease left are reddish spots or blotches, which disappear after a time without leaving cicatrices. The whole duration of the attack is generally from ten to twenty days.

Varioloid may be so mild that the patient never goes to bed. Some malaise, a little loss of appetite, the appearance on the skin of half a dozen papules, which soon become umbilicated vesicles, and then rapidly form scabs, constitute the whole history of some cases. Here it is that a correct diagnosis is invaluable to the family. To the patient it is of no consequence.

He is safe, but he may inoculate any or all of those who have not been properly protected.

Complications.—The most frequent and important complications of variola in children, are inflammations of the mucous membrane of the lower half of the intestinal tube, ophthalmia, otitis, and different hæmorrhages. In a smaller number of cases, attacks of bronchitis, pneumonia, anasarca, articular inflammations, subcutaneous abscesses, simple and pseudo-membranous coryza, angina, and laryngitis, and other eruptive diseases, occur at different periods of the malady.

It is impossible for us, for want of space, to attempt a description of the various symptoms of the different complications just enumerated. Having mentioned the possibility and probability of their occurrence, we must leave the reader with the advice always to suspect the existence or approach of some one of them, when the symptoms, in any case, differ much from those which have been described as characteristic of the regular form.

Anatomical Lesions.—The characteristic lesions of small-pox are a certain deteriorated state of the blood, congestion of the internal organs, and the inflammation of the skin and mucous membranes constituting the eruption. The blood is found to be entirely liquid and uncoagulable, and of a dark color; or if coagula exist, they are small, soft, and very dark in color. The exceptions to this rule are those in which some acute and severe inflammation exists, under which circumstances the dissolved state of the blood is less marked, and fully formed coagula are more abundant. The congestion referred to affects almost the whole system. The muscles are firm and of a deep red color; the membranes of the brain are strongly injected, the sinuses are filled with blood, and the cerebral substance presents numerous red points or dots. The vessels of the lungs contain a large quantity of blood, and the liver, spleen, and kidneys, are all deeply congested.

The condition of the mucous membranes is important. The pharynx, larynx, and trachea, present an eruption, or simple inflammation without eruption. The eruption exists under the aspect of small, circular, thin, and whitish pseudo-membranous points, scattered over the mucous tissue, and slightly adherent to it, beneath which that tissue is often observed to be red and inflamed. At a more advanced degree, and in severer cases, the false membranes have disappeared, and in their places we find circular ulcerations, which are either superficial, or they penetrate the tissue of the mucous coat and rest upon the muscular, or even pierce that and reach to the cartilaginous tissue beneath. In addition to these lesions are found inflammation of the mucous tissue with its consequences, redness, softening, thickening, and extensive deposits of false membrane, quite distinct from the appearances above described as characteristic of the eruption upon these tissues.

It has been a contested point whether a true vesicular or pustular eruption ever exists upon the mucous lining of the stomach and intestines. The general opinion appears now to be, however, that the changes observed in these organs cannot be ascribed to the formation either of ves-

icles or pustules. The appearances that have led some observers to consider them as the result of a proper eruption, are the following. The follicles at the commencement and termination of the small intestines, and in rarer cases, of the large intestine also, present an abnormal degree of development, appearing in the form of small hemispherical or pointed, and sometimes flattened projections, on which there often exists a dark, and sometimes depressed central point. At the same time Peyer's glands are often enlarged, more projecting than usual, softened, and red.

According to the valuable researches of Desnos and Huchard (*loc. cit.*), the heart and pericardium present marked lesions in a considerable proportion of cases of confluent variola. These changes were rare in cases of the discrete form, and were not detected in any case of varioloid. The lesions may consist solely of endocarditis, or pericarditis, or these may be associated. These inflammations present the ordinary morbid products, and are not attended with the development of pustules. In other cases, the muscular walls of the heart are affected with an acute myocarditis, which is marked at first by a granular state of the muscular fibres, which soon passes into fatty degeneration.

The *anatomy of the variolous pock* is important and interesting. When a vesicle is opened soon after its formation, it is found to contain nothing but a little serosity, which is perfectly limpid and alkaline, while the skin beneath is red, softened, and moist. The umbilicated character depends on a filiform adhesion between the centre of the pock and the surface of the skin beneath. This adhesion is broken, when, at a later period, the pustule becomes globose in shape. The vesicle is also subdivided into several chambers by delicate radiating partitions, so that a single puncture will not discharge the entire contents. About the period of the conversion of the vesicles into pustules, or very soon after the formation of the latter, the cavity of the pock will be found to contain a false membrane, which is of an opaque white color, soft and friable in its texture, and seated upon the derm in small isolated points. After a time these points enlarge, and meeting, unite, and form a soft pseudo-membranous disk, uneven upon its surface, and which either fills the pock completely, or is covered at first with serosity and afterwards with pus. This false membrane is secreted originally by the true skin. At a somewhat later period it forms an adhesion to the inner surface of the cuticle, while still later in the progress of the pock, it becomes detached from the cuticle, and remains loose and free in the cavity of the pustule, surrounded by the fluid contents of the latter.

Diagnosis.—The diagnosis of this disease in all its forms ought to be made as early as possible, in order that the persons in contact with the patient, whether from necessity or by accident, may be vaccinated or revaccinated. It is well known that exposure to the mildest varioloid may produce in the unprotected any form of small-pox, from discrete to malignant, according to the constitution of the subject and the type of epidemic prevailing. Therefore the only safety after exposure is in the vaccine disease, and, therefore, the lives of the exposed hang upon the knowledge and action of the physician in charge, a responsibility from

which he cannot escape either in the estimate of the public or in his own consciousness.

Dr. Welch concludes from his observations that "vaccination performed at a period less than seven days previous to the appearance of the eruption (small-pox) will not modify the disease," but that when performed "seven days previous, (it) will almost always modify the disease to the extent of rendering it harmless."

Dr. Masson (article on Small-pox, in Reynolds's *System of Medicine*, vol. i, p. 477) says that to be effective vaccination should have gone on to the stage of areola before there is any illness from small-pox. "It has before been stated that when small-pox has been taken into the system there is twelve days' freedom from illness, generally, forty-eight hours' illness, and then the disease begins to appear on the skin. The areola of vaccination is not fully formed until the ninth or tenth day of the progress of the vaccine vesicles on those who have never been vaccinated before, so that unless there has been time for the areola to be formed after the vaccination, before the illness produced by small-pox begins, the vaccination will not be of the least benefit." He gives an example: "Suppose an unvaccinated person to inhale the germ of a variola on a Monday; if he be vaccinated as late as the following Wednesday, the vaccination will be in time to prevent the small-pox being developed; if it be put off until Thursday, the small-pox will appear, but will be modified; if the vaccination be delayed until Friday, it will be of no use, it will not have had time to reach the stage of areola, the index of safety, before the illness of small-pox begins. This we have seen over and over again, and know it to be the exact state of the question. Revaccination will have effect two days later than vaccination will have that is performed for the first time, because revaccinated cases reach the stage of areola two or three days sooner than in those persons vaccinated for the first time."

It is plain, therefore, that the diagnosis ought to be made as early as possible. Can it be made in the initial stage? Not, we think, with any certainty. Except in a time of general epidemic prevalence, cases of small-pox are almost unknown, and varioloid is very rare amongst children, and the medical man thinks of anything but varioloid or small-pox to explain a fever attended with vomiting, anorexia, restlessness, or drowsiness in the infant, and the same symptoms with headache and general soreness in the older child. The initial fever has no characteristic phenomena. When the disease is epidemic, the initial fever, as it has been described, may arouse suspicion, and the attendant physician may dare to announce the probable approach of the dreaded disease, and examine all the exposed persons as to their being fully protected. But this course is justified only by the presence of the epidemic. Not until the eruption begins to appear can the diagnosis be made with certainty; and however easy it may be for old and experienced physicians to make it then, we desire to caution the younger and more inexperienced as to the possibility of mistake.

The important points to bear in mind are the following: 1. The prodromic stage, whether of mere ailing and lassitude, such as may not send

the patient to bed, or violent fever with nervous symptoms and the different signs which declare a severe disease, which lasts two days, and on the third of which, as the law, the eruption makes its appearance. 2. The eruption appears first on the face and about the upper part of the neck, and consists of hard, distinct, shotty papules, seated, in mild cases, on a nodosal skin. 3. As the eruption appears, the fever diminishes. These three points kept steadily in view will usually prevent any mistake.

The eruption of measles shows itself on the third day of fever, as in small-pox, and occasionally appears in distinct points, which give it a suspicious likeness to that disease. But the attendant catarrhal conditions, the coryza, cough, and conjunctival catarrh, with the fact that the fever increases as the eruption comes out, instead of diminishing as in variola, ought alone to decide between the two. Moreover, a careful study of the eruption ought to enable us to decide. In variolous disease the papules are small, hard, very distinct one from another; in measles the papular character is not well marked, the stigmata are larger, broader, flatter, and much less hard and shotty to the the touch, and very soon they run together and assume irregularly crescentic outlines. By the second day of the disease there is rarely any difficulty.

Varicella, which from its name, one would think, ought to resemble variola closely, has rarely given us any trouble. The prodromic stage of varicella never lasts over a day; it often consists of but a restless night, and sometimes the first thing to attract the attention of the mother or nurse is the eruption. When the prodromic stage does exist, it consists merely of some lassitude or irritability, loss of appetite, and slight fever. The eruption shows itself at once upon the face and front and back of the body. So much is this the case that we always have the child undressed in order to get a good view of the body. If, on inspection, a number, three or four or a dozen, or very many rounded, projecting, globose vesicles are to be seen, consisting of a thin and transparent layer of the cuticle, filled often to bursting with a limpid serum, there ought to be no difficulty in the diagnosis. Such an eruption, appearing with scarcely a prodrome, or merely a slight ailing of twelve or twenty-four hours, cannot be small-pox or varioloid.

In very mild varioloid, where the eruption counts three or four or half a dozen vesicles, and where the prodromes are very mild, it is not always easy to be quite secure in one's opinion, and a careless or inexperienced person might very well fail to detect the true nature of the disorder. But even here careful inquiry will generally show that the health has been disturbed for two days, at least by altered temper, lassitude, lessened appetite, and one or two restless nights. These prodromes, when followed by a few hard, distinct papules, which become on the second day vesicles, and then umbilicated pustules, to dry up on the fourth, fifth, or sixth, can be nothing but variolous in their nature.

Again, in severe cases of small-pox itself, embarrassments sometimes occur. We once saw an infant, five weeks old, who had never been out of the mother's room, seized in the midst of perfect health, with violent fever, vomiting, loathing of the breast, and heavy stupor. On the second day of

the illness the whole cutaneous surface began to redden; soon the tint became bright-red, not unlike some scarlet fevers, but of a more crimson-red; the skin was swelled, tight, hard, and, so to speak, shining. On the third day innumerable hard and distinct papules formed upon this evidently acutely inflamed skin, and on the following day the child died comatose. The child had not been vaccinated, and there were at the time a few cases of varioloid and small-pox in the city. Even in such cases, however, where a deep roseolous or erythematous efflorescence precedes and masks the variolous eruption, the violence of the prodromic symptoms, so unlike the mild phenomena which precede ordinary roseola or erythema, and particularly the intensity of the coloration and the hard and swollen condition of the skin, indicating active inflammatory states of its deeper layers, will go far to prepare an experienced eye for what is coming.

Prognosis.—The fatality of small-pox varies greatly in different epidemics. The result is also markedly influenced by age. It is particularly fatal in infants under one year of age. Of the whole number of cases, 2377, admitted into the Municipal Hospital of this city in 1871–2, there were 35 children under one year of age. Of these 26, or 74.28 per cent., died. Between the ages of 1 and 15 years there were 291 cases, of which 95, or 32.64 per. cent., died. The mortality was therefore nearly three-fourths of the whole number under one year, and very nearly a third of those between 1 and 15 years of age.

Of a series of 23 cases that we have met with, 5 were fatal. All of these were under 5, and 3 under 1 year of age.

The amount of the eruption governs the prognosis to a great degree. As the number of pocks is abundant or otherwise,—as the case is a discrete, moderately full, semi-confluent, or confluent one,—so is the danger. Cases of full confluence are almost as fatal as malignant scarlatina. Few children escape in the confluent form. A moderately full eruption, and of course a discrete one, is favorable. The hæmorrhagic form is, almost without exception, fatal. Varioloid rarely kills. Under 15 years of age we have never seen a fatal case of it. In one case only have we known it to be dangerous.

The favorable symptoms in any case of variola are the occurrence of the disease in children previously in good health and over one year of age; the absence of any violent nervous symptoms during the initial stage; a proper duration of the first stage; and the subsidence of the fever after the appearance of the eruption. When, in addition to these circumstances, the secondary fever is not too violent, and no complication arises, there is but little doubt that the patient will recover.

The unfavorable symptoms are the occurrence of the disease at a very early age; the existence of severe nervous symptoms during the first stage; the occurrence of a thick and abundant eruption upon the face indicating a probably confluent case; continuation of the fever after the appearance of the eruption, or a merely slight subsidence of it; delirium and other nervous symptoms during the secondary fever; and any irregularity in the appearance of the eruption, as paleness instead of the usual red color, a livid or purplish color of the pustules, imperfect development of the

pocks, or their sudden shrinking without diminution of the general symptoms. The occurrence of the signs which mark the hæmorrhagic form, as petechiæ and local hæmorrhages, stamp the case as almost necessarily fatal. It is scarcely necessary to say that many of these symptoms are indicative of the existence or threatened production of some complication, upon the nature of which must depend, after all, in great measure our prognosis. The complications most apt to occur have already been considered in a previous section.

TREATMENT.—The treatment must be regulated by the type of the case under charge. It will vary, therefore, from a mere quiet expectancy throughout, to the vigorous use of such means as moderate fever, abate nervous agitation, and allay suffering in the early stages, with the peremptory exhibition of stimulants, tonics, and nutritious foods, in the period of eruption and maturation.

In the varioloid of children over eight or ten years of age, during the initial fever, rest in bed, light diet, and the use of sweet spirit of nitre, in iced lemonade, often suffice. Should there be much restlessness, insomnia, or pain, solution of citrate of potash, with small doses of laudanum or paregoric, may be given. When the eruption appears, if it be slight, and the fever disappears, nothing more is necessary than to keep the diet moderate and seclude the patient in one room, for the sake of others, until the crusts have fallen. If the eruption be more copious, enough to cause a good deal of irritation and restlessness, a warm bath at night, especially with some bran added to it, and the application through the day of an ointment of glycerin and cold cream, with a mild opiate at night, are all-sufficient.

In the variola of unvaccinated children, the treatment must also depend on the type of the symptoms. In the initial stage, when the fever is high, the child must be confined to the breast, if it is still nursing, and, if weaned, it is to be kept upon a proper mixture of milk and water, with lime-water, and upon chicken or beef tea, for food. Cold water must be frequently offered to the child at all ages, and it should be allowed to take all it desires. A tepid bath morning and evening, or even three times a day, if the child does not resist, is very soothing, and tends to reduce the heat. Spongings with tepid or cool water, from time to time, according to the degree of heat, and the effects of the application, may be used, if the bath terrifies or fails to reduce the fever.

Diaphoretics, and especially the citrate of potash, with sweet spirit of nitre, and very small proportions of laudanum, should be administered in this stage. Or the spirit of Mindererus may be given,—twenty to thirty drops, with ten drops of nitre and five of paregoric, in a tablespoonful of iced water, every two hours, to children of six months to two years. For older children the doses must be enlarged.

When there is, as often happens, great agitation of the nervous system, as shown by jactitation, insomnia, and mild or active delirium, some remedy should be given to control these symptoms. If the citrate of potash and opium fail to relieve these conditions, the best remedy is bromide of potassium, one to two and a half grains, with one to two drops of deodorized

laudanum, at the age of one to three years, every two hours until rest is obtained, or until three or four doses have been given. After the age of four years the proportion of the bromide may be doubled.

When great heat and swelling of the skin, severe headache, and signs of congestion of the lungs or brain, exist, cold applications to the head, with hot mustard foot-baths, may be used with the diaphoretics. If, in older children, the headache or pain in the loins be very severe, a few dry cups or a sinapism may be applied to the back of the neck or loins.

If the bowels are not moved spontaneously, a moderate laxative ought to be used, as syrup of rhubarb or castor oil, or an enema may be ordered. Purging with large doses of cathartics must be avoided at all ages.

In the eruptive stage the treatment must vary with the type of the eruption and the constitutional peculiarities of the patient. It may be laid down as a rule that, the more copious the eruption, the more carefully should the strength be husbanded, and the vitality supported, to enable the patient to pass through the long and exhaustive processes of maturation and desiccation necessary to a cure.

If the eruption come out slowly and tardily, and the extremities be cool, even though the body is hot, hot mustard foot-baths, or warm baths, with hot drinks, as milk and water, hot broths, and small quantities of brandy, ought to be employed, and are often very useful.

If the eruption be discrete and moderate in amount, nothing but rest in bed, simple sustaining foods, and some local remedy to allay cutaneous irritation, as an ointment or an occasional warm bath, will be necessary until the secondary fever appears. When this arrives, the same means, in the form of diaphoretics, anodynes, and nervous sedatives, should be used as in the initial stage. In the stage of maturation the strength must be sustained by a diet adapted to each particular case. If the patient be feeble, and therefore much reduced by even a moderate eruption, he must have brandy added to his milk, or wine-whey, from time to time, increased doses of beef or chicken soup, if he can take them, and, if old enough, eggs, or egg-nog. Quinia and muriated tincture of iron should be used as in confluent cases, of which we shall speak directly.

In the semi-confluent and confluent cases all must be done to sustain the strength and vitality. From an early period of the eruptive stage, alcohol, quinia, and iron, must be employed. From twenty to thirty drops of brandy, in a wineglassful of milk, may be given every two hours, and two or three tablespoonfuls of thin beef tea, every alternate two hours, at the age of two or three years. After the age of five, these quantities may be doubled. To infants, brandy, in doses of ten to twenty drops, may be given every two hours, in breast-milk, or in warm water and sugar. Quinia, in doses of half a grain, at a year old, and one grain at four and five years, with or without muriated tincture of iron, ought to be administered every four hours. It is best to choose the four-hour interval, because of the difficulty there is in giving frequent doses to children. If the stomach will not retain the iron and quinia mixed together, the quinia may be used in suppository, two grains every four hours, and the tincture of iron in doses of two to five drops, according to the age, every two hours, in syrup of

ginger, or in combination with dilute acetic acid and solution of acetate of ammonia, as proposed in the article on scarlet fever. On account of the well-known frequency of cardiac complications in such cases, digitalis may be added to the treatment if the symptoms indicate marked failure of the heart's action.

The condition of the pharynx and larynx present in confluent small-pox, as described in the article on symptoms, constitutes one of the great difficulties of the disease. The patient suffers so much in the act of swallowing, the respiration is so interfered with when he attempts to drink or eat, that it ends in his taking but little, and, at last, almost nothing. Here ice should be given, iced flaxseed tea and iced brandy and water, or frozen beef tea. A solution of chlorate of potash may also be tried. Lemonade may be used, and a warm poultice to the throat is to be recommended. Still we must persevere, as small quantities are better than nothing, and we may employ nutritive injections of beef tea, of milk, or of egg and milk.

If the patient survives the stage of eruption, we must continue the tonics, stimulants, and nutritious food through the decline of the disease. During the latter period something must be done to allay the itching, burning, and irritation of the skin. If the patient is not too weak, a flaxseed or bran bath is very soothing, or we may use lime-water and sweet-oil liniment, or glycerin and cold cream ointment, applied with a large camel's-hair brush frequently.

In hæmorrhagic small-pox, which is almost always fatal, we know nothing better to recommend than the treatment just advised for the confluent form, to which turpentine in full doses may be added, on account of both its stimulant and hæmostatic properties.

Treatment of Complications.—If *complications* occur in the course of the disease, they must be treated always with a full consideration of the primary importance of the general disorder. The angina and laryngitis of confluent cases can scarcely be looked upon as complications. They belong to the disease. We have already alluded to their treatment, and may refer the reader to what has been said of the same series of symptoms in scarlet fever. In pleurisy or pneumonia we can do nothing better than persevere with the measures most proper to combat fever. Pain may make it necessary to use opium in full doses. Counter-irritation is not to be thought of because of the eruption, and even cataplasms, which are so useful in ordinary pleurisy and pneumonia, are objectionable here.

The treatment of the ophthalmia which so often threatens, and sometimes occasions great or irreparable injury to the eye, is very important. Niemeyer says that much may be done to prevent the development of a severe eruption on the conjunctiva by the assiduous employment of cold water compresses, or, still better, by compresses moistened with a weak solution of corrosive sublimate, one of one grain to six ounces of distilled water. When ulcerations occur upon the cornea, they ought to be touched, if this be practicable, with solid nitrate of silver sharpened to a point, or with a fine camel's-hair pencil which has been moistened and rubbed over the nitrate of silver crystal to insure a caustic solution. When it is im-

possible to apply the solid caustic or the brush, we must resort to some collyrium. This may consist of a solution of nitrate of silver, a grain to the ounce, or of one or two grains of sulphate of zinc, with twenty or thirty drops of wine of opium, dissolved in an ounce of rose-water, two or three drops of either of which may be introduced into the eye, morning and evening. An excellent collyrium is one composed of twelve grains of borate of soda, one grain of sulphate of zinc, a drachm of camphor-water, to seven drachms of distilled water.

Catarrh of the intestine must be treated by the most careful attention to the diet, by emollient and anodyne injections, and by the internal administration of astringents, and small doses of opiates. When the diarrhœa is severe, and the stools mucous and bloody, we may use with advantage the nitrate of silver by enema, as recommended in the article on entero-colitis.

The treatment of the convalescence is important. The same rules apply here as in other infantile and children's diseases.

Ventilation and Disinfectants.—It is even more important in this disease than in others, for the physician to see to it himself that the rooms occupied by the patient, and the house of which they form a part, shall be well ventilated, and that so soon as the eruption becomes purulent, and its exhalations more or less fetid, proper disinfectants shall be applied. This is necessary, not only for the good of the patient, but also for the safety and comfort of the other inmates of the house. The best ventilation in winter is that procured by an open fire, or, if this cannot be had, by a stove. If the room can be warmed only by a furnace, the windows must be very carefully opened from time to time, so as to supply fresh air, and yet avoid currents flowing over the patient. In summer, of course, the windows must be open.

Among the best disinfectants is Labarraque's solution. If this cannot be had, or if more than one be desired, chloride of lime in saucers, wetted, or a mixture of equal parts of impure sulphate of iron and of chloride of lime, wetted, and placed in saucers, in the entries and passages of the house, are very efficient. Solutions of carbolic acid or permanganate of potassa, chloralum, and other disinfectants may be substituted for the above if more convenient.

Before terminating our remarks upon the subject of small-pox, it will be proper to give some account of the treatment of the eruption which has been recommended and practiced, with a view to prevent the scarring and disfiguration which so often result from the ravages of the disease. Of the different means that have been employed with this view, there are two which are chiefly relied upon at present. One is to cauterize the pustules with nitrate of silver, and the other to make a mercurial application upon the part where it is desirable to cause the abortion of the eruption. The cauterization has been performed in two modes: by the application of the caustic to each pustule separately, or to masses of the eruption without puncturing the cuticle. It appears, however, that the first-named method is much the most preferable. To succeed perfectly, it is necessary to touch

the derm forming the base of the pustule; so that the best plan is to remove or lift up a portion of the top of the vesicle with a lancet, and then to introduce into its interior the sharpened point of a stick of caustic. This operation is certainly successful only when performed on the first or second day of the eruption, though MM. Rilliet and Barthez have known it to answer as late as the third and fourth, or even fifth day. The process of cauterization is productive of acute pain, but does not increase the local inflammation, according to the authors just quoted, at least when applied to a small number of the pocks. They state that when applied to the pustules seated upon the edges of the eyelids, it is almost incredible to behold how great is the diminution of the œdema of those parts in a single day. The conclusion of these gentlemen is, that individual cauterization of the pustules with nitrate of silver does certainly cause them, as well as the surrounding tumefaction, to abort, and prevents them from leaving cicatrices.

This plan is, however, manifestly inapplicable to any but cases of the discrete form, where the vesicles are not very numerous.

The other method which has been employed to cause the abortion of the pustules, and thus prevent disfiguration, is, as has been stated, the application of some one of the mercurial preparations. The effects of this treatment are said to be an almost certain arrest of the development of the eruption, when it is used from the first or second, or not after the third day; the vesicles and pustules remaining small and isolated, and not assuming, or else soon losing, the umbilicated character. When applied early, while there are as yet but few vesicles formed, it prevents the development of new ones, and diminishes the accompanying swelling and soreness. When the application is removed on the seventh or eighth day, it is found that desiccation has occurred imperfectly, the surface presenting small soft scabs, or little whitish, soft elevations, consisting of the pseudo-membranous substance situated between the true skin and the new epidermis, the old cuticle having generally peeled off with the plaster. In some places a light rose-colored surface alone remains.

In regard to the success of this treatment in preventing disfiguration, we may quote the statement of MM. Rilliet and Barthez, that none of the patients upon whom they saw it tried presented any cicatrices, though several had had confluent small-pox, which pursued its usual course on the parts not covered by the application. Dr. Stewardson, of this city, made a considerable number of trials of this treatment at the Small-pox Hospital of this city in 1841–42. He gave his conclusions in the following words (*Am. Jour. Med. Sci.*, January, 1843, pp. 86–7): "From these experiments, it seems pretty evident that the mercurial plaster has a decided influence upon the small-pox pustules, preventing more or less completely their perfect maturation, and diminishing the concomitant swelling and soreness, the process of desiccation being completed without the formation of thick scabs, and the resulting cicatrices less marked than when the process of suppuration was left to pursue its natural course. . . . . That, by its use, pitting may be entirely prevented, or the mortality from small-pox materially lessened, seems to me very doubtful, although had all the pre-

cautions above-mentioned been taken, it is not improbable that the effects would have been still more decided."

The use of the mercurial application is attended with some inconvenience. In the first place it is difficult to keep it accurately applied, particularly in children, in consequence of the unpleasant sensations it occasions. In the second place, it not very unfrequently, according to MM. Rilliet and Barthez, produces an eruption of hydrargyriasis or mercurial roseola, in about eight or fourteen days after the variolous eruption, or four or ten after the application of the remedy. M. Rayer, however, states this effect to be a rare one.

Dr. Stewardson says that he thinks no apprehension need be felt as to constitutional affection from the mercury, for scarcely ever were the gums even touched. One of ourselves, however, when in Paris, in 1840, saw this effect produced in a young girl at the Children's Hospital.

The method of its application is different in different hands. The French generally employ the emplastrum de Vigo cum mercurio. Dr. Stewardson prefers the strong mercurial ointment, either pure or rubbed down with an equal bulk of lard, spread upon a piece of thick muslin. The muslin is to be cut into the shape of a mask, with apertures for the eyes, nose, and mouth. It is secured upon the face by means of strings attached to its margin and tied across the back of the head and neck. It it important always for the success of the measure, that the application should be kept in close contact with the skin. To insure this, he employed a separate piece of muslin for the nose, which is the part most difficult to fit. With the same view, the French authors recommend that the plaster should be cut in pieces to suit the different portions of the face, making one for the forehead, and others for the cheeks, sides and back of the nose, and upper and lower lips. Any spaces that may remain are to be covered with other portions of the plaster, and the whole secured with strips of diachylon. On account of the difficulty of applying the mercurial plaster, the following ointment was compounded by the apothecary of the Children's Hospital at Paris, and has been found to answer very well:

℞.—Mercurial Ointment, ...	24 parts.
Yellow Wax, ...	10 parts.
Black Pitch, ...	6 parts.—Mix.

The application ought to be confined to the face, as that is the part which it is most important to save from disfiguration, and as it is better not to use it upon a larger surface than necessary, lest it might occasion the mercurial roseola, or possibly salivation. As a general rule, four or five days are sufficient, according to Guersant and Blache, to leave it in contact with the skin, in order to avoid the bad effects just referred to.

The object sought in these applications being, to a great extent, to protect the vesicles from contact with the atmosphere, it has been advised to paint a saturated solution of gutta percha in chloroform, over the neck and face, so soon as the papular eruption is fully out. This plan was tried in five of our own cases (*loc. cit.*, p. 345), two of which were discrete and three confluent, and with very satisfactory results.

To conclude this matter we will add that Niemeyer states that Skoda prefers compresses moistened with solution of corrosive sublimate (gr. ij–iv to water ℥vj) to mercurial plaster, which induces an injurious elevation of temperature. He also says that Hebra rejects both mercurial plaster and solution of corrosive sublimate, as well as collodion, and touching the individual pocks with nitrate of silver, and that he has come to this decision from the observation in his wards, that the pocks do not leave cicatrices any oftener since he has ceased to employ these remedies than when he used them. He (Hebra) applies only cold water compresses, which, while the skin is tense, relieves the patient, although they do not protect the skin from destruction.

ARTICLE IX.

VACCINE DISEASE.

Definition; Synonyms; History.—The vaccine disease is an affection produced by the inoculation of the virus of variola, modified by passing through the system of the cow.

The proofs which exist as to the truly variolous nature of the vaccine disease in the cow, are altogether incontestable; so that we must regard the vaccine disease in the human subject merely as a remarkably modified form of variola.

It is susceptible of propagation from individual to individual by inoculation, but is contagious in no other way, and it possesses the invaluable quality of protecting, with very great, though not with absolute certainty, those through whom it has passed, against small-pox.

Besides the name given above, it is known by the titles of cow-pox, kine-pock, vaccina, and vaccinia.

Some knowledge of the nature of the vaccine disease, and of its power to protect the human constitution against small-pox, has been found to have existed in different parts of the world, but there can be no doubt that we owe to the genius and patient research of Dr. Jenner the inestimable blessing of vaccination, since it was by him that its marvellous virtue was demonstrated and proclaimed to the world. Dr. Jenner learned, at an early period of his life, that there existed a popular belief in Gloucestershire, England, that persons who had contracted a peculiar vesicular disease from the udder of the cow, were thereby protected from the attack of small-pox. Becoming convinced by a long course of patient observation, that this belief was founded in fact, he determined at last to try whether the disease might not be transmitted from one person to another, and thus increase immeasurably the utility of this wonderful protective means. On the 14th of May, 1796, accordingly, he vaccinated a child eight years old with matter taken from the hands of a milker who had received the disease

from the cow. The experiment succeeded perfectly, the child having received and passed through the disorder in the most satisfactory manner. On the 1st of July following, this child was inoculated with variolous matter, and resisted the contagion entirely, as Dr. Jenner had expected. It was not, however, until two years later, in 1798, after additional experiments, that the results of his researches were published to the world. From this time the belief in the utility of vaccination and its application in practice spread rapidly throughout England. In 1799 it was introduced into this country; in 1800 it reached France, and in the course of a very few years extended to all civilized nations.

Symptoms; Course.—It is very important for the physician to be thoroughly acquainted with the appearances presented by the vaccine disease in its various stages, since he is to judge by those appearances whether the subject has had the disease in such perfection as to derive all the benefit from its protective power which it is possible for it to impart.

The first effect of the puncture by which the virus is introduced into the tissues, is to produce a very slight redness at the point where the operation is performed. This redness usually disappears within twenty-four hours, and there is left merely a little mark or scab at the point of insertion. On the third day after the operation we first begin to perceive the specific effects of the virus, in the shape of a small, hardened point at the seat of the wound, surrounded by a faint, erythematous redness. Over this hardened point, which grows gradually larger, the cuticle is elevated on the fifth day into a vesicle, by a thin, transparent, and pearl-colored serous exudation. This vesicle soon becomes umbilicated, so that by the following day, the sixth, the depression in the centre, constituting the umbilicated character, is generally perfectly manifest, and at the same time the vesicle is surrounded by a very narrow ring of inflammation. The vesicle continues to increase in size, until on the eighth or ninth day it has reached its highest degree of development. At this stage the vesicle or pock is large, usually about one-third of an inch in diameter, and it projects very considerably above the general surface. Its shape is circular, as a general rule, though not unfrequently it is oval, this depending apparently upon the mode in which the puncture has been made. The color of the pock is dull white or pearly, or sometimes it has a yellowish tint. The quantity of fluid contained in the cavity of the vesicle differs, of course, according to its size. The structure of the pock is found, upon careful examination at this time, to be cellular, the number of cells amounting commonly to eight or ten; very often there is a small, dark-colored scab on the very centre of the vesicle, even at this period, though in other instances this is absent, the surface of the vesicle being formed exclusively of thin and transparent cuticle. The scab just alluded to has seemed to us to consist of the little incrustation, formed at the point where we had introduced the virus by the drying up of the minute quantity of blood escaping after the puncture, and of the dissolved virus which had not been absorbed. We have often noticed that when the small scab just alluded to has been rubbed off the arm on the second day, the vesicle has presented no scab as early as the eighth day. On the eighth day the

little ring of redness at the base of the pock, which has hitherto been very small and narrow, begins to enlarge so as to form the areola. This increases during the ninth and tenth days, forming a brilliant scarlet or dark-red inflammatory circle of about two inches in diameter, and constituting one of the most strongly marked features of the vaccine disease. The color of the ring is most intense at the edge of the vesicle, and then fades gradually to its outermost boundary. On the ninth and tenth days, in connection with the areola, the skin and cellular tissue on which the vesicle is seated, and that for a short distance beyond the margin of the latter, become hardened and tumefied, forming a solid knot or lump in the derm, like the base of a furunculus. The inflammation which causes the areola is often so intense as to occasion the production of vesicles, which are almost always discoverable with the aid of a lens, and are sometimes distinctly visible to the naked eye. On the tenth day the disease is usually at its height, and it is then, of course, that all its peculiar characteristics are most strongly marked. At this time the child, when of an age to describe its sensations, will often complain of heat, itching, and pain in the inflamed spot; the arm is heavy and not willingly moved, or it is moved with care and caution; there is, in a good many instances, some irritation and swelling of the axillary glands, and very frequently a decided febrile reaction may be noticed. In other cases, on the contrary, none of these symptoms will be present. The child is gay and cheerful, its movements free, quick, and unembarrassed, and it seems in all respects to be in its ordinary condition of health.

From the tenth day the disease begins to subside. The areola fades so as to have nearly disappeared by the fourteenth day; the fluid contained in the vesicle is gradually converted into pus, and the cellular structure of the pock is broken down so as to form, by the thirteenth day, but a single cavity, in which the pus is contained; the process of desiccation is going on rapidly during this time, so that about the fourteenth day the vesicle has disappeared, and in its place there is a firm, hard scab, of the shape and size of the vesicle. This scab continues to harden for some days longer, and at the same time contracts somewhat in size and grows darker in color, until at last it is of a very dark brown or mahogany tint. It separates gradually from the tissues beneath, the separation beginning at the circumference, and falls off usually about the eighteenth or twenty-first day, leaving beneath a small ulcer, which soon heals, or else a cicatrix of the shape and size of the pock. The cicatrix is at first of a deep red or purple color, but fades gradually, until it becomes much whiter than the surrounding skin. The scar left by the vaccine disease is very characteristic, and is often, though not by any means invariably, indelible. To be at all depended on as a mark of the disease, the scar should be small, circular, of a smooth and somewhat shining appearance, and it should exhibit radiations and little depressions or pits. The depressions are supposed to have been caused by the cells constituting the pock in its early period.

There is rarely more than a very slight constitutional disturbance attendant upon the course of this disease. About the eighth day, a decided

febrile reaction, attended with some unusual warmth of the surface, restlessness at night, and fretfulness of the temper, is often observed. In a few instances we have noticed distinct disturbance of the health about the third and fourth days; amounting only, however, to unusual irritability and discomfort through the day, and to wakefulness or disturbed sleep at night.

Irregularities and Anomalies.—We have now described the regular course of a vaccination—that which it pursues in a large majority of the cases. Certain variations from the above standard or typical course are frequently, however, met with, and require some notice. These variations may consist merely in the degree of severity of the local and general symptoms, or in the appearances presented by the pock, without affecting at all the validity of the disease; or they may concern the duration of the phenomena; or, lastly, they may be such as to call in question the validity of the disease, leaving us in some doubt as to whether it has protected the constitution against variolous attacks or not.

The severity of the local inflammation occasioned by the vaccination, and that of the general symptoms also, varies often to a considerable extent. In some instances, and especially when the virus employed has been procured recently from the cow, the specific inflammation proves very severe. We have seen the arm intensely red, and very considerably swelled, from the shoulder to an inch below the elbow, while at the same time the axillary glands were tumefied and tender, and the child very feverish and uncomfortable. This happened in three children, in all of whom we had employed the same virus; which, as we afterwards learned of the person from whom we obtained it, had been taken quite recently from the cow. It produced the same violent inflammation, moreover, in several other subjects in whom it was employed. This, however, is not to be regarded as by any means a usual occurrence when bovine virus has been employed, since now that we very frequently vaccinate with lymph directly from the cow, it is rarely that we observe any severe inflammation.

If the vesicle happens to be broken by accident soon after its formation, its appearances during the subsequent progress of the disorder will often be very different from those exhibited in subjects in whom no such accident occurs. The vesicle loses a portion of its contents; it becomes conoidal and irregular in shape, instead of being circular and umbilicated; it does not exhibit the pearly white and diaphanous color which belongs to it, but is yellowish and opaque; the areola is often premature and irregular in shape, and the scab is frequently small, uneven on the edges, and falls off at an unusually early period.

Occasionally there is observed in the course of cow-pox a papular eruption over the body of the child. This occurs usually between the ninth and twelfth days.

It is quite common for the disease to be retarded in its progress. The delay generally takes place in the appearance of the vesicle, this not showing itself until the sixth or eighth day, or, in some rare instances, not until the sixteenth, or even the twentieth, or forty-sixth day. The longest re-

tardation that we have met with has been seven days. In this kind of retardation, the disease usually runs through its regular and natural phases after the vesicle has once made its appearance. In another kind of retardation the delay occurs in the vesicular and pustular stages of the affection, the papule appearing at the ordinary time, but the disease not reaching its height or maturity until the eleventh or twelfth day.

The forms of variation from the ordinary course of cow-pox just described, do not seem to be connected with any diminution in the protective power of the disease.

It sometimes happens that the operation of vaccination gives rise to a disease totally unlike the true vaccine disease, one which does not protect against small-pox, and which has therefore been called *spurious vaccine disease.*

It was formerly the custom to describe quite a variety of appearances as indicating with greater or less probability a spurious disease. Of late years, however, it is generally admitted that the spurious pock is of much less frequent occurrence than was at one time supposed, and that, when it does occur, its characters are so marked as to make it easy of recognition. In fact, it happens in a very large majority of cases, that the vaccination either fails entirely, the puncture being productive of no other results than those which would naturally flow from a slight wound of the skin, or else that it is followed by a true and easily recognized vaccine pock.

When, however, the operation is followed immediately or within a day or two days by inflammation, and the appearance of a pustule, without the previous production of a vesicle; when this pustule is irregular in shape, yellow in color, acuminated, easily broken, and terminating in a soft, yellowish, ragged-looking crust, which falls off upon the fifth, sixth, or seventh day, there is assuredly reason enough to call the vaccination spurious, and it becomes the imperative duty of the practitioner to regard it as such until subsequent and repeated trials with other and fresh virus, have proved the child to be protected.

Diagnosis.—There can be no difficulty whatever in distinguishing the vaccine disease when it occurs in its regular form. The successive phases through which the eruption passes, and the particular appearances which it presents in each stage, are so unlike all other diseases, except, indeed, small-pox, as to render it very easy of recognition.

Sometimes, however, there is a little difficulty in determining whether the eruption is spurious or regular. But this rarely happens except under circumstances in which we should expect some modification in the phenomena of the disease, to wit, when its course is interfered with by the effects of a previous vaccination, or of an attack of variola. The irregularities arising from these causes are such as might be anticipated, and will be described in the article on revaccination. Whenever, however, the disease fails, in any important respect, to exhibit the perfect attributes of a well-marked pock, both as regards its time of development, its changes, and its particular appearances at each stage, in a child not previously vaccinated, nor having had small-pox, the only wise and prudent plan to

follow is to repeat the operation a few weeks after the doubtful one, so as to test thereby the protective power of the first.

Protective Powers.—Though vaccination in infancy has not proved a sovereign protection against small-pox, as was at first hoped and expected, the security it does afford, when properly used, against one of the most loathsome and dangerous of diseases, is so nearly perfect that the thought of its benevolent power ought to rouse every feeling of thankfulness of which the human heart is capable. It has come to pass within a few years, here and there in the world, and we know this was the case in Philadelphia, that some persons have begun to question the real value of vaccination. Such persons always seemed to us the most crotchety and foolish of mankind, and since small-pox exhibited its powers here, as it did in the epidemic of 1871–2, we imagine those very persons are quite ready once again to thank Providence for its great boon, and to do true homage to the great discoverers of vaccination.

As to the protective powers of vaccination, we have had proof abundant, in our own experience alone, to satisfy us that this is complete when it is properly applied. We have never seen life lost or the face disfigured, during thirty-two years of experience, in any one who had been well vaccinated in infancy, and then *successfully* revaccinated at puberty. We had never seen a fatal case of small-pox in a subject under 43 years of age, who had been well vaccinated in infancy, until the late epidemic, though we had seen two who had it severely enough to pock-mark them. We knew that such cases occurred, but none had occurred in our own practice; and our experience in the late terrible epidemic has but confirmed our faith in the powers of vaccination. During its prevalence we saw no severe nor dangerous varioloid or variola in children under 10 and 12 years of age. It was not except among those over 15 and 20 years of age that we began to see and hear of dangerous cases of the disease; and after successful revaccination, even in those most exposed, we saw not a case even of varioloid, much less of severe variola. We could, had we the space, cite particular instances in our own practice in proof of the absolute protection afforded by revaccination, but deem it best to give some facts illustrative of this power from the hospital experiences of the late epidemic.

In the report made to the Board of Health, of this city, by Dr. Welch, of the Municipal Hospital, during the epidemic of 1871–2, are some facts which show most strikingly the power of vaccination. At page 9 are given the following cases:

"Case 1. Child, aged two years; vaccinated in infancy; two good cicatrices; came in with mother, who had small-pox; sixteen days in hospital; no disease.

"No. VI. Infant, ætat. 10 months; not vaccinated; admitted February 10th, along with its mother, who had varioloid, and from whose breast it was nursing; vaccinated same day. February 16th.—Two convulsions. 17th.—Perfectly well again; vaccination taking well; fourteen (14) days in hospital; no disease. (This child returned to the hospital with measles.)

"No. IX. Child, æt. 7 years; vaccinated six months ago; fair cicatrix; eleven (11) days in hospital; no disease.

"No. X. Child, æt. 8 years; vaccinated six months ago; fair cicatrix; eleven (11) days in hospital; no disease."

At page 12 Dr. Welch states another very interesting fact, which coincides with the experience of the London Small-pox Hospital. He says: "In this connection we might add that the physician in charge, his two assistants, the matron—who has been connected with the hospital for twenty-four years—the chief male nurse, and a number of others employed at the hospital during the epidemic, were protected only by vaccination and revaccination. Indeed, not a single person connected with the hospital, who had been revaccinated, contracted the disease; while on the other hand, some three or four of the nurses, who had been affected by small-pox previously, took the disease a second time."

How any one can read such facts as these, and they might be indefinitely increased, and yet refuse a child the boon of vaccination, is beyond our comprehension.

In the last edition of this work we endeavored to show the necessity and propriety of revaccination. Hereafter we shall advocate revaccination in all cases, no matter how perfect the first vaccination may be stated to have been, or how perfect the cicatrix or cicatrices. At the age of fifteen, or as soon afterwards as possible, all young persons ought to be revaccinated. There should be no waiting for an epidemic or for direct exposure to infection. The operation ought to be performed as regularly as the primary vaccination.

There is now a host of evidence on this point, but that which is given by Dr. Welch, in the report just quoted, of facts demonstrated by the late epidemic in this city will be all-sufficient.

"With reference to the practical efficacy of revaccination," he says, "the hospital record shows as follows: Among 2377 cases of small-pox admitted during the epidemic, only 36 are said to have been revaccinated, of which 4 died. But by subjecting these cases to a careful analysis, we find as follows; Seventeen (17) were revaccinated at a distant period, some as far back as thirty-one (31) years; five (5) had not been revaccinated until after exposure; seven (7) were said to have been successfully revaccinated, but were unable to exhibit any cicatrices as the result; sixteen (16) bore upon their arms very poor and uncharacteristic scars, some of which, indeed, were scarcely visible; five (5) presented fair cicatrices; and only three (3) were able to show good cicatrices.

"Of the four (4) who died, two (2) occurred among those without cicatrices, one among those revaccinated after exposure, and one among those showing poor and uncharacteristic scars.

"All the cases which bore upon their arms unmistakable evidence of successful revaccination, suffered from the mildest form possible of the disease. Indeed, three (3) of these cases exhibited an eruption of doubtful character, and have therefore been recorded as cases of varioloid (?). The eruption on three (3) others did not advance beyond the papular stage, and on seven (7) it was barely vesicular."

It is unnecessary to add anything more as to the protective power of the vaccine disease against small-pox. Those who are not convinced by such facts as these, would not believe one though he rose from the dead.

Period of Performance.—The period usually chosen for the performance of this operation, is soon after the age of three months. If, however, the infant be exposed to the contagion of variola, it is necessary to perform it immediately, even upon the first day of life; and in such cases the protective power is as perfect, and the local or constitutional irritation little greater, than when the operation has been deferred to the usual time.

Susceptibility to the Disease.—The susceptibility to the vaccine disease varies greatly in different persons and different families, and is modified to a greater or less extent by the existence of other diseases in the individual at the moment of the operation. In some it is said never to be received, no matter how frequently or how carefully the virus may be inserted. In others it is received with difficulty, requiring several repetitions of the operation before it can be made to take; whilst in yet another class of subjects, the smallest amount of virus, when inserted in a careless and imperfect manner even, will produce the disease with the greatest certainty. Nevertheless a large majority of children take the disease after a single operation, if this be performed with ordinary care and nicety. No explanation of the different susceptibilities of individuals to the disease can be given. The same difference is known to exist in regard to other contagious and even epidemic diseases, as measles, scarlatina, pertussis, variola itself, typhoid fever, and cholera.

The susceptibility varies also in the same person at different times, without its being possible to ascribe this fact to any evident cause, since the child may appear on both occasions to be in the same condition as to health and other circumstances likely to influence its susceptibility to the contagion. Thus, we knew a child a few months old to be vaccinated four times, twice by the late Dr. C. D. Meigs and twice by one of ourselves, each operation following rapidly the preceding one, without success, though the virus was known to be good from its having succeeded in other subjects, and though it was changed each time. The child appeared to be in perfect health. There was no eruption of any kind upon its surface, nor any other condition that could explain its insusceptibility. After the fourth operation, the attempt was suspended for about four months, then renewed, and with instant and entire success. In another case, the varying susceptibility of the same individual to the disease was still more strikingly exemplified. An infant, a few months old, was vaccinated four times in succession from the scab without success. It was then vaccinated with fresh lymph taken from the arm of an infant who was undergoing the disease. This also failed. A few weeks after this, the operation was again performed with the dried scab, and this time with perfect success. This same experience has more recently occurred to us in a case where vaccination was performed four times at short intervals with fresh bovine virus without success, but on a fifth attempt complete success was obtained.

Certain eruptions existing previously upon the surface, have seemed to us to prevent the reception of a vaccination. The eczematous and impeti-

ginous diseases of infancy and childhood have certainly had this effect in our experience, though M. Taupin (*Dict. de Médecine*, t. xxx, p. 406) is of the contrary opinion; he having found that the disease has been merely retarded when the operation was performed during the initial stage of the eruptive fevers, whilst its course was suspended even entirely when any of these affections occurred in a child already vaccinated, to be resumed again after the cure of the eruptive fever.

There is another circumstance concerning the supposed effects of other diseases on the vaccine affection, to which it will be well to draw attention. We are sure there are few practitioners, having any considerable amount of business, but must have been annoyed, and injured perhaps in their reputations, by the notion so prevalent in the community that vaccination may impart to children other diseases. This prejudice exists particularly in regard to the chronic cutaneous eruptions of infancy and childhood, so that we have frequently had parents to insist to us that the impetiginous or eczematous disease under which their child might be laboring, has been caused by the vaccination, performed perhaps recently, or even months before. M. Taupin, quoted by MM. Guersant and Blache (*Dict. de Méd.*, t. xxx, p. 414), vaccinated a large number of children at the Children's Hospital in Paris, with virus taken from subjects affected with itch, scarlatina, measles, varicella, varioloid and variola, rachitis, scrofula, tuberculosis, chronic eruptions of the scalp, dartres, etc., without communicating to the patient any of these affections, either those of acknowledged contagious or non-contagious nature. A very curious case illustrative of this point is mentioned by Dr. Gregory in his *Lectures on the Eruptive Fevers* (Am. ed., New York, p. 270). "A child, who had been exposed to the infection of small-pox, was vaccinated. Both diseases advanced. A lancet charged with lymph from the vaccine vesicle produced cow-pox. Another lancet charged with matter from a *variolous* pustule, *formed within the vaccine areola*, communicated small-pox." We mention the result of these experiments in order to show how little foundation there is for the popular notion above alluded to, and to give to the practitioner an argument with which to defend himself against the unjust accusations of those who may assert his vaccination to have been the cause of any disorder that may have followed upon it. Not that we would ourselves employ virus taken from a child suffering from disease of any kind whatsoever, since this is, to say the least, unnecessary, and ought to be avoided. Indeed, we have never employed a vaccine crust taken from a child who was not apparently in perfect health. The smallest amount of cutaneous eruption upon a child has always been sufficient reason with us to reject the virus afforded by such a patient, and as this *must* be the safest plan to adopt, it is of course the proper one.

The still more serious charge has, of recent years, been made against vaccination, that it may be the means of transmitting constitutional syphilis. And there are well-authenticated cases in which the operation has undoubtedly been followed by this terrible result. In every instance, however, so far as we are aware, in which the exact mode of the vaccination could be ascertained, it has been found either that the child from

whom the virus was obtained, presented at the time evidences of constitutional syphilis, or that the virus had been impure, being mixed with blood or pus, which may have been the medium of infection. There is, indeed, no evidence whatever to show that the lymph or crust derived from a typical vaccine eruption, in an apparently healthy child, can possibly be the means of transmitting any constitutional disease. It is more prudent, however, that if the lymph be used, it should not be taken after the eighth day of the existence of the vesicles; and that in obtaining it, all hæmorrhage should be avoided.

Mr. Jonathan Hutchinson (*Med.-Chirurg. Transactions*, for 1871) gives two series of cases which show the possibility of communicating syphilis by means of vaccination. At page 322 he states his belief that the blood is the source of the contamination. He says: "There can, I think, be little doubt that in this instance it was the blood, and not the vaccine lymph, which was the source of contamination." At page 325 he quotes, from a previous report, the following, amongst other conclusions: "That the blood of a child suffering from inherited syphilis can, if inoculated, transmit the disease with great certainty.

"That it is quite possible for vaccine lymph and blood to be transferred at the same time, and for each to produce its specific results, the effects of the syphilitic inoculation occurring subsequently to those of vaccination.

"That it is quite possible to vaccinate successfully from a syphilitic infant in the stage of the utmost potency as regards its blood, without communicating syphilis."

In regard to this most important point we have two statements to make: that we have never had occasion to suspect even that we have been the unfortunate instruments in communicating this disease in our own practice, and that we have always used the dried scab. Is this happy exemption from such an accident the result of care in selecting the virus, or does it depend on our constant use of the dried scab? Is not the danger of having blood intermixed with the lymph much greater, when the vesicle is opened by the surgeon on the eighth day, than when the lymph is left to dry and form a scab in the natural mode?

Still as the danger of communicating syphilis by badly selected vaccine virus does exist, it is important to be aware that recently there has been introduced into the American market a supply of lymph directly taken from the cow. This is furnished in the form of quill slips, one end of which is charged with the lymph; and they can be constantly obtained fresh in our larger cities, as the supply is replenished every day or two. Whenever it is not possible to obtain perfectly satisfactory humanized virus, either lymph or crust, the bovine virus above mentioned should invariably be used. Indeed, of late we have been more and more in the habit of employing it on account of its convenience and reliability. The more severe local inflammations which was formerly thought to attend the use of lymph directly or only a few removes from the cow, is not found to follow the employment of these slips to any objectionable degree.

Operation.—Under this head we shall consider several important points: the relative value of the dried scab and fresh lymph; the question

as to whether it is best to raise more than one vesicle by more than one insertion of the virus; and the various modes of performing the operation.

In this city it has been the custom for many years past to use the dried scab, and to raise, as a rule, but one vesicle. After an experience, extending, in the case of one of us, over thirty-two years, during which we have never used anything, but the crust, and have rarely made more than one insertion, we can aver that we have never known any one to die of small-pox who had been successfully vaccinated and then successfully revaccinated by this method. We have seen a good many mild varioloids, in subjects that had not been revaccinated, from the ages of twelve and fifteen upwards, but only in two cases have we known the disease to be severe enough to pock-mark the patient. We know of but one death from small-pox in our own circle of patients. This occurred in a gentleman 43 years of age, who was originally vaccinated by the late Dr. C. D. Meigs, and who was never revaccinated until four or five days after he had been exposed directly to the small-pox infection. The operation came too late. Though the puncture took, he died of hæmorrhagic small-pox of a virulent form.

In using the crust we have always taken great care to select only those from the most healthy children. Any blemish upon the skin, any shadow of doubt as to the perfection of the vaccine disease, ought always to cause the rejection of the crust.

The scab is less certain to take the first time than the fresh lymph, but it can always be made to take by perseverance, and we confess that it is hard for us to understand why the vaccine disease, if it be perfect in all its stages and phenomena, is not as much a vaccine disease when it springs from the crust as when it proceeds from fresh lymph, and therefore as competent to affect the economy through which it passes according to its natural law.

If the crust is to be used, it ought to be as fresh as possible, to insure its taking at the first operation. When the physician is obliged to keep it for several weeks, he should preserve it in some close receptacle, as between glasses, in tin-foil, oiled paper, between two pieces of wax, or in hermetically closed glass vials.

If the fresh lymph is preferred, the children to be vaccinated should be collected together about the vaccinifer (the child from whom it is to be taken) on the eighth day of the disease. The vesicle must be very carefully opened, so as to avoid wounding the true derm, and thereby causing any effusion of blood, and the lymph conveyed on a lancet directly from arm to arm.

It is proper to say that this is the mode of vaccinating usually preferred in Europe as the most certain and successful.

Though we have stated that, in our own practice in this city, one thoroughly characteristic vesicle at the primary vaccination, and one again at the revaccination, has been entirely successful in securing complete protection against small-pox, the opinion is held abroad that more than one vesicle gives greater security, in the event of small-pox attacking the vaccinated, than a single one. This opinion, which is based upon very numerous

observations in England and Germany, is so strong and positive that we think it best to advise herafter that at least two insertions, so as to raise two vesicles, shall be made in this country. Any one who wishes to study this question may refer to an excellent article on Vaccination, by Dr. Edward Cator Seaton, in *Reynolds's System of Medicine*, vol. i, page 483, where the whole subject is fully discussed. At page 499 Dr. Seaton insists that it is the duty of the physician to produce four or five genuine good-sized vesicles.[1]

It is proper to put before the reader this opinion of so able an authority as Dr. Seaton, so that any one who feels bound by such authority may follow his rule. For ourselves, we can only repeat that thus far in our own experience, one thoroughly good primary vaccination, and a second characteristic vesicle obtained at the revaccination, have been entirely successful and sufficient. In obedience, however, to the facts collected in England and Germany, we shall, hereafter, as stated above, advise the raising of at least two good vesicles at each vaccination. It makes but little difference whether the two be raised on one arm, or one on each. For the convenience of handling the child, we think it will be best to make the two insertions on one arm.

We think it the duty of the physician who vaccinates a child always to see to it himself that the result is a perfect vaccine disease. This matter is too important to be trusted to any inexperienced person. The physician has not done his duty who trusts to anything but his own eye as to the genuineness of the vesicle which results from his operation. He should examine it himself on the eighth or ninth day of the disease. The special characters of the disease have already been fully described.

It would be well, too, that physicians in charge of families should examine the cicatrices which follow vaccination, and if they fail to present the characters which belong to successful operations, he ought to repeat the vaccination. Dr. Welch, whose experience in this matter was large,

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[1] The protective power of vaccination, as well as the influence exerted by the perfection and the number of the insertions, as shown by the cicatrices, is remarkably well exhibited in the following table quoted by Dr. Seaton (Art. Vaccination, in Reynolds's Syst. of Med., vol. i, p. 499), from Mr. Marson. The table is based upon 15,000 cases. Of these it was found that the unvaccinated died at the rate of 37 per cent., and the vaccinated at the rate of only 6½ per cent.

Classification of Patients affected with Small-pox.	Number of Deaths per cent. in each class respectively.
1. Unvaccinated,	37.
2. Stated to have been vaccinated, but having no cicatrix,	23.57
3. Vaccinated.	
a. Having one vaccine cicatrix,	7.73
b. Having two vaccine cicatrices,	4.70
c. Having three " "	1.95
d. Having four or more vaccine cicatrices,	0.55
α. Having well-marked cicatrices,	2.52
β. Having badly-marked "	8.82
4. Having previously had small-pox,	19.

says that a good cicatrix is one "with a well-defined margin, slightly excavated, and reticulated or honeycombed." What he classifies as a fair cicatrix presents the same characteristics, but to a less marked degree, and poor ones are those "pointed out as the result of vaccination, but which are so indistinct or uncharacteristic as to make it difficult, and sometimes even impossible, to recognize them as vaccine scars." In case any practitioner should meet with the latter in a family he may be attending, he ought, we think, to urge upon the parents the necessity of repeating the operation at once.

REVACCINATION.—We think few physicians or laymen who watched the violent epidemic of small-pox which prevailed in this city during 1871 and 1872, can doubt as to the necessity of revaccination. So convinced are we by what we saw during that epidemic of this necessity, that we shall hereafter advocate the repetition of the operation at the age of puberty as a matter of domestic habit and law, a matter to be attended to by the heads of families with the same regularity and care that is now universally bestowed by all educated and careful people upon the vaccination of infants. Each child of a family ought to be subjected to this operation at or about the age of fifteen, and we think the family physician ought to bestow the same care upon this as upon the primary vaccination. One trial, without result, we hold to be of no more use than it would be in an unvaccinated child. The trial should be made again and again until a result is obtained. We have ourselves of late years repeated it twice, three times, and, in one instance, seven times, before we succeeded in obtaining a vesicle. Once the vesicle obtained, with a good areola, we believe the subject is safe for many years, probably for the lifetime.

The characters of the vaccine disease produced by a revaccination are not always the same as those obtained at the primary vaccination, especially when the time between the two operations is only that extending from birth to puberty. We have seen at later periods of life, at thirty and forty years of age, for instance, as perfect specimens of the vaccine disease from a secondary vaccination as we have ever seen in the infant. Not a feature has been wanting. The exact phases of the disease, the papule, the vesicle, the precise duration as to time, the areola, the constitutional disturbance, and the resulting cicatrix, have all been perfect in every point.

It is difficult to escape the conviction, that in such cases as these just mentioned the protective power of the primary vaccination had been entirely obliterated, and such, indeed, is and has been the opinion of many. A careful observation has shown, however, that this is not correct, and that, to use the words of Dr. Seaton (*loc. cit.*, p. 511), we cannot "draw from the local phenomena of revaccination any inferences whatever as to the state in which the revaccinated person was as to liability to small-pox. Jenner himself, indeed, pointed this out in his first treatise, and showed that the natural cow-pox might be induced again and again in persons who, being protected against variola by their first attack of cow-pox, could not be variolated either by inoculation or by exposure, as well as that cow-pox might be made to take on those who had had small-pox." A table, given by Dr. Seaton to show the results of revaccination in the Würtem-

burg army in 1831–35, and in the English army in 1861, shows conclusively that revaccination was nearly as successful in producing a perfect vaccine disease in those who bore the marks of previous small-pox, and in those who had good cicatrices of previous vaccinations, as in those who bore no marks of previous vaccination or small-pox.

These facts overthrow the prevalent notion held by the public at large and by many physicians, that a successful revaccination is a sure sign that the subject had lost the protection afforded by the previous vaccination. They also overthrow the idea that it is necessary to revaccinate every few years in order to renew the protective power of the vaccine disease. One good primary vaccination doubtless affords full protection throughout life in many, but it does not in all, and since it is impossible to determine which are the protected and which the unprotected, it is necessary to revaccinate all. But one successful revaccination is probably all that is required. Should, however, any one who has been thus successfully revaccinated be exposed directly to the infection of small-pox many years afterwards, it might be well to repeat the operation once again. The fashion, however, of being revaccinated every few years, which some persons indulge in and some physicians assent to only too readily, is simply a work of foolish supererogation not unattended with risk, since vaccine punctures, though made in the most legitimate way, will occasionally cause severe and even dangerous sores.

We have already said that revaccination at puberty rarely produces a vaccine disease of typical character. Still more is this true of children under puberty. At that early age the disease usually begins earlier after the puncture than in the primary form, reaches its height by the fifth or sixth day, and then declines. The vesicle is apt to be acuminated rather than umbilicated, the areola is irregular in outline, narrower, paler, and is usually hard. The scab is small and imperfect, looking more like one formed by the desiccation of pus than like that formed from true vaccine lymph, and it is often complete by the eighth day, and soon falls. There is often a good deal of constitutional irritation caused by revaccination, more even than in the primary disease, and there is also much local irritation in the form of itching and pain. Nevertheless, these appearances are invaluable as showing that the lymph employed has affected the constitution of the patient. Without some such response to the revaccination, we hold the operation to have been useless, and always repeat it, as has already been stated.

To impress upon all the power and value of revaccination, we will quote some facts given by Dr. Seaton (*loc. cit.*, p. 509): "Heine found that in five years there occurred among 14,384 revaccinated soldiers in Würtemburg only one instance of varioloid, and in 30,000 revaccinated persons in civil practice only two cases of varioloid, though during these years small-pox had prevailed in 344 localities, producing 1674 cases of modified and unmodified small-pox among the not revaccinated, and in part not vaccinated, population of 363,298 persons in those places in which it had prevailed. In the Prussian army, since the introduction of systematic revaccination of all, the annual deaths from small-pox (which at one time

were 104) have not averaged more than 2; and on analysis of 40 fatal cases that occurred in twenty years, it appeared that only 4 were in persons who were said to have been successfully revaccinated."

He also cites Mr. Marson's statement, to the effect that in "thirty years no nurse or servant at the Small-pox Hospital has taken small-pox, he having taken care always to revaccinate them on their coming to live in the hospital; and further, that when a large number of work-people were employed for several months about the hospital, most of whom consented to be revaccinated, two only were attacked by small-pox, but they were amongst the few who were not revaccinated."

With a few words on the mode of performing the operation of vaccination, we shall bring this article to a close.

Different methods of inserting the vaccine virus have been employed by different practitioners. The two methods most frequently resorted to are those by incision and puncture. The former consists in making a superficial incision of several lines in length into the skin, in such a way as to cause a very slight effusion of blood. Into this is introduced a small quantity of a dried vaccine scab reduced to a fine powder, or a piece of fine thread wet with the vaccine fluid, or with water holding in suspension a portion of dried virus. Over the wound is then placed a piece of isinglass plaster, which is secured by a bandage. This is to be removed after two or three days, and the disease allowed to pursue its regular course. The operation by puncture is performed by introducing horizontally beneath the skin a needle or lancet charged with the virus, and then withdrawing it in such a way as to leave the virus in the wound. Of these two modes the latter is the one now most frequently adopted, the former having been found to occasion, not unfrequently, a spurious disease, and to be of very difficult application in the cases of children. For our own part we have used for some years past a method that we have found much the most convenient in children, and which rarely fails when it is carefully performed. We take a common thumb lancet, which should not be too sharp. Holding the arm of the child with our left hand, and stretching the skin between the forefinger and thumb, whilst the under part of the arm is grasped by the second finger placed beneath the first, we lay the lancet flat upon the skin, and using the point, remove, by a repeated and very gentle rubbing movement, the cuticle, until the surface of the derm is laid bare, so as to allow of a perceptible, and merely perceptible oozing of blood, or, in other words, so as to expose a living surface. This surface should be about as large as a small-sized bird-shot, and it should not bleed, but merely show that the vascular part of the derm has been reached and slightly exposed. On this surface the vaccine fluid or dissolved scab is to be placed in quantity sufficient to cover it, and the nurse should be told to leave the arm bare and untouched for twenty minutes, or until the applied fluid has dried into a little scab, when no further precautions are necessary. This mode of operating may at first seem tedious and painful. We can only say that when performed gently and gradually, it causes so little pain that we have often practiced it upon sleeping children without waking them.

If the quills of fresh bovine lymph are used, an abrasion of the cuticle is made in the ordinary manner, and the end of the quill charged with lymph is very slightly moistened and then rubbed on the abraded spot until the virus is thoroughly removed.

The place usually selected for the operation is, as every one knows, on the arm, close to the insertion of the deltoid muscle. This is the best place as a general rule, and particularly in girls, whose parents often object to having the insertion made below this, lest the scar should be visible in after years, when the arm is uncovered. In boys we often select the radial edge of the forearm some two inches below the elbow, since in this place the pock is least apt to be injured in the act of dressing the child, or of lifting it about.

ARTICLE X.

VARICELLA.

Definition; Synonyms; Forms.—Varicella is a contagious eruptive disease of benign nature, characterized by more or less numerous transparent vesicles following rapidly upon small red elevations. The eruption is usually preceded by slight initial symptoms lasting from one to two days, and it terminates by the desiccation of the vesicles about the fifth or eighth day after their appearance.

It is known also in English by the names of chicken-pox, swine-pox, and crystalli.

Several different forms of the disease have been described by different writers under the titles of lenticular, conoidal, and globular; but inasmuch as these varieties are of no real importance in practice, we shall merely advert to them casually in our account of the eruption.

Causes.—Varicella is propagated in two ways; by *contagion*, and by *epidemic* influence. That it is contagious there can be no doubt, since nearly all observers agree upon this point. In our own experience we have seldom known any child, who had not had the disorder previously, to escape it when once it has entered a household. It rarely attacks any but children. Its epidemic nature is shown by the fact that in some seasons it is scarcely seen, whilst in others it prevails extensively over large districts of country, and attacks many children in the great towns and cities of those districts. Varicella occurs only once in the same individual.

Considerable discussion has taken place at various times as to the real nature of varicella, some asserting that the disorder is merely one of the varieties of modified small-pox, while others maintain as strenuously that it is an independent and specific disease. The weight of authority, however, seems to be clearly in favor of the last-mentioned opinion, and we have no hesitation in avowing this to be the conclusion to which our own

reading and experience have brought us. When we consider, indeed, that varicella is, unlike either variola or varioloid, incommunicable by inoculation,[1] that it attacks indifferently the vaccinated and unvaccinated, that its course is entirely unaffected by previous vaccination, and that the vaccine disease is readily taken, and passes through its regular phases after varicella, we do not see how we can refuse to believe that the latter is something entirely independent of small-pox, and therefore a distinct and peculiar malady.

Symptoms; Course; Duration.—The eruption is usually, but not always preceded by prodromic symptoms. These seldom last more than one, or at most two days, and consist at the very beginning of slight chilliness, or of a chill even, which is followed by a more or less marked febrile reaction. In some instances there is vomiting, but this is rare, and when it does occur, slight. When fever exists it is marked by headache, accelerated pulse, slight warmth of the surface, pain in the back and limbs, languor, indisposition to play, some unusual irritability of temper, diminution or loss of appetite, and unusual thirst. These symptoms may be present, and yet in so mild a shape that the child shall show no disposition to abandon its ordinary habits of activity and play, while in other cases again, there are literally no initiatory symptoms whatever, and the appearance of the eruption is the first declaration of the presence of the malady. Even when constitutional symptoms are present, they usually disappear by the third day.

The eruption appears in the form of small papular spots, of a deep red color, and irregularly circular shape, which generally show themselves first on the front and back of the trunk, and extend very soon to the face, and a little later, to the extremities. We have known a child to go to bed at night with slight headache and fever, and present a well-marked though not yet abundant varicellous rash upon the upper part of the trunk, and on the face, on the following morning. These papules exhibit, in the course of a very few hours, small vesicles in their centres; indeed, according to some observers, the eruption is vesicular from the very beginning. On the second day the papules are in great measure converted into vesicles, which may be either small and acuminated, constituting the *lenticular* form of the disease, or they may be larger and of a more globular shape, constituting the *conoidal* and *globular* or *globose* forms of Willan

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[1] Steiner of Prague (quoted in Medical and Surgical Reporter, July 17th, 1875, p. 57) has lately inoculated varicella in several cases, with the following results:

1. The contents of varicella vesicles are inoculable; of 10 cases of inoculation, 8 were successful and 2 failed.

2. After the successful inoculation of varicella, varicella and not variola or varioloid was invariably produced.

3. The stage of inoculation in all the successful cases was eight days.

4. In 4 cases there were no prodromes; in 4 cases there were prodromes of four days' duration.

Vaccination has no influence on the production of the exanthem; of the 8 cases of successful inoculation, 5 had been vaccinated, 3 had not.

Varicella does not protect against variola; in one case a child died of confluent variola fourteen days after convalescence from an attack of varicella.

and Bateman. We deem it unnecessary, as above stated, to describe different varieties of varicella, since this is useless for any practical purposes, and because we constantly see upon the same subject vesicles of very different shape and size. When fully completed, the vesicles are often of very considerable size—two or three lines in diameter; they contain a transparent fluid, which is either entirely colorless or of a faint orange tint, and some of them are surrounded by a small ring of inflammation. On the third day, the eruption continues in nearly the same state as on the second, except that the fluid contained within the vesicles assumes a yellowish appearance, owing to its passage from the serous into the purulent condition. On the fourth day, the process of desiccation begins and goes on rapidly, the vesicles that have not been broken by accident, or torn by the fingers of the child in its efforts to appease the itching which they give rise to, assuming a shrivelled and shrunken appearance at their margins. As this process goes on, the vesicles are gradually converted into light brownish scabs, so that by the sixth day they are nearly all dried up. The scabs are usually thin ; they dry from the circumference to the centre, and between the eighth and ninth days fall off, leaving behind faint red spots, not depressed below the general surface, and which soon disappear.

The eruption is generally accompanied, as was stated above, by a sensation of heat and itching in the vesicles, which causes the child to rub and scratch them in such a way as often to break those which he can reach, and thus prevent them from passing through the regular periods of maturation and desiccation.

Diagnosis.—There is but one disease with which varicella could be confounded, and that is variola in some of its shapes. With regular smallpox such a mistake could scarcely happen even to the inexperienced. With varioloid, on the contrary, there might be some difficulty, and yet, if it is borne in mind that in varioloid the initiatory fever is much more severe, lasting three days instead of twelve or thirty-six hours, that the eruption appears first on the face and extends very slowly to the trunk and extremities, and that the conversion from the papular into the vesicular condition is much more gradual than in chicken-pox, we think no serious difficulty can ever occur in making the distinction between the two affections.

Prognosis.—The prognosis is always favorable. The only real trouble that we have ever known to occur has been from catarrh or pneumonia contracted by imprudent exposure during the convalescence.

Treatment.—In a large majority of the cases, varicella requires no treatment beyond attention to diet for the first two or three days, and the avoidance of cold during the convalescence. When the constitutional symptoms are marked, the fever and headache being considerable, a dose of some mild cathartic, a little sweet spirit of nitre in cold lemonade or orangeade, rest in bed, and one or two foot-baths, will be all that is necessary to reduce these symptoms and make the patient comfortable.

ARTICLE XI.

TYPHOID FEVER.

It is only of late years that the frequent occurrence of typhoid fever in young children has been fully recognized by medical authors. From the date of the publication of the classical work of Louis on this disease, until the year 1839, it appears to have been the almost universal belief that it was an affection limited to adult life; and with the exception of a few brief and vague descriptions, which evidently referred to this disease, though other names were used to designate it, medical literature contained no account of typhoid fever as it occurs in childhood. In the latter part of 1839, however, Rilliet (*Thèse de la Faculté*, 1840; and *Maladies des Enfants*, t. ii, pp. 663–739) and Taupin (*Journal des Connaissances Méd.-Chirurgicales*) published separate and independent memoirs on this subject; and since that time the occurrence of typhoid fever in children has been frequently observed and very carefully studied.

The fact that it was so long overlooked, is undoubtedly to be explained, in great part, by certain peculiarities which the disease presents in children, which caused its real nature to be mistaken, and led to the application of other names.

Of these names, that of infantile remittent fever was the most frequently used, and though this term was made to include a number of other diseases, and although remittent fever does occur in children, there can now be no doubt that a large proportion of the cases so styled, were in reality cases of typhoid fever.

Causes.—*Age.*—Typhoid fever has been observed during the first year of life, but is rare under the age of two years. We have however met with well-marked instances of it at the age of eighteen or twenty months. It is comparatively frequent between the ages of three and eight years, and it attains its maximum of frequency in childhood between the ages of eight and eleven years.

Sex.—The statistics of most authorities show a preponderance, more or less marked, of cases occurring in boys. In some series of cases this disparity has been remarkable (three to one); but, notwithstanding, it is probable that in a very extensive series the difference would be comparatively trifling.

Contagion: Epidemic Influence.—If typhoid fever be at all contagious it is in the slightest degree. On the other hand, it is well known that the dejecta from patients with this disease possess the power of producing it in those who are exposed to their emanations, or who drink fluid which have been allowed to become in any way tainted by them. The noxious vapors from foul sewers, drains or cesspools are also frequently the cause of typhoid fever. It is moreover subject both to epidemic and endemic influences in a marked degree; and it is owing to the varying action of

these causes that it presents the wide variety, in type and severity, which will be described.

Anatomical Appearances.—These are strictly analogous to those found in the adult. When death occurs early in the attack, the agminate glands of the ileum are found swollen, prominent, injected; the alteration being most marked in those nearest to the ileo-cœcal valve. Later, however, these glands ulcerate, the softening beginning either on the surface, and extending more and more deeply, or beginning in the deeper portion of the patch, so that the superficial layer may be thrown off as a slough.

These ulcers thus destroy the mucous membrane, and present the submucous or muscular coats for their base; or, in some instances, the ulcerative process may extend through the muscular and even though the peritoneal coats. We have known the most violent general peritonitis to be excited early in an attack of typhoid fever, in a girl 4 years of age, by the simple extrusion of inflammation, without the occurrence of perforation.

According to Rilliet (*loc. cit.*), however, these ulcers are more slow in forming, smaller, and less numerous and deep in children than in adults; and, indeed, he believes that in not a few instances the swelling and inflammation of the gland may undergo resolution without the occurrence of ulceration.

Too much importance must not, however, be attached to this statement, since it appears to us evident that a few cases, at least, of typhus fever are included amongst those upon which his memoir is based.

The solitary glands are, in the early stage of the disease, prominent, and may be distended with a serous or more thick and yellowish secretion, so as to resemble vesicles or even pustules. Later in the attack their mucous covering is destroyed, and small, round, or oval ulcers, with everted edges, remain. These ulcers are also most numerous in the lower part of the ileum, though in some cases they are met with quite abundantly in the large intestine.

The mesenteric glands are enlarged, softened, and strongly injected, the change corresponding in intensity to that of the agminate glands in the ileum, and being most marked in those glands which are nearest the ileo-cœcal valve. Usually the swelling of these glands subsides without suppuration occurring, but occasionally this ensues, and the gland is converted into an abscess with thin walls.

The cicatrization of the intestinal ulcers appears usually to occur rapidly; thus, Rilliet has seen the process completed by the thirtieth day, though this is probably sooner than it is entirely finished in the majority of cases.

Ulcers of other mucous surfaces, as of the pharynx and larynx, are more rarely met with in children than in adults. The spleen is nearly always considerably enlarged and softened.

The blood in severe cases is dark and uncoagulable, and the lining membrane of the heart and large vessels is stained by imbibition. In some cases quite firm coagula are met with in the cavities of the heart.

Even in cases where the most violent nervous symptoms have been present, the brain rarely presents any more positive lesion than mere con-

gestion of the vessels of its membranes and substance, with at times some subarachnoid effusion. Of course, in cases where death has resulted in consequence of some complication, the lesions of the intercurrent disease will be found.

Symptoms.—The general course of typhoid fever is much the same in children as in adults.

It presents also the same wide variety in its type and degree of severity, depending upon the predominance and excessive development of some one of the elements of the disease; and it would be easy, therefore, to divide the disease into a great number of forms, according to the prominence of each functional disturbance; but as our object is merely to give a practical description of the disease as met with in children, we will, in considering its course, give a brief sketch of an ordinary case, and then dwell in detail upon certain symptoms which require special notice, as presenting special peculiarities in childhood.

In the majority of cases, the attack is preceded for some days by slight prodromes; the child, who ordinarily may enjoy robust health, appears languid, and is easily tired, and indisposed to play; he loses his appetite, is restless during sleep, and possibly may complain of colicky pain in the abdomen, perhaps attended with slight looseness of the bowels. After this state of vague indisposition has lasted from three or four to eight or ten days, more decided symptoms manifest themselves, and the attack may be said to fairly begin.

More or less febrile action now appears; but this is rarely continuous, and for the ensuing five or six days there are distinct and marked remissions, usually in the morning, but sometimes so marked and prolonged that it is only towards night that the skin becomes heated, the pulse frequent, and the child grows restless, while, during the day, he has merely appeared somewhat dull and languid. The loss of appetite continues, and becomes more complete, though thirst is marked; vomiting is apt to follow eating, and is sometimes frequent and spontaneous; the tongue presents a moist, whitish-yellow fur in the centre. The bowels either continue loose, or now become so for the first time; the abdomen becomes somewhat large and tympanitic, and slight tenderness may be present in the right iliac region towards the close of the first week.

The strength is rapidly lost, and the child, after the first few days shows no desire to leave the bed. The respirations are somewhat hurried, and are aften accompanied by sonorous râles and slight dry cough. The pulse is accelerated, but rarely rises at this stage above 110.

The expression grows dull and listless, unless temporarily excited during delirium, and the child takes but little notice of surrounding persons or objects. During the night there may even now be a tendency to more marked cerebral disturbance, and the little patient grows very restless, utters sharp, shrill cries, or talks unmeaningly.

About the end of the first week the characteristic eruption appears, first on the upper part of the abdomen, in the form of small, oval spots, scarcely, if at all, elevated above the surface, of a light rose color, disappearing on very slight pressure, and quite rapidly returning.

During the second week, the symptoms become more severe. The fever is more continuous, and the temperature ranges in different cases from 102° to 105°; it may still present, however, decided morning remissions, and it is not rare for profuse warm perspiration to occur, without having any critical value whatever. The pulse becomes more frequent, 120, 140, even 160, and at the same time smaller and of less force. The respirations are also more hurried, and, when the pulmonary complication is marked, may be very rapid and shallow, and the cough frequent and annoying; in such cases, auscultation reveals, especially over the postero-inferior part of the lungs, abundant mucous or subcrepitant râles. The vomiting ceases, and the child will usually take the liquid food offered it; the tongue becomes more heavily furred, and may be dry and brownish in the centre, though it often remains moist and yellowish-white throughout. Thirst is apt to diminish, owing to dulness of the perceptions, but the child will frequently drink greedily of cold water if offered to it. The diarrhœa persists, however, and the stools are ochre yellow and fluid; the belly is more tympanitic, and may be extremely distended. The discharges, both of urine and fæces, are often involuntary, and the child does not even appear conscious of them. The urine is high-colored and scanty. The eruption continues and becomes more abundant, the spots which appeared passing away and being followed by successive crops. Sudamina are also frequently present especially when sweating occurs. The mind becomes more and more dull, though it is nearly always possible to rouse the child by speaking loudly to it; delirium is usually present, especially in the night, and manifests itself in young children by restlessness, sharp, unmeaning cries, and a wild expression of the face, and in older ones by muttering, or even by attempts to leave the bed. Irregular muscular movements such as floccitatio and subsultus, are rarely noticed; though at times these, and even spasmodic rigidity of the trunk or limbs, or convulsions, may be present.

We have thus sketched the course of what is, perhaps, the most common form of typhoid fever in children, where the disease begins gradually, and either remains mild throughout, or assumes a more grave character during the second week.

In a certain number of cases, however, the onset of the disease is far more sudden and violent, and the severity of the attack is manifested from its earliest period. In this form, the prodromes are brief, or almost entirely absent; and there may be in older children an initial chill, or the only symptoms present are marked debility, languor, and drowsiness. During even the first two or three days, however, there is apt also to be frequent vomiting, severe headache, or marked hebetude, and high fever, which usually presents the same marked morning remissions and evening exacerbations as in the milder form. The sleep is restless and disturbed, and the child either utters sharp cries, or, if older, talks incoherently. The pulse and respiration are much accelerated, and the temperature of the surface rapidly rises, till, by the end of the first week, it may reach 103° or 105°. The cerebral disturbance may mask the presence of any abdominal pain; and as it is not unusual for the bowels to be quiet for

the first few days, the case may closely simulate some acute cerebral disorder. By the end of the first week the disease is developed in its full severity. The fever is more nearly continuous, the morning remissions being comparatively slight, and the skin remains constantly dry and hot. There is deep stupor, from which the child is roused only with much difficulty, and which occasionally alternates at night with restlessness, jactitation, and noisy delirium. The pulse is very frequent and feeble, and the breathing accelerated, and usually accompanied with bronchial râles. The vomiting ceases, but the abdomen becomes tympanitic, and there is more or less abundant diarrhœa; the stools are often passed quite involuntarily, and the urine is either retained or dribbles away unconsciously. Epistaxis occurs in a large proportion of cases, and about this time the characteristic rose-colored eruption makes its appearance. During the second week, all of the symptoms become more grave, and the patient may succumb to the violence of the disease, or remain for a week or ten days plunged in profound stupor, with subsultus and marked muscular tremor; with the lips and teeth coated with sordes, the tongue tremulous, dry, and coated with brown crusts, the abdomen tympanitic, and the stools frequent, thin, and passed involuntarily; with the pulse running, feeble, from 130 to 160 in the minute; the respirations shallow, imperfect, and attended with subcrepitant râles, indicating passive congestion of the lungs; with the urine retained, dark-colored, and even albuminous; and yet gradually emerge from this apparently hopeless condition to enter upon convalescence about the close of the third week.

In favorable cases, between the fifteenth and twenty-first day, the grave symptoms begin to abate. The child's expression becomes more natural, and often the earliest sign of approaching convalescence will be the appearance of a smile of recognition, or of pleasure at the consciousness of improvement. The fur upon the tongue becomes looser, moister, and begins to separate, and the appetite slowly returns; the distension of the abdomen diminishes, and the stools are again passed consciously and voluntarily, and gradually assume a healthy appearance. Restlessness and delirium disappear, and the sleep becomes quiet and refreshing; the fever subsides, and the temperature falls, and again shows a marked difference between the morning and evening. The child thus passes into a state of convalescence, which, when not disturbed by complications, is quite rapid, though attended with marked emaciation, extreme debility, and feebleness of digestive power, with a tendency to intestinal disturbances. In some rare cases, at times without assignable cause, at others from improper exposure or exertion, or indiscretions in diet, the patient suffers a relapse, the original symptoms reappear, and a second fully developed attack of typhoid fever, attended with marked nervous symptoms, characteristic eruption, and diarrhœa, may ensue.

In very severe cases, on the contrary, and especially when a fatal result is to follow, the condition of the patient grows more and more grave after the end of the second week, unless, as at times happens, death has occurred sooner from the violence or malignancy of the attack. The nervous symptoms become more marked, and the child sinks into a deeper stupor, even

approaching true coma, or the stupor is interrupted by violent agitation, with cries or efforts to leave the bed, or by muscular twichings, picking at the bed-clothes, or even general convulsions. The pulse is very rapid and small; the respirations hurried and noisy, and physical examination frequently reveals the existence of extensive bronchitis or hypostatic pneumonia. Vomiting is rarely present, but hiccup may be frequent and distressing; the belly is enormously distended, the stools frequent, involuntary, and at times bloody. Bed-sores form on points subjected to pressure, and death ensues amid profound stupor and with signs of extreme pulmonary obstruction.

At other times death occurs not so much from the extreme violence of the disease itself as from the development of some one of the complications which will be mentioned hereafter.

Special Symptoms.—Although, as has been seen, the general course of typhoid fever is much the same in children as in adults, there are a few symptoms which require more detailed notice, as presenting peculiarities which impress special features upon the disease as it occurs in childhood.

Prodromes.—In children, as in adults, typhoid fever is nearly always preceded by a marked prodromic stage, and the passage from the state of health to the fully developed disease is usually very gradual. The duration of these prodromes varies from three or four to ten days, being least in the more severe cases.

Fever.—Condition of Skin.—We have already remarked that, in the early stage, there are apt to be very marked remissions in the febrile action, lasting even throughout a considerable part of the day; the exacerbations of the fever usually occurring towards evening. West states that in some few instances two distinct remissions and exacerbations may be noticed in the course of every twenty-four hours. It is this feature which gained for the disease the name of infantile remittent fever, and caused it to be ranked formerly with the malarial diseases. Towards the middle of the second week, however, the remissions become much less marked; the temperature, which in some cases reaches 104° or 105°, merely presenting a somewhat marked fall in the morning. In general terms it may be said that the law of the accession of febrile temperature in typhoid fever in children, although in general correspondence with that found in adults, presents occasional marked eruptions. Thus, in some instances, the onset is so abrupt that a temperature of 104.5° has been noted by Roger on the first day, while it will be remembered as a law laid down by Wunderlich for the typhoid fever of adults, that the disease is never attended by a temperature of 104° so early as the second day. The skin is hot and dry as a general rule, but sweats are more apt to occur during the height of the disease than they are in adults; they are not, however, of any prognostic value.

Digestive Symptoms.—Among the earliest and most important symptoms are various disturbances of the digestive functions. The appetite rapidly fails, and is often lost before the attack fairly begins. Thirst is, however, marked until dulness of the mind appears, after which it also may be entirely absent, though the child will usually drink if cold water be offered to it. The tongue is always furred, usually being covered throughout the

course of the disease by a thick yellowish-white coat, which may remain moist and loose, or, in very grave cases, become dry and brownish. Sordes are not often observed. Vomiting, which is perhaps not more frequently met with in the early stage in children than in adults, may be very frequent and persist until far into the second week. In the majority of cases, diarrhœa is either present or the bowels are peculiarily sensitive to the action of laxatives. In some cases, however, and especially those where vomiting is marked, constipation of a quite obstinate form is present. The conjunction of these two symptoms, in connection with the cerebral symptoms present, may cause the case to strongly resemble the first stage of tuberculous meningitis; the doubt may, however, be usually resolved by careful examination, as will be more fully alluded to under the head of diagnosis.

The stools, when diarrhœa exists, are ochre-colored, fluid, and, on standing, deposit a sediment of shreds of mucous membrane, epithelium, and partially digested food. Mucus is rarely present; but blood, in varying amount, may be mixed with the fecal matter. When the amount is large, it is usually due to the ulcerative process in the intestine having opened a vessel of considerable size, and then constitutes a very grave complication.

In young children it is difficult to establish the existence of abdominal pain, but, when they are capable of describing their sensations, colicky pain is frequently complained of in the early stages; and even in the youngest children, pressure in the right iliac region may often be seen to be painful.

Tympany is usually present at some time during the attack, especially when there is diarrhœa. Even when the bowels are confined, however, the abdomen is never retracted. Rilliet states that, in some grave cases, he observed such great tympany that the abdominal walls were thin enough to allow the outlines of the convolutions of the intestine to be clearly seen.

Enlargement of the spleen nearly always exists, but frequently to so slight a degree that it cannot be readily detected either by palpation or percussion, and even when considerably enlarged, it is apt to be entirely hidden by the distension of the abdomen. On the other hand, we have repeatedly found this organ so much enlarged, as to be distinctly perceptible on careful palpation.

The *urine* presents the ordinary febrile conditions, being scanty, high-colored and of high specific gravity; the pigment is increased, and the chlorides much diminished.

The stools are, as we have already said, often involuntary during the height of grave cases, after the beginning of the second week. Until this time, however, and throughout the entire course of more mild cases, the child is conscious of the desire, and can control the passage, or even wishes to be taken from the bed for the purpose.

The urine is also, though more rarely, discharged involuntarily; in rare cases, which may ultimately recover, retention of urine is present, and is of grave import. Rilliet never observed this symptom, but we have seen it more than once, and especially in a boy aged five years, who required catheterization for several days successively, but who finally recovered.

Respiratory and Circulatory Symptoms.—Even during the first week, there is usually more or less dry cough, with sonorous and sibilant râles over the posterior part of the lungs. Indeed, in some cases, we have known the cough and signs of catarrhal inflammation to be so marked in the first days of the disease, as to cause the attack to be regarded as one of severe acute bronchitis. Later in the disease, and owing merely to the passive hypostatic congestion of the lungs, and the accumulation of mucus in the bronchial tubes, the cough is apt to grow more frequent and troublesome, the respiration is hurried and oppressed, and auscultation reveals moist and dry râles throughout both lungs. When pneumonia or bronchitis supervene, these symptoms of respiratory obstruction increase to a marked degree. Extreme rapidity of breathing, with alterations in its character and rhythm, are also met with, however, in cases where the pulmonary obstruction seems moderate, but where the nervous system is profoundly disturbed.

The *pulse* is accelerated from the very first, and during the height of the disease, rises to 120, 140, or even 180, according to the age of the child. In grave cases it may become extremely small, feeble, and compressible, but scarcely ever is intermitting or irregular.

The *eruption* of typhoid fever in children presents precisely the same appearances as in the adult; it usually appears first on the upper part of the abdomen, and often presents several successive crops. It is, however, more frequently absent entirely, and presents even greater irregularities, as to the date of its appearance, in them than in adults. The abundance of the eruption certainly bears no relation whatever to the severity of the attack; and in a varying proportion of cases (7 in 30, Hillier), the most careful daily examination fails to detect the characteristic spots at any period of the case. The eruption makes its appearance in a large majority of cases between the sixth and twelfth days, but the first spot has been observed so late as the twenty-fifth day (Hillier), or the twenty-ninth (Rilliet).

Sudamina are frequently present in large numbers at any time after the ninth day.

It is very important to be aware that in some cases, owing to the peculiar state of the cutaneous circulation, a marked reddish streak will be produced if the finger be somewhat firmly drawn across the skin. This sign, which we have described under the name of "tâche meningitique," in our article on tubercular meningitis, does not therefore possess the high degree of diagnostic value accorded to it by Trousseau and others, which would make it of much use in doubtful cases.

Epistaxis is very rarely abundant, but is met with in a majority of cases at some period after the third day.

Nervous Symptoms.—In none of the symptoms of this disease is such variety observed as in those furnished by the nervous system.

In mild cases, consciousness is retained throughout the attack; the expression of the face is stupid and heavy; the child is dull and disposed to doze during the day, but becomes feverish and restless towards night, and sleeps uneasily and wakes frequently.

In more severe cases, the nervous symptoms soon become prominent. The face assumes an almost characteristic expression; the eyes are dull and vacant, or bright and excited during temporary delirium; the cheeks present a circumscribed flush; the lips are dry and parched; and the features remain almost motionless.

Headache is sometimes complained of, and without doubt exists in many cases when the child is too young to call attention to it. It is especially observed in the early part of the attack, when there may be some hebetude and deafness present, and, according to Dr. Jenner, ceases upon the appearance of delirium.

This latter symptom rarely appears in marked degree before the second week, but then may become violent, the child crying out loudly, or muttering incoherently, and struggling violently to leave its bed. The delirium is rarely continuous but is more marked during the night, being replaced during the day by more or less profound stupor, which, however, rarely amounts to actual coma.

Subsultus and carphologia, as well as muscular rigidity, are comparatively rarely observed in children, and only in very grave cases. Convulsions, even of a general and violent character, are met with in a very small proportion of cases; they may occur in the early stages of cases which subsequently recover, or as one of the final phenomena in fatal cases. They are, however, at whatever stage they present themselves, of very great import. In a case mentioned by West, the convulsions recurred on two successive days at the middle of the third week of the fever, and were succeeded by hemiplegia, which continued, though gradually diminishing, for four days. The child was unconscious even before their occurrence, and continued so for several days, though he eventually recovered.

As a general rule, the course of typhoid fever is much less apt to be attended by any *complication* in children than in adults; there are, however, some which occur with considerable frequency.

We have already stated that cough and signs of slight bronchitis are frequent in the early stage. In a considerable number of cases these symptoms become aggravated as the case progresses, and there may be a development of general bronchitis or even pneumonia; more frequently, however, the condition of the lungs is rather one of hypostatic congestion than of true inflammation. These complications, when present in a marked degree, protract the case and add greatly to its danger. Pleurisy is comparatively rare.

Perforation of the ileum, from ulceration of Peyer's patches, is more rare in children than in adults; but when present gives rise to the same symptoms, and leads to an equally rapidly fatal result. In some cases, its occurrence is announced by an attack of convulsions (Rilliet). We have already alluded to the fact that we have known violent general peritonitis to be excited by extension of inflammation without the occurrence of actual perforation of the bowel.

Intestinal hæmorrhage, on the other hand, is comparatively frequent; thus Hillier observed it four times out of thirty in which the stools were

carefully examined. It is usually of grave significance, but is at times seen in mild cases, which recover readily.

Earache is not infrequently observed after the height of the disease; in some cases it is followed by abundant purulent discharge.

Inflammation of the parotid gland is much less frequent than in adults, as is also phlegmasia alba dolens, of which, however, there are instances on record.

There is very little tendency to the formation of bed-sores in children, and with care in the management of the patient, they will scarcely ever occur. In some epidemics, gangrene of other parts, as of the vulva or cheek, have been observed in a few instances. Angina, and occasionally pseudo-membranous laryngitis, have also been noticed.

We have seen that the urine is at times albuminous, and in these cases there is undoubtedly an intense congestion of the kidneys, which in very rare instances eventuates in Bright's disease. Œdema is not usually present, even when there is albuminuria, though Rilliet records two cases where anasarca, accompanied by albuminous urine, appeared on the fifth day, and lasted about a week. When œdema appears late in the course of the disease, it is probably to be rather attributed to a watery state of the blood and the debility of the circulation.

We have already seen that the febrile movement in typhoid fever, in children, presents such marked remissions, as to have led many observers to apply the name infantile remittent fever to the disease. We must bear in mind, however, that it is far from being rare for a true malarial element to be present, complicating the case, and constituting it a typho-malarial fever.

During the height of the disease, it is rare for any of the other eruptive fevers to make their appearance; but during convalescence, variola, rubeola, and scarlatina, have all been occasionally observed to appear, and run through their regular course.

Tuberculosis is by some regarded as one of the most frequent of the sequelæ of typhoid fever in childhood; and in some cases, indeed, it appears as though the extreme debility of constitution induced by the disease favored the development of tubercle in children with hereditary predisposition. In other cases it is probable that the production of tuberculosis after typhoid fever depends upon the infection of the system by the products of cheesy metamorphosis derived from some of the mesenteric glands, which, instead of returning to their normal state, have undergone this form of degeneration. It is probable, however, that in some cases also the early stage of acute tuberculosis has been mistaken for typhoid fever, with which, as will be more clearly pointed out, it possesses some strong features of resemblance.

Various disturbances of the nervous system may occur as sequelæ of typhoid fever in childhood. Among these may be mentioned paralysis, either in the forms of paraplegia, or limited to a single nerve-trunk, chorea, and locomotor ataxia.

Convalescence.—The convalescence is, as in adults, tedious and uncertain. The child often remains for many weeks in a condition of great

debility, and with such extreme nervous exhaustion, that hydrencephaloid symptoms may even be present.

The digestive system also manifests this debility in a most marked degree, and it requires the greatest tact and care to encourage the child to eat, and at the same time, to regulate the diet, since the slightest indiscretion will serve to excite serious symptoms. Not rarely death ensues many weeks after the termination of the disease itself, in a state of intense emaciation, the child being worn out by persistent diarrhœa, which resists all change of diet and treatment.

We have already alluded to the fact, that occasionally relapses have been observed, either without cause or following some trifling indiscretion, in which the symptoms of the fully developed disease have reappeared and gone through their regular course.

Duration.—The duration of the fever varies according to the severity of the case. Even in the mildest forms it rarely begins to subside before the end of the second week, while much more frequently it is protracted until from the twentieth to the twenty-third day. In many cases, indeed, convalescence cannot be said to be fairly entered upon before the end of the fourth week.

Prognosis and Mortality.—The symptoms and conditions which indicate a favorable or unfavorable termination to the case are the same as present themselves in the adult, and may be readily gathered from the foregoing description. The mortality of typhoid fever is, however, decidedly less in children than in adults, partly owing to the comparative rarity of dangerous complications, and partly to the fact that the disease is usually of a less severe type. In mild cases, death scarcely ever occurs; and even in the more severe forms, the mortality is only from 5 to 10 per cent., under favorable hygienic circumstances.

Diagnosis.—We have already stated that, partly owing to the imperfect recognition of typhoid fever, and partly to the various names which were loosely applied to this disease as occurring in children, it was formerly frequently confounded with other affections.

There are, however, several diseases from which it is not always easy, even with our improved knowledge of its peculiar symptoms, to distinguish it.

Thus, in some cases of gastro-enteritis, such as are not rare among children, and especially when the disease assumes a typhoid form, the resemblance to typhoid fever is so great as to have led Rilliet and Barthez to assert that it is impossible to make a differential diagnosis.

It should be borne in mind, however, that typhoid fever may often be traced to epidemic or endemic influence, and occasionally to contagion; that it is very rarely possible to assign any direct exciting cause for the attack; and that it especially attacks children over five years of age, comparatively rarely those between two and five years, and very rarely those under the former age. Its onset is usually more gradual; the vomiting and diarrhœa are rarely so marked; the fever is more intense, the loss of strength greater and more rapid; while the marked dulness alternating with delirium during the night, the occurrence of the characteristic erup-

tion and of epistaxis, and the more fixed duration, form a group of symptoms which should serve, when present, to clearly distinguish these two diseases.

In some cases, as already stated, the pulmonary complication, either in the form of diffuse bronchitis or of pneumonia, appears so early and causes such marked symptoms as tend to conceal those of the constitutional disease, and render care necessary to avoid overlooking it entirely.

On the other hand, it occasionally happens, and more frequently in children than in adults, that cases of pneumonia assume a typhoid condition, and present very many of the general symptoms of typhoid fever. It will, however, usually be sufficient in cases of this kind to pay careful attention to the early symptoms and mode of development of the disease, as well as to the existence or absence of the characteristic symptoms of typhoid fever, such as diarrhœa, tympany, epistaxis, rose-colored eruption, to avoid any error in diagnosis.

In some cases of acute, general tuberculosis, in which the deposit affects the brain, lungs, and intestinal canal, the symptoms may closely resemble those of typhoid fever. This form of tubercular disease may develop itself in the midst of seeming good health, the child losing strength and spirits; fever of a remittent type soon appearing; with vomiting, diarrhœa, tympanitic abdomen, and dry, furred tongue; and dulness of mind during the day, alternating with delirium at night. At the same time there is cough and rapidity of respiration, though the deposit in the lungs may be too slight and uniformly diffused to reveal itself by any positive physical signs.

In some such cases, indeed, it is only possible to form a probable diagnosis, based upon the age and previous history of the child; for acute general tuberculosis appears even at the earliest ages, and especially in children who have an hereditary tendency to tubercular disease, or who are delicate and frail, or have lately passed through an attack of some one of the eruptive fevers, or of hooping-cough; and upon the absence of eruption and the greater duration of the case.

Usually, however, there is a sufficient ground for diagnosis furnished by the special symptoms, even early in the course of the case. Thus, in typhoid fever the vomiting in the early stage is rarely frequent or obstinate, and only follows eating; and, though the bowels may be constipated for a day or two, diarrhœa soon makes its appearance, and the abdomen begins early to enlarge. In acute tuberculosis, on the other hand, the vomiting in the early stage is usually both frequent and obstinate, and occurs entirely causelessly; whilst the bowels are in most cases constipated, and the abdomen retracted until a much later period in the case, when the disease of the mucous membrane excites diarrhœa. The approach of fever in the tubercular disease is more slow, its course less regular, and its degree less intense, as a general rule than in typhoid fever.

The nervous symptoms in the early stage of the two affections may be almost identical, but before long, in cases of tuberculosis, some of the unmistakable signs of tubercular meningitis, such as strabismus or partial paralysis, usually appear. Epistaxis is rare in tuberculosis, and, of course, the characteristic eruption of typhoid fever is absent, though it must be

borne in mind that this is not constant in the latter disease. In doubtful cases, ophthalmoscopic examination should never be omitted, since it will frequently reveal lesions of the optic nerve or retina in meningitis which are absent in typhoid fever. And, finally, though the pulmonary disease may in some cases of the tubercular affection be slight, and not reveal itself by positive physical signs, most important aid is often derived from a careful exploration of the chest. We have already alluded to the fact that although the production of a reddish streak by drawing the finger over the skin is frequently observed in tubercular meningitis, the occasional occurrence of the same sign in typhoid fever deprives it of much of its diagnostic value.

TREATMENT.—Typhoid fever in childhood requires the same general plan of treatment as in adults. In mild cases little else is required than strict attention to all hygienic precautions, and a supporting, but fluid and digestible, diet. Whatever complications ensue, should of course be treated appropriately. There are, however, a few indications in regard to which it may be well to speak more in detail.

When the fever is high, febrifuges, such as liq. ammoniæ acetatis and sp. ætheris nitrosi should be given; to which a little syr. ipecac. may be added, if the cough be troublesome. The surface of the body should be sponged daily or several times a day with tepid water, to which a little vinegar may be added; or the child may be carefully lifted for a few minutes every day or every other day into a bath of about 65° to 75°.

If there is much gastric irritability in the early stage, food should be given in very small quantities, and should be of the lightest character, as milk with lime-water or weak beef extract; counter-irritation may be employed in the form of mustard-plasters to the epigastrium; or, if there be reason to think that the stomach contains undigested, irritating food, an emetic of ipecacuanha may be given. In cases where marked symptoms of gastro-hepatic disturbance occur at the beginning of the attack, a few small doses of calomel with bismuth, or of blue mass, followed by a very gentle laxative, will be followed by relief to these symptoms. If the bowels are constipated, very small doses of some mild laxative, as castor oil or syr. rhei aromat., should be given during the first week; but when spontaneous diarrhœa is present, it should, unless it becomes excessive, not be interfered with. When, however, the stools exceed three or four daily, chalk mixture, with some vegetable astringent and opium, or small doses of opium and acetate of lead, or of paregoric alone, may be administered.

In ordinary cases, the nervous symptoms scarcely require any especial attention. When, however, they become marked, it will often suffice to apply wet cloths to the head, and to administer warm mustard foot-baths to allay the agitation. In cases where delirium becomes extreme, with great nervous agitation, the above remedies should still be used, but, in addition, small doses of chloroform with camphor-water, or even of opium, should be given, and will often produce the happiest effect. Dr. West speaks highly in such cases of the combination of opium and tartar emetic, recommended by Graves in the treatment of the head symptoms of typhus fever. It will be found, also, that chloral, in doses of five grains at three

to five years, or of bromide of potassium, in doses of seven to ten grains at the same age, repeated according to the urgency of the symptoms and the effect produced, will often prove successful in affording relief.

In regard to the occurrence of complications, we have already alluded to the remedies by which diarrhœa is to be checked if it becomes excessive. When the symptoms of pulmonary obstruction become marked, frequent counter-irritation by mustard or turpentine should be applied to the chest, and stimulating expectorants, as carbonate or muriate of ammonia, administered internally.

Hæmorrhage from the bowels and peritonitis from perforation or extension of inflammation, must be treated exactly as in the adult, the one by astringents, either vegetable or mineral, or by ergot and moderate doses of opium; the other by the free use of opium.

Of the special remedies which are recommended in this disease, we may allude to the treatment by means of mineral acids, especially the muriatic and nitro-muriatic, which is highly praised by some authorities.

Quinia is necessary in many cases as a tonic when adynamic symptoms begin to appear, and is of service in cases attended with high temperature, when given in full doses with a view of reducing the excessive heat of the body. In some cases, also, where the remittent character of the fever is marked, and where there is a suspicion that the case is complicated with a malarial element, it should be administered in full antiperiodic doses in the earliest stages.

Opium is rarely necessary in the early part of the disease, unless it be required to check diarrhœa; but when, in the latter part of the second or third week, the delirium becomes extreme, and the child sleeps but little, the night being spent in violent restless agitation, with loud screaming, opium should be fearlessly given until quiet sleep is produced.

The oil of turpentine is to be administered under the same conditions which call for its use in adults.

Stimulants are by no means absolutely necessary in all cases of typhoid fever in children. Excepting in the very mildest, however, it is prudent to administer them in small quantities after the middle of the second week. When, however, the condition of the child calls for their more free use, as shown by the frequent feeble pulse, rapid labored breathing, dry, brownish tongue, dulness alternating with noisy delirium, and other marked nervous symptoms, they should be given to the extent of f℥iij to f℥vj of sherry wine, or even of brandy, to children of six years old. It will be found in these cases that even such large amounts of stimulants as the above are very well borne by children.

The food should be given in small quantities, and frequently repeated. It should throughout the entire course of the disease be exclusively fluid, consisting of milk, chicken-water, or the various animal broths. It is rarely difficult to regulate the diet of children suffering with this disease, since their entire loss of appetite renders them indifferent to all food, and they will usually take whatever is offered to them.

During convalescence, the utmost care must be exercised, both in

regard to food and exercise. Solid food should be permitted very gradually, and with much caution; beginning with the lightest and most digestible forms, and watching the manner in which each article is digested.

In those cases where the child remains a long time in a condition of extreme debility, with impaired power of digestion, the bitter tonics and iron should be given, if the stomach will tolerate them. Sea, or cold water bathing, change of residence, and the utmost attention to all hygienic rules, are also to be recommended. When there is any reason to dread the development of tubercular disease, this treatment must be carried out with the greatest assiduity; and, if the child can digest it, cod-liver oil may be given with advantage.

CLASS VI.

CACHECTIC DISEASES.

ARTICLE I.

SCROFULA.

It does not seem appropriate, in a work whose chief character is designed to be practical, to enter upon a full discussion of the important pathological questions connected with the subject of scrofula, particularly in regard to its relations to simple chronic inflammation on the one hand, and to tuberculosis on the other. Indeed, in some respects these questions may be said to be still in such an unsettled state that no definite position in regard to them can be assumed with confidence. We propose therefore to confine our remarks at present chiefly to a description of the most marked manifestations of scrofula as generally recognized, and to a discussion of the appropriate treatment.

Definition; Characters.—The term scrofula is of very long standing. It appears to have been originally applied to a peculiar cachectic state of the system in which there is a special tendency to enlargement of the lymphatic glands. Subsequently it has been employed in so many and such varied senses as to make it difficult in many cases to decide in which way it is meant to be understood. We ourselves would be understood to employ it much in the old sense, to indicate a peculiar constitutional condition in which there is a "*vulnerable*" or irritable state of the lymphatics, which renders them liable to become enlarged from trifling causes, and at the same time indisposed to healthy reparative action; and which is also apt to manifest itself by various obstinate chronic inflammations of the skin, mucous or synovial membranes, or bones.

Scrofula is undoubtedly closely associated with tuberculosis. It very often happens that the children of tuberculous parents are scrofulous. And again we frequently observe that patients who have suffered with some chronic scrofulous affection become the subjects of tuberculosis, even of the most acute miliary form. So also there is a stage, that of yellow cheesy degeneration, in which it is not possible to distinguish between products of a scrofulous and of a tuberculous character. Still, however, we do not regard these two cachexiæ as identical, and enough points of difference can be indicated to fully support this opinion. Tuberculosis, it is true, often follows scrofulous affections, just as it follows any other con-

dition attended with the formation of cheesy deposits, which may infect the system and give rise to acute miliary tuberculosis. On the other hand, it is not common for tuberculous subjects to develop any manifestations of scrofula; and, as West points out, we frequently see whole families which display one or the other diathesis in its most intense form, and yet perfectly uncomplicated. Scrofula, moreover, is, far more markedly than tuberculosis, a disease of early life. The most common and characteristic of its manifestations also are very different from those of the latter disease; it affects the bones, the skin and adjacent mucous membranes, the glands, the synovial membranes in preference to the serous membranes, the lungs, the solid abdominal organs, and the alimentary and respiratory mucous membranes. These differences in the leading pathological tendencies of these two great cachexiæ, as well as the many points of difference in the physical peculiarities of children who are liable to tuberculosis or scrofula, are clearly and forcibly pointed out by Jenner in a clinical lecture published in *The Medical Times and Gazette*, 1860, p. 259.

Causes.—Scrofula is, we think, in many cases undoubtedly due to inherited predisposition. As in the case of other cachexiæ, the actual disease is not transmitted from parent to offspring, but merely so strong a tendency to its development that in some cases no care or favorable hygienic influences will overcome it. Not only do we meet with scrofula in the children of parents who themselves have been scrofulous, but also in cases where a feeble and vitiated constitution has been inherited from parents affected with tuberculosis or constitutional syphilis. In other cases, it is undoubtedly acquired after birth, appearing in children born to parents of sound constitution. The causes which tend to thus develop it act by impairing the nutrition, and include such influences as insufficient, improper food, protracted exposure to damp, cold, and especially to vitiated atmospheres, attacks of certain diseases, which like measles, typhoid fever, and chronic malaria, exercise a remarkably injurious action upon nutrition.

Symptoms.—Although by no means all scrofulous children present the same physical peculiarities, there are yet certain features so commonly met with in such subjects as to have led to their recognition as forming together the symptoms of a *scrofulous diathesis*. Thus, as a rule, such children are heavy and lethargic in mind, and of phlegmatic temperament, with dull expression, and thick, opaque skin. The features are apt to be coarse, especially the lips and nose; the lymphatic glands are perceptible to the touch; the abdomen is apt to be full and large; and the bones are large, with coarse, thick ends.

There is nothing peculiar or pathognomonic about the special manifestations of scrofula. Almost all of them may also appear as simple idiopathic affections due to some definite exciting cause, in children of entirely sound constitution. That which characterizes these same affections when they occur in what we term the scrofulous form, are the trivial causes which excite them, the inveterate obstinacy with which they persist, and their association with other analogous phenomena in the same subject. There is also in some cases a certain order of succession of the manifestations of scrofula which has even led to the division of its course into

three stages, corresponding somewhat to the classic phases of constitutional syphilis. Thus in the earliest stage, the lymphatic glands and skin are chiefly affected; subsequently affections of the mucous membranes and cellular tissue make their appearance; and in the final and most aggravated form the bones and viscera suffer. We cannot affirm, however, that this division and order of succession of the manifestations of scrofula is by any means constant or even marked in many cases.

Most of these manifestations appear as chronic inflammation of the part affected. At times such inflammation seems to arise spontaneously, while more frequently some more or less trivial exciting cause can be assigned. Thus the scrofulous enlargement of any group of glands is apt to be preceded by irritation of the area whose lymphatics pass to the affected glands, as, for instance, enlargement of the cervical lymphatics follows eruptions on the scalp or behind the ears, or attacks of sore throat.

Among the most frequent affections which are generally classed as scrofulous may be mentioned, without any reference to their frequency of occurrence, enlargement of the superficial lymphatic glands, cutaneous eruptions, especially of the vesicular and pustular varieties, small subcutaneous abscesses, chronic inflammation of the mucous membranes which are continuous with the external skin, as of the conjunctiva, the membrane of the external auditory meatus, that of the nose, and of the vulva and vagina, chronic effusions in the synovial membranes, chronic ostitis with caries.

The reader is referred for more detailed accounts of these numerous local scrofulous affections, to the special works which treat of the diseases of the skin or organs of special sense, or to general treatises upon surgery. Our own purpose is of necessity limited to a discussion of the general symptoms and treatment of the scrofulous cachexia, rather than of its numberless local manifestations. In the most advanced and severe forms of scrofula, lesions of various internal viscera may be developed. Among the most frequent and clearly marked in their nature, of these, are caseous bronchitis and pneumonia, and albuminoid degeneration of the abdominal viscera, the liver, spleen, and kidneys. Bronchitis and pneumonia at times appear in forms which entitle them to be regarded as scrofulous from the first. At other times, they apparently originate as acute inflammatory affections, but which, owing to the strong scrofulous diathesis of the patient, pass into a chronic form characterized by the low grade of the morbid products developed, by the obstinate and intractable course the affections run, and by the marked tendency to the occurrence of caseous degeneration and destructive changes in the diseased parts. In this condition, a sudden development of miliary tuberculosis not rarely occurs, either in the adjacent portions of the diseased organ, or throughout the other parts of the system. The exact nature of the primary changes in such cases is, at the present moment, one of the most unsettled and disputed points in pathology. The reader will find a tolerably full description of the lesions and symptoms under the head of pulmonary phthisis.

The exact relation of albuminoid degeneration of the viscera to scrofula is also somewhat uncertain. Although one of the most frequent of the

unfavorable sequelæ of scrofulous affections, it cannot itself be regarded as scrofulous in nature, since it makes its appearance in connection with other cachectic states of the system. The attempt of Dickinson to associate it with the changes in the blood and tissues caused by prolonged suppuration (which so often occurs in scrofulous disease of the bones, joints, or glands), has not been altogether successful. Although it is undoubtedly true that in many cases where albuminoid degeneration has been developed there has been previous prolonged suppuration, there are many exceptions where the visceral lesions have apparently been induced directly in connection with the scrofulous or other cachexia. The occurrence of this sequel must always be anticipated with anxiety in protracted and severe cases of scrofula. Although usually involving, simultaneously or in rapid succession, the various abdominal organs, the liver, spleen, kidneys, and gastro-intestinal canal, it may present a marked localization, for an indefinite time, in any of these parts.

When one of the above solid organs is affected with advanced albuminoid degeneration, it is found enlarged, though still preserving its original shape; the peritoneal capsule is unchanged; and on section the tissue presents a homogeneous, waxy, or lardaceous appearance, which is associated, when the section is examined by transmitted light, with abnormal translucence. The intimate nature of the change consists in an infiltration of the organ with a peculiar structureless albuminoid neoplasm or exudation. This first affects the walls of the arterioles, and later the glandular cells of the organ.

When the kidneys are involved, there is usually œdema, which appears early and increases rapidly; the urine is abundant, clear, with but slight reduction in its specific gravity, contains a large amount of albumen, and deposits numerous hyaline tube-casts. Albuminoid disease of the liver and spleen usually coexists. These organs are markedly enlarged, as can readily be detected by palpation and percussion. There is usually abdominal dropsy, with distension of the subcutaneous veins of the abdominal walls; and frequently there is also albuminuria and diarrhœa from coexisting disease of the kidneys and intestine. We have much less frequently observed marked albuminoid disease of the gastro-intestinal canal than of the solid abdominal organs, as above described. When it occurs, the walls of the stomach or intestine are thickened and present a peculiar homogeneous, glistening, and infiltrated appearance. The same microscopic changes are found as already described. The lesion of the mucous membrane is usually attended with chronic diarrhœa, and, if the stomach is also seriously involved, frequent and obstinate vomiting. Hæmorrhages from the bowels have been observed, but much less frequently than in the same condition in the adult. The general symptoms which mark the later stages of fatal cases of scrofula, especially when these serious visceral lesions have been developed, are expressive of the most profound anæmia and malnutrition.

Diagnosis.—The recognition of the existence of scrofula depends, not so much upon the presence of any special symptom or local affection, as upon the general marks of the scrofulous diathesis, the existence of hered-

itary tendency, or of some of the well-known exciting causes; the spontaneity and order of evolution of the phenomena; and finally their intractable resistance to the ordinary remedies, and the marked benefit which is often found to follow the use of special antiscrofulous treatment.

Prognosis.—The prognosis in cases of scrofula must of course depend upon the intensity of the diathesis, the gravity of the local manifestations, and the hygienic surroundings of the child. When the general health is fair, and the only scrofulous affections present are superficial, although the case is likely to prove obstinate and tedious, complete recovery can often be insured. It must never be forgotten, however, that such children are liable to the recurrence of scrofulous disease in some other form, and even to the development of the grave visceral lesions we have above alluded to. In the later and more advanced stages of the cachexia, when serious disease of the osseous and glandular tissues exists, the prognosis becomes in the highest degree unfavorable.

Treatment.—A great variety of local treatment—both medicinal and operative—is required for the various local scrofulous affections. We shall not, of course, attempt even to refer to these, but shall merely allude to the general principles that we think of prime importance; that, in the first place, all such affections should be cured as promptly as possible, and also that, in their treatment, the essential value of proper hygiene and constitutional remedies should never be forgotten.

The *preventive* treatment is of the greatest value; but it merely consists in the employment, with special and continued care, in the case of any child who probably possesses a scrofulous diathesis, of all those precautions as to diet, dress, exercise, and residence, which sound hygiene would dictate. In children born of scrofulous or tuberculous parents, a wet-nurse should be secured even if the mother is able to suckle them; and under no circumstances should the attempt be made to rear them on artificial food. Later, when the child has been weaned, the diet should be of the most nutritious and digestible character, especially containing a large proportion of well-selected animal food. The utmost care should also be exerted as to the dress, in order that it may be adapted to the season and sufficiently warm to prevent the child from contracting any of the catarrhal attacks, to which there is so great a liability in the scrofulous diathesis. Outdoor exercise in fair weather and gymnastic exercises indoors when it is unfit for the child to be exposed to the weather, must be enjoined. As a general rule, it may be said that the child should be encouraged to spend as much time out of doors as possible, when the weather is fine, dry, and sunny. If the circumstances of the parents admit of it the residence of the child should be chosen in an elevated, dry, and comparatively open part of the city, and for several months in each year it should be taken to the sea-shore, or to some elevated inland locality. While at the sea-shore, sea-bathing should be regularly followed, and throughout the rest of the year brine-baths, made with either bay-salt, or rock-salt, may be used daily. All forms of catarrhal inflammation, as angina, conjunctivitis, enteritis, and the like, should receive prompt and careful attention and be cured as soon as possible, since there is danger, if

they are allowed to continue, not only of their becoming chronic and extremely obstinate, but also of troublesome glandular enlargements being induced by the protracted irritation. After any of the local manifestations of scrofula which we have above enumerated have made their appearance, the above hygienic management must be sedulously persisted in. There are also various medical substances which exercise a beneficial effect by their alterative and tonic action upon the general nutrition. Among these the best are cod-liver oil, various preparations of iodine and of iron. Cod-liver oil may be used alone, or combined with the compound syrup of the phosphates of the alkalies and iron.

The preparations of iodine most frequently used, and which we have been led to prefer, are the compound tincture or solution of iodine, in the dose of from two to four drops three times a day, and the iodide of potassium, either alone, given in solution, as follows:

℞.—Potassii Iodidi, ... gr. xxiv.
Decoct. Sarsaparillæ Comp., ... f℥iv.

Ft. sol. Dose, a dessertspoonful to a tablespoonful thrice daily, at three to five years of age.

Or in combination with the iodide of iron, as follows:

℞.—Potassii Iodidi, ... gr. xlviij.
Syr. Ferri Iodidi, ... f℥ij.
Syr. Zingiberis, ... f℥x.
Aquæ, ... f℥iss.

Ft. sol. Dose, a teaspoonful thrice daily in water, at five years of age.

It is probable that the above is the best mode in which iron can be administered, though it is often desirable to give it in association with quinia or some other vegetable bitter, in order to stimulate the appetite and digestion.

Mercury, despite its powerful absorbent action, is not to be recommended for the treatment of scrofulous enlargement of the glands, in any form in which it is likely to produce its characteristic effect upon the blood. We are satisfied, however, that in some very obstinate cases which resist all other modes of treatment, minute doses of the bichloride or biniodide may be employed without risk, and with much advantage.

Arsenic deservedly occupies a high place among the internal remedies in scrofula. It may be given in combination with iron or quinia; or in some cases will be found of service in the form of small doses of Donovan's solution, the liquor hydrargyri et arsenici iodidi of our Pharmacopœia.

When circumstances permit, the use of certain mineral waters, particularly if the child can have the advantage of a temporary change of residence to the locality of the spring, is often attended with marked benefit. The waters which prove most useful are the sulphurated and iodo-bromated.

ARTICLE II.

TUBERCULOSIS.

This subject has received from many uathors upon diseases of children, far less attention than it merits, under the idea that it is merely a repetition, upon a small scale, of the same disease in the adult, and not possessed of any individual characteristics. In fact, however, tuberculosis in childhood is an affection possessing characters and presenting symptoms entirely special, and differing from its manifestation in adult life both in causes, locality, and clinical history.

Causes.—The causes which exert most manifest influence in its production are hereditary tendency, and all those debilitating agencies which act directly or indirectly upon nutrition. Of these latter causes, early weaning is the most prominent. Thus, we have met with a case where a healthy woman, the mother of several vigorous children, all of whom she had nursed, gave birth to one which she was unable to suckle, and this child, after pining for some months, died of an attack of tubercular meningitis. A bad quality of the nurse's milk, or improper artificial food after weaning, also exert a powerful influence in the production of tuberculosis; and not unfrequently its development has been traced to repeated attacks of indigestion or diarrhœa.

It has also a tendency to develop itself after certain acute affections, especially in children predisposed by hereditary influence. Of these diseases, rubeola, pertussis, typhoid fever, and, according to Greenhow, variola, are most frequently followed by tuberculosis.

There is still some difference of opinion in regard to the rôle which pneumonia plays in the development of tuberculosis. When the two coexist, the inflammation is by some regarded as a secondary affection, induced by the deposit of tubercle in the lung; while by others it is held that, amongst predisposed children, it is the pneumonia which causes the development of tuberculosis of the lung. We believe that pneumonia occupies each of these relations in a certain number of cases; but reliable statistics upon this point are still too scanty to determine the exact proportion.

Of recent years the influence exerted by foci of cheesy degeneration in the production of general tuberculosis has been established by careful clinical and experimental observation. In childhood the most frequent seat of such foci is in connection with the lymphatic glands, though they may also occur in connection with disease of the bones or with chronic ulcers.

Anatomical Appearances.—The most frequent seats of tubercular deposit in the child are the brain, constituting tubercular meningitis, which has already been treated of at length; the bronchial glands, the lungs, and the mesenteric glands and peritoneum. It is, however, one of the distinguishing features of tuberculosis in the young subject, that it is

apt to involve several viscera simultaneously, while not unfrequently the lungs remain free. Thus, in 312 children in whom Rilliet and Barthez found a deposit of tubercle in one or more of the viscera, the lungs were healthy in 47; while in 123 similar instances in the adult, Louis only found one such exception.

Locality.—In *bronchial phthisis*, which generally accompanies pulmonary phthisis, but also exists as a separate affection (though according to Bouchut, this is a rare occurrence), the glands are much enlarged and inclose tubercular matter, frequently in large proportion. This is especially marked in those glands which lie along the trachea and around its bifurcation, and, when many of them are involved and adherent to each other, they form masses varying in size from a hen's egg to a large apple. The deposit, which in by far the majority of cases exists as infiltrated tubercle, does not usually soften, though cases are recorded where such softening has occurred, and the fluid has been discharged through an opening into a bronchus. Obsolescence and calcification, however, are quite common terminations of bronchial tubercles; and when the lungs do not become involved in the morbid process, a cure may be effected by these transformations. Calcified tubercle may be eliminated through a communication between the gland and one of the air-passages; and a few cases are also reported where the œsophagus, trachea, and even the pulmonary artery have been perforated in this manner. Most of these tuberculous glands are inclosed in a distinct and dense capsule, which may attain the thickness of one or two lines, and is usually quite vascular. This fibrous capsule is due to the hypertrophy of the originally delicate cellular investment of the gland.

Pulmonary Phthisis.—The anatomical characters of tuberculosis of the lungs in children present several peculiarities, as distinguished from the same disease in adults. Thus gray granulations and crude miliary tubercles frequently exist in the lungs, independently of each other and of any other form of tubercular deposit. In the adult, Louis discovered miliary tubercles unassociated with gray granulations only in 2 out of 123 cases, or in 1.6 per cent.; and gray granulations alone in but 5 more, or 4 per cent.; while in the child, Rilliet and Barthez found miliary tubercles without gray granulations in 107 out of 265 cases, or in 40.4 per cent.; and gray granulations alone in 36 instances, or in 13 per cent.; and the observations of West, "which are based on 102 cases, yield 20 instances of the presence of miliary tubercles alone, and 17 of the presence of gray granulations alone in the tissue of the lungs."

The great frequency with which the so-called yellow infiltrated tubercle is observed in early life constitutes another anatomical peculiarity, Rilliet and Barthez, and West, having found it in from 23 to 33 per cent. of their cases. This condition rarely exists as an isolated state, but is found in conjunction with gray granulations and crude yellow tubercles, and not unfrequently also with advanced tuberculization of the bronchial glands.

The rare occurrence of cavities in the lungs is a most striking peculiarity of phthisis in children. It is probably no exaggeration to say that,

in adults, cavities are found in the lungs in 90 out of every 100 cases of tuberculosis; whilst out of 265 cases of tuberculosis of the lungs in children that came under the notice of Rilliet and Barthez, only 77, or 29 per cent., presented cavities; they existed in only 23.5 per cent. of West's cases, and Bouchut found them in but three out of 36 cases.

Occasionally the cavities resemble the vomicæ found in the lungs of adults, and this occurs with more frequency as we advance beyond the age of six years. In other cases, the excavation is produced by the softening of very small tuberculous deposits, distinct, though in close proximity, which form small vacuoles, communicating with each other and with the neighboring bronchial tubes. All three of M. Bouchut's cases appear to have been of this form.

In addition to these two varieties of tuberculous cavities, there is still a third, produced by the simultaneous softening of considerable portions of a lung affected with yellow infiltration. This action, which is most commonly met with in very early life, and in cases which progress with great rapidity, pervades the whole of the tissue affected, instead of producing a central cavity. Cavities of this kind sometimes form very quickly, and involve large portions of lung, the whole of one lobe even being converted into a mere sac, with thin walls.

There is another form of excavation occasionally noticed, which is not a true pulmonary vomica, but the result of the softening and evacuation of a tuberculous pulmonary gland. The diagnosis, however, may be rendered easy by reflecting that a pulmonary cavity of such small dimensions is hardly ever solitary, unless it proceeds from the softening of tubercular infiltration, whilst the deposit of tubercle which takes place in the neighborhood of a diseased pulmonary gland is always in the form of distinct deposits, not of tubercular infiltration (West).

The last anatomical peculiarity, already alluded to, of pulmonary phthisis in children, is its frequent complication with tubercular deposit in the bronchial glands.

Peritoneum.—Tubercular deposit on the peritoneum rarely or never occurs without the presence of a similar disease in some other parts of the economy. It may be either general or partial in its disposition, though it is far more frequently the latter. The deposit varies also in its character, appearing generally in the form of yellow granulations or of miliary tubercles, either isolated or united into small masses. Gray granulations, however, are also of quite frequent occurrence.

The relation which the tubercles bear to the peritoneum is not uniform, though they are more frequently found deposited on its surface than beneath it. In 86 cases examined by Rilliet and Barthez, the seat was as follows: intra-peritoneal in 40; extra-peritoneal in 22; both intra- and extra-peritoneal in 14; in the other 10 cases the exact seat was doubtful.

When the deposit involves the entire extent of the serous membrane, we find the anterior parietes of the abdomen adherent to the subjacent structures, and the viscera so matted together and adherent, as to form an almost inseparable mass. More frequently, however, the tuberculization is partial, and even limited to the vicinity of a single organ. The perito-

neum investing the diaphragm, especially that portion which is in contact with the liver or spleen, or the adjacent parietal peritoneum, is very often affected; and as tubercles rarely fail to be deposited in the peritoneum covering these viscera, we find them firmly adhering to the diaphragm or abdominal wall.

In some cases the omentum is the chief seat of the disease, and may either present numerous gray granulations scattered through its folds, or may be thickened or matted together from a kind of grayish tubercular infiltration, due to the coalescence of innumerable minute gray granulations. It is more rare to find the tuberculization limited to the intestines, merely causing adhesion of the adjoining coils.

In examining the adhesions which are almost universally found to exist between the various organs and portions of peritoneum affected, we find them to present two elements. In the first place, the tubercular deposits on the adjoining surfaces gradually coalesce as they increase in size, and finally unite the surfaces by more or less extensive patches of tubercular matter. And again, at the same time, the subacute inflammation caused by their presence leads to the formation of cellular and fibrous adhesions as in cases of simple peritonitis. This is well seen in cases where some coils of the intestine present tubercular adhesions to each other, forming masses which can only be separated by rupturing the walls of the bowel, while between other coils the adhesions merely consist of delicate and easily lacerated cellular bands.

It is a well-established fact that the tubercular granulations on the surface of the peritoneum have no tendency to perforate this membrane; but that the perforations which are occasionally found, especially in the walls of the intestines, are due to the development and softening of the subperitoneal tubercles, which always tend to penetrate into its cavity. This same law holds elsewhere, and it is on this account that the adhesions which so constantly form between tuberculous membranes are of such great value in preventing the escape of foreign matters into the serous cavities. In the intestines this action can be traced even further, and when tubercles exist under both layers of the peritoneum at a point of adhesion between two folds of intestine, as softening advances, the layers of peritoneum are destroyed, and the little collection of tuberculous pus remains confined only by the inner coats of the two layers of bowel. Sooner or later these also break down, the softened tubercle is discharged into the bowel, and a direct communication established between distant parts of the intestinal canal, as between a fold of the ileum and the ascending or descending colon. This perforation, then, is not caused by tuberculous ulceration of the mucous membrane; nor does this latter affection bear any fixed relation to the degree of tuberculization of the peritoneum.

There is generally some deposit of tubercle in the mesenteric glands in these cases; and when the splenic portion of the peritoneum is involved, we frequently find an abundant deposit in this organ.

Tuberculization of the *mesenteric glands*, or tabes mesenterica, offers few anatomical features in addition to those present in bronchial phthisis. It is, moreover, far from being a frequent form of the disease, for although,

according to Rilliet and Barthez, some tubercle is found in these glands in one-half of all tuberculous subjects, it exists in considerable quantity only in one out of every sixteen of the whole number. The deposit generally appears as infiltrated tubercle, though not unfrequently miliary tubercles are present. The glands attain a size varying from that of an almond to a pigeon's egg, and occasionally, from the aggregation of several enlarged glands, a mass is formed double the size of the child's fist.

The capsule which surrounds them is usually more delicate and less vascular than the same structure in tuberculous bronchial glands. The tubercular deposit here, as elsewhere, is liable to undergo calcification or softening, the latter process being more frequently met with.

Owing both to the yielding nature of the abdominal walls, which do not resist the forward growth of the mesenteric glands, and to the mobility of the adjacent viscera, we never see the same degree of compression exerted on surrounding structures, as is noticed in tuberculization of the bronchial glands.

Occasionally, however, adhesions may form between a tuberculous mesenteric gland and a fold of the intestine, and ultimately result in perforation of the bowel.

In thus describing these various lesions as being all tuberculous in their essential nature, we have purposely employed this term in the somewhat inaccurate and vague sense which was assigned to it until within the past few years.

Recognizing, as we distinctly do, but one elementary form of tuberculous deposit, the gray granulation or miliary tubercle, which may, it is true, undergo cheesy degeneration, it is evident that many of the cases in which extensive and uniform cheesy deposits are found, rather depend upon scrofulous inflammation of the part than upon true tuberculous formation. It is comparatively rare to meet with such cheesy deposits in the lungs in children, while, as already described, they occur very frequently both in the bronchial and mesenteric glands. And, therefore, we are disposed to believe that in many cases of so-called bronchial or mesenteric phthisis, the enlargement and degeneration of the glands are really due to an inflammatory process of a low and unhealthy type, excited by the previous occurrence of attacks of bronchitis or enteritis, and leading to the formation of a cacoplastic lymph, which soon undergoes cheesy degeneration.

It is in this way, doubtless, that the comparatively numerous cases are to be explained in which such deposits soften and are evacuated, or undergo partial absorption and calcification, and where ultimately the child's health is restored. We have preferred, however, in the present edition, for practical purposes, to group the descriptions of these various conditions under one common head, being unwilling to separate them until more extended study shall have more clearly demonstrated the degree of resemblance which exists between true tuberculous matter and such cacoplastic inflammatory formations.

Symptoms.—The symptoms of tuberculosis in children may be studied

under the forms of bronchial phthisis; acute and chronic pulmonary phthisis; and tuberculization of the peritoneum and mesenteric glands.

Bronchial Phthisis.—In addition to the general symptoms of tuberculosis, which will be fully given under the head of pulmonary phthisis, the most marked symptoms of bronchial phthisis are those due to the mechanical effect of the enlarged and hardened glands upon the surrounding tissues. Our knowledge of the functions of the lymphatic glands is as yet so inaccurate that we are entirely unable to appreciate the symptoms of disordered action which are probably present in cases of extensive disease of these organs.

Bronchial phthisis occurs in its best-marked form between the ages of two and six years; and in many cases appears to be developed after some severe attack of bronchitis, either accompanying measles or arising without apparent cause.

The cough which, in the early stage, is hacking and not very troublesome, soon acquires severity and becomes intermittent, recurring in paroxysms like those of pertussis.

The respiration becomes habitually labored and oppressed, with a prolonged wheezing sound, as in asthmatic cases.

The veins of the neck are often greatly distended, the distension becoming extreme during the violent paroxysms of coughing; the face becomes puffy and œdematous, a condition occasionally extending to the upper extremities; and, as West points out, the superficial vessels of the thorax become enlarged, just as those of the abdomen do in cases of cirrhosis of the liver. The obstruction to the return of blood from the superior vena cava is further shown by the occurrence of epistaxis, or even of hæmorrhage into the arachnoid; and the compression of the pulmonary tissue occasionally produces hæmoptysis and œdema of the lungs. Dr. Jenner has seen hydrothorax produced from compression of the vena azygos.

The œsophagus does not always escape the encroachment of the glands, but may be so compressed as to produce dysphagia.

It is hardly necessary to say that so long as the tubercular deposit remains small, it may exist without causing any symptoms, and it is only when several glands become infiltrated with tubercle, enlarged and firm, that they give rise either to the symptoms already enumerated, or to the physical signs below alluded to.

Physical Signs.—In estimating the value of these, it is necessary to constantly bear in mind the fact that the enlarged and tuberculous bronchial glands, while they still surround the trachea and bronchi, also come into contact with the spinal column, or, in a few cases, with the sternum. From their solidity, and the consequent readiness with which they are thrown into vibration, they transmit directly to the ear and seem to exaggerate many respiratory sounds, which are in reality produced at a distance from the thoracic walls, and which are either entirely normal or dependent upon a small amount of disease.

It is also due to these relations, that the signs, both of auscultation and percussion, of bronchial phthisis are best detected at the summit of the

lungs posteriorly, or at the level of the vertebræ with which the enlarged glands come in contact.

Our knowledge of these important considerations is chiefly due to the investigations of Rilliet and Barthez.

Percussion.—In the young child in health, there is a diminution in resonance over the manubrium of the sternum, owing to the remains of the thymus glands; but, in some cases of marked bronchial phthisis, this dulness extends both downwards and laterally to a varying but perceptible degree, owing to the projection of the enlarged glands into the anterior mediastinum.

More generally, however, as we have said, the tuberculous glands are in contact with the spinal column, so that we find dulness on percussion in the interscapular space as a pretty constant and characteristic symptom.

According to Dr. Jenner, it is common to have a cracked-pot sound on percussing the cartilages of the upper three ribs on one or both sides. This is due to the fact that the enlarged glands accompanying the bronchial tubes frequently extend under the anterior margin of the lungs, so that, in percussing, the air-containing lung is compressed between the solid mass of glands behind and the in-driven parietes in front, and the air is forced out suddenly from the healthy layer of lung, producing the chinking sound.

Auscultation often reveals true tubular breathing over the upper part of the sternum, extending almost to the base of the heart. In those cases where a large bronchial tube is compressed or occluded, we, of course, find an enfeebled or extinct respiratory murmur over the corresponding lung segment.

Occasionally the enlarged glands compress the superior vena cava, and give rise to a permanent venous hum; or a systolic murmur, having its seat of greatest intensity at the second left interspace, may be produced by similar compression of the pulmonary artery.

There is one characteristic, however, of this form of phthisis, which is especially dwelt upon by Dr. West, and which it is well to bear in mind, to avoid being misled. This is the frequent occurrence of great fluctuations in the condition of the patient; so that, even when the rapid breathing, frequent cough, emaciation and loss of strength would betoken a speedily fatal issue, a pause will occur in the progress of the disease, during which the diminution of any bronchitic complication, with partial disappearance of the dyspnœa and cough, and the return of flesh and strength to the little patient, all tend to awaken delusive hopes. In the great majority of cases, this respite is but brief, and the disease again resumes its onward course; but there are well-authenticated cases on record in which the gravest symptoms have gradually disappeared, and the child has ultimately regained fair health. In these cases, the tuberculous deposit may either have undergone cretaceous degeneration, or, having softened and formed an opening into a bronchus, have been expectorated.

The characteristics of bronchial phthisis, which we have been considering, are thus summed up by West:

"1. The frequent development of its symptoms out of one or more attacks of bronchitis.

"2. The peculiar paroxysmal cough which attends it, resembling that of incipient pertussis.

"3. The great and frequent fluctuations in the patient's condition, and the occasional and apparently causeless aggravation both of the cough and dyspnœa."

Symptoms of Pulmonary Phthisis.—Valuable as are the general symptoms of tuberculosis in the adult, it is in the young child peculiarily that they reach their highest importance, owing either to the absence or the difficulty of appreciation of many symptoms which aid greatly in the diagnosis of phthisis in adult life.

It is necessary, therefore, to examine with the greatest care the child's hereditary tendencies, its past history, and its appearance and physical development. Thus it is in cases of inherited tuberculosis that we see its characteristic features most strongly marked, in the tall, slim frame; the firm bones, with small and yielding cartilages; the delicate diaphanous complexion; the fine, silky hair; the active, often precocious intelligence; the ease with which the general health is affected by slight causes, and the peculiar proneness to catch cold on the least exposure. By careful attention to these and other similar points, as much, or often more valuable information can be obtained in the phthisis of children, than from the most careful investigation of the physical signs.

In enumerating the symptoms, it is unnecessary to detail those which exist in common with pulmonary phthisis in the adult, save to point out any particular in which they may differ as seen in the young subject.

The *cough* varies much, in accordance with the varying amount of bronchial irritation, being at one time scarcely troublesome, or so aggravated and accompanied with such violent dyspnœa, from some intercurrent attack of bronchitis, as to threaten immediate death.

It not unfrequently has a somewhat paroxysmal character from the accompanying tuberculization of the bronchial glands. One of the most marked peculiarities of the cough in the phthisis of children is the entire absence of expectoration, since the secretions are either retained in the bronchial tubes, or, if raised into the pharynx, are swallowed without any effort at expulsion.

Hæmoptysis very rarely occurs in the early stage or during the progress of the disease; and when it occurs as the cause of sudden death, is due to the complication with bronchial phthisis, rather than to the rupture of a bloodvessel in a pulmonary vomica.

The *temperature* of the body is, as a rule, higher than normal, although it presents fluctuations on different days, and even at different hours of the same day; at times being normal, and again rising as high as 102°, or more. The greatest elevation of the temperature is generally noticed at night, and is usually accompanied by flushing of one or both cheeks; but it is rare to find the colliquative night-sweats which prove so exhausting to adults.

The *pulse* is always accelerated, and becomes very frequent as the temperature rises.

The *appetite* is capricious, the tongue furred, and the digestion imper-

fect; the bowels alternate from a state of constipation to diarrhœa, and the stools are unhealthy in appearance, being generally putty-like or clay-colored. Naturally, with this disturbed state of the primæ viæ, nutrition is seriously impaired, and the child steadily loses flesh and strength. Indeed, in very many cases, the little patient presents merely the symptoms of impaired nutrition, becomes languid and drooping, and loses appetite, strength, and flesh, for many weeks before the development of cough reveals the lungs as the seat of the disease.

Physical Signs.—We have already remarked the fact that in the investigation of phthisis, the physical signs are of much less value in the case of children than in adults. This arises not only from peculiarities of the physical and moral organization in childhood, but also from the mode in which the tuberculous deposit takes place. Thus, as a rule, the deposit of tubercle in the lungs of children is more generally diffused and uniform; so that we lose to a great degree the advantages derived in adults from a comparison of the results of auscultation and percussion in one part, with those obtained in another. For the same reason, we are also deprived of those signs which, in the adult, are developed in a single point: as, for instance, the *coarse breathing*, which is of so much diagnostic importance as one of the earliest signs of the deposit of tubercle at the apex of the lungs.

Another source of difficulty and error lies in the fact already alluded to, that the bronchial glands, when enlarged by the deposit of tubercle, as so constantly happens in conjunction with the pulmonary phthisis of children, are brought into contact with the thoracic walls, and transmit many sounds with intensified force. It is thus that prolongation of the expiratory sound beneath the clavicle, and jerking respiration, lose much of the importance they have as signs of the early stage of phthisis in adults. For although, when heard in children, they should always be regarded as probable evidence of phthisis, they have frequently been noticed in cases whose progress shows the tubercular deposit to have been, at the most, trifling. In the same way, caution must be used not to mistake the blowing sound, mixed with moist râles, which is thus transmitted from a compressed bronchial tube containing mucus, for a large tubercular vomica. The only way in which this mistake, and the consequent too unfavorable prognosis, can be avoided, is by comparing daily the results of auscultation and percussion, and noticing whether they remain exactly the same, or whether, while the dulness on percussion over the enlarged glands persists, the results of auscultation vary from day to day with the varying amount of compression of the bronchus and the nature of its contents.

A still further source of difficulty results from the loss of all the information which is derived, in older persons, from the vocal resonance and its alterations; although it is occasionally possible to draw reliable conclusions from the resonance and fremitus of the cry or cough. And again, owing to the excitability of children, patient and prolonged observation is required, both as to the situation, degree, extent, and duration of any inequality of breathing, before any conclusion can be drawn from it.

Finally, the extreme resonance of the thorax in early life tends to viti-

ate the results of percussion by preventing the recognition of fine variations of sonority, such as are readily detected in more advanced life.

We have thus far been considering the symptoms of pulmonary phthisis in its usual moderately acute form, but it is necessary to be aware that in some cases it deviates from this course, being at one time extremely rapid, and at another very chronic in its progress.

In the acute cases, we often find that there has been a previous deposit of tubercle or of caseous inflammatory exudation in different parts of the economy, though to so small an extent as scarcely to have interfered with nutrition or the performance of the functions, or to have attracted the least attention.

In such a state of system, death may be produced in a few days or weeks by an acute development of tubercle. When this occurs in the lungs, it is not unfrequently attended by inflammation of the pulmonary parenchyma, constituting tuberculous pneumonia; and, whatever may be the view entertained as to the relation between the inflammation and the tubercular deposit, the recognition of this latter element is of the greatest importance, from its bearing on the treatment to be adopted.

In *tuberculous pneumonia*, in addition to the hereditary tendency and past history of the child, we rarely find the same heat of skin or vascular excitement as in pure pneumonia. The degree of oppression of the chest is also, from the beginning, out of proportion to the catarrhal or bronchial symptoms with which the case sets in. And auscultation reveals both that the amount of inflamed lung-tissue is not sufficient to account for the dyspnœa, and that the râles developed are of the subcrepitant and mucous varieties, rather than the true fine crepitant râle of uncomplicated pneumonia.

In the *chronic form* of phthisis alluded to, the symptoms may be prolonged during several years. They consist of progressive emaciation, chronic cough, with or without expectoration according to the age of the patient, and the physical signs of more or less advanced tubercular deposit. In favorable cases, it is not unusual for some degree of temporary improvement to occur in the general symptoms, and in some rare cases the child slowly regains good health, and the physical signs gradually diminish, leaving merely some dulness and feeble respiration at points where positive signs of advanced pulmonary disease previously existed. It is needless to add that in such cases the nature of the morbid condition present has probably been of a chronic inflammatory rather than of a truly tuberculous character.

Symptoms of Tuberculous Peritonitis.—The peritoneum may either become implicated late in the course of general tuberculosis, or it may be the first structure involved. Apart, however, from the general symptoms of the tuberculous cachexia which in some cases precede its appearance, there are few symptoms of much diagnostic value during its early stage. Thus the child retains its appetite and spirits; does not lose flesh rapidly; and only complains of occasional and apparently causeless abdominal pain. This condition does not, however, last long; the nutrition soon fails, the appetite becomes capricious, the bowels irregular, the colicky pains more fre-

quent and severe, and the abdomen acquires an abnormal size and appearance. These symptoms, however, merit a more detailed allusion. The tongue rarely indicates, either by dryness or furring, any serious disturbance of the digestive functions. The bowels are almost invariably loose, or alternations of constipation and diarrhœa present themselves, the stools usually being unhealthy in appearance. This condition frequently appears to depend upon inflammation or tuberculous ulceration of the intestines. Vomiting is not usually present; it is rarely spontaneous, and merely consists in the occasional rejection of alimentary matters.

Pain in the abdomen has been mentioned as one of the earliest symptoms. It is rarely constant or confined to the seat of the lesion, but is rather shifting, intermittent, and colicky in its nature, recurring with greater or less frequency. There is also tenderness on pressure over the abdomen, which becomes especially marked during the later stages of the disease, though in some cases the abdomen remains indolent throughout. At a variable period after the appearance of the preceding symptoms, and sometimes simultaneously with the occurrence of colicky pains, the abdomen undergoes a marked modification in its size and shape. It becomes tense and large, and assumes an oval or globular form, the depressions and fossæ being all effaced. It generally retains its tympanitic note upon percussion; and in proportion as the distension increases, the sound becomes more and more tympanitic. The tension often varies without any apparent cause; and when it is much diminished, an imperfect sense of fluctuation may be obtained by filliping the sides of the abdomen. This sign is rarely due to any ascites being present, but is beyond doubt rightly explained by Rilliet and Barthez as due to the transmission of the impulse of the hand by the agglutinated intestinal mass.

It is only in very exceptional cases that even the most careful percussion or palpation will detect any inequalities in the abdominal walls, due to the presence of large tuberculous patches. In every case in which the last-named observers detected any abdominal tumor, the omentum was found to be the chief seat of the tuberculous deposit.

After this condition of the abdomen has persisted some time, the distended skin desquamates, and assumes a rough and dirty appearance. At about the same period, usually, the cutaneous veins of the abdomen become prominent and dilated, owing to the obstruction to the abdominal circulation.

As the case progresses, and the general symptoms assume more gravity, these local symptoms become more pronounced. Like all forms of tuberculosis in children, however, the advance of this disease is rarely uniform, and intermissions and fluctuations in the symptoms are often noticed. Toward the close of life, all the symptoms usually undergo aggravation, and the remissions become more and more rare and brief.

Death is either produced by the advance of tuberculous disease in the lungs, or by tubercular meningitis; or the little patient sinks from sheer exhaustion under the persistent diarrhœa and the repeated accessions of peritoneal disease.

Symptoms of Tuberculosis of the Mesenteric Glands.—The symptoms of

this condition are even less positive and diagnostic than those of tuberculous peritonitis. So long as the glands remain only moderately enlarged, buried as they are beneath the small intestine, it is impossible to detect their presence, especially as the absorption of chyle is not materially interfered with.

We have already mentioned, moreover, the comparative rarity of symptoms due to the pressure of the enlarged glands upon neighboring structures, such as perforation or compression of the intestines, and dilatation of the cutaneous veins, or œdema.

The modifications of the size and shape of the abdomen occasionally furnish useful information. It is rarely so large and tense as in tuberculous peritonitis, and its shape is rather globular than oval.

There is scarcely any tenderness on pressure over the abdomen, unless there is some accompanying peritonitis.

The only really pathognomonic symptom, indeed, is the detection of the enlarged glands by palpation. This, however, is far from being possible in all cases, even when the bulk of the glands is very considerable, as they are frequently covered and concealed by the intestines.

It is, in fact, only in those cases where the abdomen is supple and relaxed, that we can establish the presence of the tumor, which is usually lobulated, varying in size from a hen's egg to a large orange, and seated in the neighborhood of the umbilicus.

The digestive system here also presents more or less marked disturbances; the bowels in particular being loose, a condition generally due to the existence of tuberculous ulceration of the intestine.

The general symptoms which accompany tuberculization of the mesenteric glands alone, are often not so marked as when other organs are affected; in fact, MM. Rilliet and Barthez assert that they have not met with a case in which this affection, isolated from all others, has produced any considerable emaciation. This does not, however, correspond with our own observation, since we have met with cases where the interference with general health and the attendant emaciation were very marked.

Duration.—The duration of tuberculosis in children, as might have been expected, varies considerably according to the position and surroundings of the patients. In large hospitals, where the children have not the advantage of the best hygienic influences, the majority of cases terminate in from 3 to 7 months, though occasionally protracted to upwards of 2 years. In private practice, on the other hand, many cases of chronic phthisis are met with, in which the disease continues for 3, 4, or even 5 years before producing death. It is extremely difficult to assign any probable duration for either tuberculous peritonitis or tabes mesenterica, as they can rarely be diagnosed during the early stages of their development.

Diagnosis.—The danger in regard to the diagnosis of phthisis in children is not so much of entirely overlooking the nature of the disease, as of overestimating its amount. We have already given the reasons why the physical signs of pulmonary and bronchial tuberculosis in children are less reliable and more difficult to appreciate than in adults. A proper atten-

tion to the hereditary tendencies and individual history of the child; a close scrutiny of its physical conformation and development, with an intelligent interpretation of the physical signs, will, however, generally suffice to prevent any serious error.

In the earlier stages of the more acute forms of phthisis, the disease with which it is most apt to be confounded is remittent fever; from which it may be distinguished by the history of malarial exposure, by the definite commencement of the case, and by the very marked exacerbations which occur towards night, attended with high fever, great heat of skin, and considerable delirium. In its more chronic forms, the diagnosis of pulmonary phthisis from chronic bronchitis is often attended with the greatest difficulty. In fact, the physical signs of the two conditions are frequently so entirely analogous, that it is only by the general symptoms of tuberculosis, the greater amount of hectic irritation, the more rapid emaciation, and the frequent supervention of tubercular deposit in other organs, that a diagnosis can be established.

We have already dwelt upon the value of abnormal development of the abdomen as a symptom of tubercular peritonitis. There are, however, many cases of simple functional derangement of the intestines, in which no suspicion of tuberculous deposit can be entertained, where this symptom is also noticed. It is due to this circumstance that tubercular disease of the peritoneum and mesenteric glands was formerly considered of such frequent occurrence. A careful regard, however, to the age of the patient; for simple distension of the abdomen occurs generally in infancy, whilst tuberculous peritonitis is most frequent after the age of 3 years; and to the effects of simple remedies, will usually remove any doubt.

The cases which are most apt to be confounded with tabes mesenterica are those in which abdominal tumors, due to some other cause, are present. Thus, in extensive tubercular deposit in the omentum, we may have, in addition to the general symptoms of tuberculosis, a well-defined tumor about the middle of the abdomen. The greater degree of tenderness of the abdomen, and the mobility in this case, may, however, serve to distinguish it. Again, it is not rare to find in cases of digestive derangement, where irregular action of the bowels with more or less pain may have been present, a distinct and only slightly movable tumor in the abdomen, due to the impaction of the intestine with hardened fæces. A careful consideration, however, of the position of these masses, which is generally in one or the other iliac fossa; their entire painlessness and doughy character upon palpation, and their complete disappearance after the administration of laxatives and enemata, will reveal their true nature.

Prognosis.—The very name of tuberculosis has grown, with only too much reason, to be almost synonymous with impending, unavoidable death. And yet, while pulmonary phthisis shows the same fatal tendency in childhood as in adult life, the prognosis is somewhat less gloomy. For not only does well-directed treatment occasionally render the morbid deposits in the lungs in some cases of phthisis, whose existence has been proved by the symptoms of the incipient stage, inert and obsolescent; but in rare cases, where the deposit has advanced to softening and destruction

of lung-tissue, a cure has been slowly effected by the evacuation of the softened tubercle and the gradual cicatrization of the cavity.

In tuberculization of the bronchial and mesenteric glands, moreover, numerous cases have been noticed where the glands have undergone complete calcification, and the progress of the disease has been arrested.

While, therefore, the prognosis must ever be grave and unfavorable, we must bear in mind the possibility of recovery when the hereditary tendency of the child is not too strongly pronounced, and the actual tuberculous deposit not extensive or rapidly progressing.

Modes of Death.—Having thus spoken briefly of the prognosis, a few words will suffice to call attention to the various modes in which phthisis brings about a fatal issue in children.

In the majority of cases, death occurs from sheer exhaustion of the powers of life, from impaired nutrition and perverted functions. In a few instances of bronchial phthisis, death is suddenly caused by copious hæmorrhage, owing to the perforation of one of the pulmonary blood-vessels.

The immediate cause of death is frequently found in an intercurrent attack of bronchitis, pneumonia, or peritonitis; while, in other cases, the cerebral symptoms which precede the fatal event, show that the membranes of the brain have become the seat of tuberculous deposit.

It is not unusual, moreover, whether the original seat of the tuberculous deposit have been in the abdomen or thorax, for marked abdominal symptoms to be developed towards the close of the case; the tuberculous ulceration of the intestines serving to maintain an uncontrollable and exhausting diarrhœa.

Treatment.—*Prophylactic.*—In children whose parents are tuberculous, and who in early life give evidence of delicate health, the prophylaxis becomes most important. The infant should be kept at the mother's breast up to the age of fifteen or eighteen months; but in case the mother be herself tuberculous, on no account should she be allowed to nurse the child, for whom a healthy wet-nurse should be immediately procured. By attention to this precaution, we have succeeded in raising children of tuberculous mothers, who had suckled their previous children and had lost them all in early life from tuberculous disease.

As the child advances in age, every caution should be paid to its food and clothing, to securing sufficient exercise in the open air, and free ventilation in its sleeping apartment. When the circumstances of the parents permit it, it is of the greatest consequence that the child should enjoy the benefits of a country life, in some healthy, invigorating atmosphere, for four or six months out of every year.

The child should further be guarded sedulously from the ailments incident to early life, and especially from hooping-cough and measles; and the slightest disturbance of either the respiratory or digestive functions should receive prompt and careful treatment; nor should we be tempted to discontinue these efforts, even if positive signs of tuberculous deposit appear; for the possibility of these deposits in childhood becoming latent

or being evacuated, and the general health re-established, should never be lost sight of.

Curative.—Little need be said of the treatment of fully developed tuberculosis in children, since the same indications present themselves as in adults, and call for the same remedies. The most essential points in the treatment are attention to all hygienic conditions, careful regulation of the diet, and the administration of remedies calculated to improve nutrition and primary assimilation.

It is indeed impossible to overestimate the importance of maintaining the appetite and powers of digestion; and if these show any sign of failing, we should resort to some of the bitter vegetable tonics, of which, perhaps, the combination of tincture of nux vomica, gtt. ij to v, with the compound tincture of gentian, ♏xv to xxx, according to the age of the child, is most desirable. On the other hand, if we find reason to believe that any remedy we are administering disturbs the nutrition of the child, disgusts it, lessens its appetite, or rouses violent opposition at every dose, it should be instantly abandoned as producing the very effect we most desire to avoid.

The child should be strongly encouraged to take nourishing food at regular intervals, and so soon as any of the articles of its diet become unattractive, other preparations of similar nature should be substituted. Milk should enter largely into the diet, and ought to be taken at least every morning and evening. Tender, finely divided meat should be eaten at the midday meal, in such quantities as the digestion will easily bear. If marked signs of debility present themselves, a few drachms of good brandy may be taken at intervals through the day, with advantage.

When the stomach does not reject it, there are few remedies whose action is more beneficial than cod-liver oil, given in the dose of a teaspoonful or even less, three times a day. In many instances, children soon become accustomed to the taste of this substance, and even grow to relish it almost as a luxury, and to take it eagerly; in some cases, however, the taste is so unpleasant that the children refuse to take it, and it is, therefore, advisable in such instances to prescribe it in the combination which we have already recommended, at least during the first few weeks of its administration.

In those cases where it is impossible to administer cod-liver oil internally, very good results may often be obtained here, as well as under similar circumstances in other wasting diseases of children, by the use of the oil by inunction.

Iron and its various preparations are strongly indicated, and we can generally find some of the milder forms which will be readily tolerated. In those cases where there is considerable implication of the lymphatic glands, the syrup of the iodide of iron appears especially useful, and this may be well given alternately or in conjunction with iodide of potassium.

Sea-bathing is strongly recommended, especially in the tuberculization of the glandular system; or when this is not attainable, baths in which some tonic drug has been mixed may be used.

In tuberculous deposit in the peritoneum or mesenteric glands, the diet

must be regulated with peculiar care; the most bland, unirritating, and digestible food being selected. If, however, despite our precautions, diarrhœa should make its appearance, the various astringents in combination with opium should be given freely. The pain in the abdomen, which is frequently so severe in these forms of tuberculosis, may be relieved by the application of sinapisms, or of warm anodyne poultices, or by gentle friction with a sedative liniment.

When the symptoms of any intercurrent inflammation in the diseased organ present themselves, we must limit our treatment to the application of a few cups or leeches over the part, and the administration of a less stimulating diet, with some mild febrifuge. When the peritoneum is involved in the tubercular deposit, and we have reason to fear an accession of inflammation of that membrane, there is urgent necessity for the use of topical depletion in moderation; but we must, at the same time, bear in mind the cachectic nature of the disease, and refrain from the adoption of any depressing plan of treatment.

ARTICLE III.

RICKETS.

Definition; Synonyms; Frequency. — Rickets is a constitutional disease peculiar to childhood, which first manifests itself by various disturbances of nutrition, and later by a specific alteration in the bones.

This disease has been known under a vast variety of names in many different languages;[1] almost the only terms by which it is designated by English or American authors, however, are rickets and rachitis.

An idea of the vast importance and frequency of this disease may be gained from the statements of some of the recent writers upon this subject. Thus Sir W. Jenner, whose lectures upon this subject (*loc. cit.*) present a most original, philosophical, and lifelike description of the disease, speaks of it as "without question the most common, the most important, and in its effects the most fatal of the diseases which exclusively affect children." Hillier, at the close of an excellent chapter upon rickets (*loc. cit.*), presents a table showing the proportion borne by the number of cases of this disease to the total number of out-patients treated at the Hospital for Sick Children, London, from which we calculate that of 128,656 children treated during thirteen years (1854–66), not less than 8419, or 6.5 per cent., were rachitic; and in some years the proportion of such patients rose as high as 9 per cent.

The statistics furnished by other English writers, as Gee (*loc. cit.*), Merei, and Ritchie, support the view that in all classes of English society a notable proportion of the children are rachitic. In the same way, the

[1] For Synonymy, see Art. Rickets in Reynolds's Syst. of Med., vol. i, p. 768.

highest German authorities, as Ritter von Rittershain and Henoch, state that the proportion of the children treated at public institutions in that country, who are found to be rachitic, is not less than 30 per cent.

Of late years, the attention of observers in this country has been more forcibly attracted to this subject, and, as a consequence, the number of cases in which the early and less prominent symptoms of rickets are now recognized is rapidly increasing. In a paper on this subject by Parry,[1] which we regard as the most valuable contribution to the literature of rachitis which has been made on this side of the Atlantic, the writer states that he has been "irresistibly forced to the conclusion that rachitis is scarcely less frequent in Philadelphia than it is in the large cities of Great Britain and the continent of Europe." We must add that, although, judging from our own experience, the above statement is an overestimate, the number of cases in which we meet with the early, or even the more grave symptoms of rickets, is quite large both in private practice and in connection with public institutions.

The fact that during the past twelve years the mortality returns of this city contain but two deaths reported as from rickets, is of little importance, since so rarely is it assigned as a cause of death even in Great Britain, that the Registrar-General has not found it necessary to devote a column of his tables of mortality to the disease. "The secondary diseases," as Hillier says, "are recognized, such as bronchitis, collapse of the lungs, atrophy, measles, hooping-cough, or convulsions, but the primary disease, which renders these secondary diseases fatal, is ignored."

We shall limit ourselves to an account of the causes, general symptoms, and treatment of the disease, with a brief description of the anatomical changes in the bones, and the deformities which result, referring the reader who desires more minute knowledge on these latter points, to any of the elaborate memoirs published on this disease.[2]

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[1] Amer. Jour. Med. Sciences, Jan. 1872, p. 17.

[2] Bibliography of Rickets.—Shaw, Med.-Chir. Trans., vols. xvii and xxvi.
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CAUSES.—*Age.*—Rickets is essentially a disease of childhood, and indeed may make its appearance during early infancy. There are also a few cases on record which show that it may, although rarely, occur in the fœtus before birth. It frequently may be detected during the first six months of extra-uterine life. Gee has noticed positive beading of the ribs at the third and fourth weeks, and Parry at the sixth week after birth. The age at which it ceases to be frequent for rachitis to begin is variously estimated. We have observed a number of cases where the earliest symptoms were detected during the second year; and we should be inclined to assign as the limits of its most frequent occurrence the second or third month to the close of the second year. It grows rarer after this latter date, and many high authorities unite in saying that it never comes on after the completion of the first dentition in a child hitherto perfectly healthy. Considerable difference of opinion exists upon the question whether rickets is hereditary or not; but there seems no evidence to show that it ever is so, in the sense, for example, in which infantile syphilis is hereditary. There can, however, be no doubt as to the great influence exercised by the health of the parents upon the development of the disease.

It is stated by some authors that too early marriages, or marriages between relations, and chronic tuberculosis or constitutional syphilis of the father, predispose to it. These causes are, however, of doubtful power; and certainly are inoperative as compared with the very positive influence exercised by the condition of the mother. Thus, it is well ascertained, that whatever tends to induce debility and anæmia in the mother, as too frequent pregnancies or prolonged lactation, renders it probable that her next born children will be rickety. Thus, Jenner states that it is very common for the first, or the two or three first born children, to be free from any sign of rickets, and yet for every subsequent child to be rickety; which he explains by the fact, "that among the poor the parents are generally worse fed, worse clothed, and worse lodged, the larger the number of their children; and among the rich and poor alike, the larger the number of children, the more has the mother's constitutional strength been taxed, and the more likely is she to have lost in general power." (*Loc. cit.*)

In addition to the tendency derived from the mother, there are numerous causes acting directly upon the child, which strongly predispose to the disease. These will be found to be nearly the same as those which favor the development of tuberculosis. Thus, premature weaning, and the substitution of improper food for the mother's milk; or, on the other hand, the continuance of suckling long after the proper period for weaning, and after the mother's milk has deteriorated in quality and become insufficient

West, Dis. of Children (4th Amer. ed.), 1866, p. 588.
W. Aitken, Art. Rickets in Reynolds's Syst. of Med., 1868, vol. i, p. 768.
Hillier, Dis. of Child. (Amer. ed.), 1868, p. 92.
S. Gee, St. Barth. Hosp. Rep., vol. iv, 1868, p. 69.
Niemeyer, Pract. Med. (Amer. ed.), 1869, vol. ii, p. 507.
Jacobi, Amer. Jour. of Obstetrics, Nov. 1870, p. 435.
Parrot, Arch. de Phys., February, 1876, p. 133.
Moore, London Lancet, August 26th, 1876.

and unwholesome; or the use of indigestible, or of poor, scanty, and innutritious food at any period during early childhood, are all potent causes of rickets. So, too, many of the acute and chronic diseases of children, which impair assimilation and nutrition, as entero-colitis; and all such depressing influences as impure water, foul air, poor ventilation, small, damp, and dirty habitations, may be classed among the predisposing causes.

The marked alterations and deformities of the bones, which are so characteristic of rickets, are not developed until after a more or less marked cachectic state of system has persisted for a time, varying from a few weeks to several months.

During this initiatory stage, the most marked symptoms are connected with the digestive system. The appetite may remain good or grow capricious; and the bowels are irregular, though for the most part of the time there is diarrhœa, with stools which are at first greenish and mucous, subsequently serous, watery, of a brownish or slate color, and horribly offensive. If this chronic intestinal catarrh be but slightly marked, the child may retain a good deal of its fat, though frequently there is extreme emaciation.

The head is frequently bathed in profuse perspiration, which occurs especially during sleep, but also after any exertion, or even while the child is lying quiet. The skin of the trunk and extremities is hot and dry, and even the lightest covering seems oppressive to the little patient; so that there is a tendency to get rid of all the bed-clothing at night.

Another symptom which makes its appearance in a certain proportion of cases, but not so constantly as the digestive disturbances, local sweatings, and restlessness at night, is general soreness and tenderness of the body, with pain on movement: when this is marked, the child dreads to be moved or even touched, cries if its limbs be pressed firmly, and will lie almost motionless for hours. According to Parry (*loc. cit.*), this symptom is associated with the commencing bone changes, so that it properly belongs to the early part of the second stage.

If the disease begins before the completion of primary dentition, the development of the teeth is always impeded, and they are not only cut late, but either decay or fall very early from their sockets. The urine does not present any constant alteration, but in a certain proportion of cases the amount is increased, and there is an excess of the phosphatic salts, while in other instances excess of some free acid, said to be usually lactic, has been detected. The mental condition in rickets has been variously described; some authors regarding the intelligence as precocious, owing probably to the isolation of the patient from other children, and his constant association with his elders; while others assert that there is an actual deficiency in intellectual capacity and power. At a somewhat later period of the disease, the child acquires a peculiar staid and sedate aspect, which, when associated with the unusual breadth and squareness of the face, imparts a strange expression of age.

According to Roger and Rilliet, a blowing murmur may frequently be heard over the anterior fontanelle in this disease, synchronous with the arterial pulse. As, however, this murmur is to be heard in other

conditions, and is often absent in cases of rickets, it cannot be considered as a sign of any positive value. The causes which appear to intensify it, are the anæmic state of the blood and the patency of the anterior fontanelle; yet Hillier states that he has found it present in thirteen, and absent in twenty-nine rickety children whose fontanelles were open.

The phenomena above described, when present in the same case, may certainly be regarded as positively indicative of the existence of this initiatory stage of rickets, but they are by no means invariably all present, so that it is often impossible to determine the approach of the next stage in which the characteristic lesions and deformities of the bones make their appearance.

They are not, moreover, limited to the stage of invasion, but continue, with more or less severity, for a varying time after the bone-changes have begun. The length of this stage of invasion is exceedingly irregular, and the earliest physical signs of bone-change may occur after it has lasted a few weeks, or may be deferred for several months after the peculiar prodromic symptoms have been marked.

Stage of Deformity.—After the initiatory stage has lasted for a varying time, bead-like swellings begin to be noticed at the line of junction of the ribs and costal cartilages, which is usually regarded as the earliest lesion of the bones, and of the epiphyses and shafts of the long bones of the upper and lower extremities, giving in these latter places, as at the ankles and wrists, a peculiar knobby double-jointed appearance. With this, there is such a degree of softening of the bones, that they yield readily to pressure.

Early in this stage the presence of craniotabes, or "soft spots" in the occipital bone, may often be detected. Indeed, in some instances this appears to be the first recognizable bone lesion.

If the disease reaches this stage before the child has begun to walk, there may be no deformity of the lower extremities whatever; but in cases where the little patient has already been walking about, the femora bend so that they become markedly convex forwards; the tibiæ bend in the same forward direction, while the knees may be bent inwards, thus giving to the legs a series of curvatures. The forward curvature of the femora may indeed be produced before the child walks, simply by the weight of the legs and feet, which hang pendent from the knee-joints as the child sits in its mother's lap or on a chair.

The bones of the upper extremities also share in these deformities; thus the humeri bend at the point of insertion of the deltoids, from the weight of the arms when raised by the action of these muscles; and both the humeri and the bones of the forearms become bent, from the pressure which the child makes on its open palms to assist itself in sitting up.

The clavicles are very constantly deformed, and present a double curvature; one curve being forwards and somewhat upwards, and seated just outside of the attachment of the sterno-cleido-mastoid muscle, the other being backwards, and seated about half an inch from the acromio-clavicular articulation.

By far the most important deformities, however, are those presented by the head, spine, thorax, and pelvis. The peculiarities by which the head in rickets is distinguished, are thus described by Jenner:

1st. By the length of time the anterior fontanelle remains open. In the healthy child, it closes completely before the expiration of the second year. In the rickety child, it is often widely open at that period.

2d. By thickening of the bones. This is usually most perceptible just outside the sutures, the situation of the sutures being indicated by deep furrows.

3d. By the relative length of the antero-posterior diameter of the head.

4th. By the height, squareness, and projection of the forehead. The first two of these peculiarities of the rickety head are the result of the affection of the bones; the last two are due chiefly to disease of the cerebrum.

Besides this thickening of the edges of the cranial bones, there are spots, irregularly distributed, where the bones are so thinned and softened that they yield to the pressure of the fingers; and, indeed, in some cases the thinning is so extreme that the pericranium and dura mater come in contact. These "soft spots," which constitute the condition known as craniotabes, were first observed by Elsässer (*loc. cit.*).

The nature and mode of their production has been a matter of much discussion. By some authorities their rachitic nature has been denied, but there seems to us no valid reason for doubting their essential connection with the rachitic alterations of the bones. They are usually limited to the occipital region, but may rarely be present over the other cranial bones. They are never observable save in those parts of the bones which are developed from membrane. At first, the spots affected are the seat merely of softening, with perhaps some thickening; then thinning of the bone occurs, and subsequently the entire thickness of the occipital bone is often removed, causing perforations. These vary in number from one or two to as many as twenty-five or thirty. In order to detect them, the skull should be carefully examined by fixing the head between the hands, and then pressing carefully over the upper part of the occipital region and the posterior portions of the parietal bones. The diseased spots are felt to be soft and easily depressed, and "impart the sensation of an orifice in the bone, closed by parchment." It is necessary to use much caution and gentleness in making this examination, since any undue pressure may produce severe nervous symptoms, even convulsions, according to Niemeyer. It is difficult to account for the production of these spots, but the most probable explanation is that they are dependent upon the prolonged pressure upon the softened bone, caused by the head resting on the pillow on one side, and by the counter-pressure of the brain on the skull on the other.

The curvature of the spine varies according as the child is able or unable to walk. In the latter case, there is a posterior curvature of the spine, beginning at the first dorsal, and extending to the last lumbar vertebræ; while if the child is able to walk, this posterior curvature is limited to the dorsal region, but is combined with an anterior curvature in the lumbar region. The cervical anterior curve is increased, and consequently the face

is directed upwards, and the head falls backwards, and being unsupported, owing to the muscular debility, sways loosely from side to side. Jenner points out that these curvatures may readily be distinguished from angular curvature, by the fact that the weight of the legs will usually remove them if the child be held by the upper part of the trunk, especially if the physician at the same time raises the lower limbs with one hand, and places the other on the curved spine.

The thorax is subject to deformities, which in a practical sense exceed all others in importance, owing to the serious interference which they occasion with the action of the heart and lungs.

In the first place, owing to the curvature of the spine, the ribs are flattened laterally, and run forwards more horizontally, so that the lateral diameter of the chest is greatly diminished, while the sternum is carried forwards, and thus the antero-posterior diameter of the thorax is increased. In addition, there is a marked groove on either side of the sternum, extending from the first to the ninth or tenth ribs, along the line of junction of the ribs with their cartilages. These grooves are produced by the bending of the ribs where the dorsal and lateral portions unite; from which point they pass forwards and inwards to unite with their cartilages, which curve outwards before uniting with the sternum.

The curvatures and deformities which have been described before this are chiefly due to the action of muscles or the weight of dependent parts; but the production of the last-described deformities of the thorax is attributed by Jenner chiefly to the atmospheric pressure, which, during inspiration, causes recession of the most yielding part of the thoracic walls, *i. e.*, the softened ribs at the line of junction with their cartilages. In consequence of the support which the liver, heart, and spleen furnish to the ribs corresponding to their position, the groove extends further down on the left than on the right side, but is deeper over the fifth and sixth ribs on the right than on the left side.

The pelvis is frequently affected in rickets, and the deformities which result, on account of the great interference they cause in childbirth in the female, rank next in importance to those of the thorax. The rickety pelvis is characterized by a shortening of the antero-posterior diameter, so that the upper strait assumes an oval form, or is at times heart-shaped. In extreme instances the sides also approximate, and give to the pelvis a triangular shape. It is evident that the form will be influenced by a number of conditions; as the stage of ossification, and the direction in which the pelvis is compressed by the spine from above, and the thigh-bones from below.

Partly in consequence of the diminished capacity of the thorax and pelvis, partly in consequence of the weakness of the abdominal muscles, the flatulent distension of the intestines, and the enlargement of the liver and spleen which are frequently present, the abdomen is unusually prominent in rickety children.

During the development of the alterations in the bones, the general symptoms before described persist; the digestion is enfeebled, and the stools liquid and fetid; the emaciation and debility increase; the respiration is

more or less embarrassed by the deformities of the thorax; the pulse is quick, small, and irritable; the skin hot, excepting on the head and neck, where it is still frequently bathed in sweat; and the general tenderness of the body is aggravated.

In cases where the disease approaches a favorable termination, the earliest signs of improvement consist in a decrease in the emaciation, debility, and suffering; the stools become more healthy, and the febrile symptoms, if any have been present, disappear.

During this stage of early convalescence, when the children attempt to leave the bed and walk about, holding on to the chairs, there is great danger of increased curvature and even of partial fractures of the bones of the lower extremities.

When, on the other hand, death occurs during the course of rickets, it is rarely from the intensity of the cachexia (which explains the apparent anomaly of so fatal a disease being scarcely represented in the mortality returns), but from the supervention of some secondary disease. Among these, the following are enumerated by Jenner as the most frequent causes of death:

1. Catarrh and bronchitis, which are rendered far more dangerous from the mechanical interference with respiration caused by the deformed thorax.

2. Albumimoid (?) infiltration of various organs, especially of the liver, spleen, and lymphatic glands. As will be seen by the remarks in the section on morbid anatomy, recent researches make it probable that the enlargement of these organs in rickets differs from ordinary albuminoid change. This peculiar form of degeneration is not unfrequently developed during the course of rickets; it manifests itself by increased emaciation, extreme pallor, occasional œdema and albuminuria, and enlargement of the affected organs.

3. Laryngismus stridulus, which, according to Jenner, is essentially connected rather with the nervous irritability due to rickets, than with the tardy and difficult dentition which is itself but another expression of the constitutional disease.

4. Chronic hydrocephalus.

5. Convulsions, depending like the laryngismus stridulus, upon the heightened irritability of the nervous system.

6. Persistent and severe diarrhœa, which is probably due in many cases to albuminoid degeneration of the intestinal mucous membrane.

Duration; Prognosis.—The duration of rickets varies so greatly, that the disease may be said to present an acute and chronic form.

When the diathesis is marked, the hygienic conditions of the child very unfavorable, and the disease makes its appearance at an early age, its course is often very rapid, and death usually follows. When, on the other hand, the disease does not begin till late in the second or third year, and when the surroundings of the child are more favorable, recovery usually occurs, although the disease may last for several years.

An unfavorable prognosis may be made, then, when the disease begins in very early infancy; when it is attended with marked constitutional dis-

turbances; when the deformities of the head and thorax are rapidly and extremely developed; when any of the secondary morbid conditions above enumerated have supervened. When, on the other hand, the reverse of these conditions obtains, recovery may be expected, though often only after prolonged illness.

Diagnosis.—It is only during the initiatory stage of rickets, that the true nature of the attack is likely to be mistaken. But during this period the disease may be confounded either with chronic entero-colitis, or with tuberculosis of the peritoneum and intestinal canal. Careful attention to the peculiar symptoms of rickets, especially the sweating of the head, the general soreness and tenderness of the body, and the retardation of dentition, will, however, lead to a correct diagnosis, even before the swelling of the sternal ends of the ribs and of the epiphysial lines of the long bones, and the projection of the sternum, remove all doubt as to the nature of the case.

Morbid Anatomy.—The essential lesions in rickets consist of the changes in the bones, though there are also certain lesions of the viscera which are frequently met with.

The long bones affected by rickets, in addition to the deformities already described, are clumsy, and present marked swellings at the line of their junction with the epiphyses. This enlargement is due to excessive development of the spongy tissue in the extremity of the bone and the epiphysis, and to marked proliferation of the epiphysial cartilage. The fact that the epiphyses widen instead of elongating, is due to the pressure of the superimposed parts upon the soft proliferating layers, causing them to bulge laterally.

The deposition of calcareous granular particles at the line of ossification is also wanting, and the cartilage-cells calcify before the matrix begins to ossify, and are converted into bone-cells.

There is thus excessive formation of the structures which precede or form the nidus for ossification, while there is at the same time retardation or incomplete performance of that process.

At the same time, the diaphyses present rarefaction of their tissue, not owing to undue softening and removal of old bone, but simply to the fact that, while the old layers of bone are consumed by the normally progressive formation of medullary cavities, the new layers which are produced are soft and do not ossify.

The medullary space may reach the line of ossification, or even project beyond it into the proliferating epiphysial cartilage.

The periosteum of rickety bones is usually thickened and highly vascular.

The bones themselves become so soft that they may be bent in any direction, or even cut with a knife without difficulty.

Upon section the spongy tissue and the enlarged areolæ are found filled with a crimson pulp, containing blood-globules, a large amount of free fat in some cases, and very many round, faintly granular cells, with one or two nuclei. According to Hillier and Parry the reaction of rachitic bones is alkaline or neutral.

The softening of the bones is fully accounted for by the diminution in the proportion of their calcareous salts. Thus Jenner states as the mean of the analyses of several observers, that the bones of healthy children yield about thirty-seven parts of organic and sixty-three of inorganic matters; whereas those of rickety children yield about seventy-nine parts of organic to twenty-one parts of inorganic matters. In addition to this, it would appear that the organic matters themselves undergo change, since it has been found by several experimenters that the bones in advanced rickets yield neither chondrin nor gelatin on boiling.

The thickening of the flat bones is caused by the formation of new osseous layers from the thickened and vascular periosteum, which are especially formed at or near the growing margins of the bones, thus accounting for the thickened ridges near the sutures of the cranial bones.

The thickening of the bones of the skull may reach a very high degree; a thickness of $\frac{1}{8}''$ having been quite frequently observed. There are also frequently found on the skull evidences of craniotabes in the form of round or oval perforations of the bone, which have been observable during life as "soft spots." These perforations are most constant and frequent in the occipital bone, and are also found in the parietal bones, or wherever the skull has been subjected to pressure. They are surrounded by thickened bone, and are produced by the wasting and resorption, under the influence of pressure, of the young and unossified layers of subperiosteal formation, while the absorption of the inner vitreous table which keeps pace with the growth of the brain, proceeds at its usual rate. In number they vary from one to twenty or thirty.

In addition to these changes in the bones, which are the constant and essential lesions in rickets, there are certain lesions of the viscera frequently met with, which depend partly upon the deformities of the skeleton and partly upon the general cachexia. Thus in consequence of the peculiar deformity of the thorax, the anterior borders of the lungs become highly emphysematous, while the band of lung-tissue corresponding to the deep groove at the sternal end of the ribs is compressed and collapsed.

This peculiar and constantly present strip of collapsed lung, is due to the recession of the corresponding part of the ribs during inspiration; but frequently there is also found extensive collapse of the postero-inferior parts of the lungs from the ordinary causes, bronchitis and impeded respiration. Jenner has also called attention to the frequent presence in rickets of white spots upon the pericardium, near the apex of the heart. These spots thus correspond to the depressed part of the fifth left rib, and are in all probability due to the friction of the heart against this hard knuckle of bone.

We have before alluded to the enlargement of the liver and spleen which appears in some severe cases of rickets. This was formerly regarded as due to albuminoid degeneration, but recent study of such organs has made it probable that the alteration is a peculiar and specific one.

The differences between this change, and albuminoid (amyloid, of Vir-

chow) degeneration were first pointed out by Jenner,[1] who showed that in the rickety enlargement, the organs present no reaction with iodine, and that in the spleen there is an absence of the peculiar sago-like transformation of the Malpighian corpuscles. Dr. W. H. Dickinson has more recently examined this subject with care, and has confirmed the view that the change in rickets differs both from albuminoid degeneration and from the peculiar enlargement of the spleen and lymphatic glands known as Hodgkin's disease. The *liver* in rickets undergoes an increase of size evenly throughout its whole bulk: it becomes pale, containing little blood, and is less friable than in health, hard, dense, and elastic. The acini are yellowish and are surrounded by a pinkish or grayish line, due to increase of the interlobular connective tissue. There is not, however, any bacony translucency as in albuminoid degeneration. The spleen is even more markedly enlarged than the liver, so that its weight may increase from one ounce to half a pound. The organ presents a resilient hardness which in extreme cases was compared by Bright to the consistence of a half-ripe apple. The color is generally a deep-red or purple, besprinkled with smooth white spots, which are enlarged Malpighian corpuscles. The trabeculæ are much thickened, and there may be also morbid hyperplasia of the cellular contents of the meshes, the corpuscles being much crowded together. The above change is described by Dickinson, as due not to the presence of any formation foreign to the structure of these organs, but to an irregularity of growth which alters the natural proportions of their tissues. The epithelial and corpuscular element is generally increased, while in the liver the capsule of Glisson, and in the spleen the trabecular tissue, is abnormally developed. There would appear also to be a deficiency of earthy salts in these organs.

In cases where death is directly due to any secondary disease, as bronchitis, intestinal catarrh, or chronic hydrocephalus, there will of course be found, in addition, the lesions common to such affections.

Pathology.—The description which has been given of the symptoms of rickets, clearly establishes the fact that it is a constitutional disease, in the same sense that scrofula and tuberculosis are; and we are consequently to regard the lesions of the bones as merely a local manifestation of the general cachexia. We are unable, however, to advance beyond this point, since we are ignorant, not only of the essential nature of the vice of nutrition, but equally so of the specific cause of the changes in the bones.

The result of chemical analysis has led to the theory that the disease essentially consists in a deficiency of the calcareous salts of the bones; and the attempt has been made to explain this deficiency by supposing an excess of lactic acid in the primæ viæ and blood, which holds the calcareous salts in solution, and prevents them from being deposited in the bones. Apart from the purely hypothetical nature of this supposition, and its entire inadequacy to explain many of the most serious symptoms of rickets, it is to be borne in mind that the excess of free

[1] Medico-Chir. Trans., vol. lii, 1869, p. 359.

acid in the urine is far from being constant, and that the changes in the bones are characterized not merely by a deficient deposit of the calcareous salts, but by their abnormal position, and by all the evidences of an active vital process.

Again the marked vascularity of the bone and periosteum, the rapid proliferation of cells, and the pain and constitutional irritation which attend the disease, have induced others to regard the process as an inflammatory one. But this view is controverted as well by the etiology and clinical history of the disease as by its constant anatomical results.

We can only assume that, in consequence either of a special predisposition on the part of the tissues themselves, or of an abnormal quantity of some stimulus which normally excites the cartilage-cells to undergo division, and the periosteum to form new layers of tissue opposed to the surface of the bone, there is a morbid activity of these processes resulting in an excessive production of preparatory or intermediate structures which can only become ossified in an imperfect, irregular, and slow manner. The pathological process is thus seen to consist, for the most part, in a morbid acceleration of the changes which precede the normal formation and growth of bone.

Treatment.—In cases where there is reason to anticipate the development of rickets, as where the previous children of the mother have become rickety, the utmost attention must be paid to the feeding and hygiene of the young infant. If careful examination of the mother's milk proves that it is unsuitable in quality, a wet-nurse should be immediately provided, or if that be unattainable, the child should be fed upon carefully selected cow's milk, or upon one of the substitutes for human milk described in the article on thrush.

So too, after the disease has made its appearance, the most appropriate, nutritious, and digestible diet must be selected, care being taken that it shall contain a large proportion of animal food.

The teeth of rickety children are so defective that, when they begin to take solid food, it is highly necessary to insure its complete mastication, and in cases where the condition of the teeth renders this impossible, the meat should be chopped finely and bruised in a mortar.

The child should be suitably and warmly dressed, and be taken freely into the sunlight and open air. The use of salt-water baths, followed by active friction of the skin, is also to be recommended.

During the early stage, when there is marked constitutional irritation and pain, the remedies used to relieve these symptoms should be alkaline mixtures, such as the effervescing draught or neutral mixture, or magnesia (Copland), conjoined with sedatives and tonics. Under no circumstances should any depressing plan of treatment be adopted.

If the digestion be much impaired and diarrhœa is present, the use of vegetable tonics, or wine of iron, with mild astringents and antacids, is indicated.

The remedy, however, from which most benefit is usually derived is cod-liver oil, and it should consequently be given, in conjunction with iron and vegetable tonics, and a small amount of some generous wine, so soon

as the nature of the attack is recognized and persevered with for months, or until the disease is overcome.

The efficacy of cod-liver oil in the treatment of this disease is, indeed, so remarkable that all other remedies formerly used have been supplanted by it. Vogel asserts (*op. cit.*, p. 534) that "rachitis may be cured by the use of cod-liver oil alone, even if the circumstances are in other respects unfavorable." Rickety children usually tolerate the oil well, and even become so fond of it that they will willingly take large doses. In some cases, however, it disagrees with the stomach and is obstinately refused by the children; and when this happens, so important is the introduction of the oil into the system, that we should recommend its use by inunction. It very rarely happens, however, that the difficulty in its administration cannot be overcome by having the oil prepared in the form of an emulsion, either according to the formula recommended on page 363, or in combination with the lacto-phosphate of lime.

There can be no doubt that when rickets is recognized in its early stages, and a suitable medicinal and hygienic treatment promptly instituted, it is usually curable in a comparatively short time. When, however, the diathesis is strong and the case overlooked until softening of the bones has occurred, and deformities begin to appear, the treatment must be persisted in for many months or even years. In such cases, unfortunately, there is only too great probability of the deformities increasing and becoming permanent, even if death does not ensue from some intercurrent or superinduced disease.

In order to guard against deformities, the little patient should lie upon a firm, smooth mattress, and high pillows should be forbidden. Niemeyer recommends that small children should be carried out in a basket; while larger ones should be drawn about in a carriage provided with a mattress. Sitting up for any length of time, or attempts at walking, should be prohibited until the bones have grown firm and inflexible.

It is not advisable, especially during the earlier stages of the disease, to employ any mechanical contrivances to prevent or relieve deformities. During convalescence, however, attempts may be made to control the deformities by means of leather or pasteboard splints.

In the treatment of any intercurrent affections it must be remembered that we have to do with a condition of malnutrition and enfeebled vitality, so that all remedies of a depressing character must be scrupulously avoided.

ARTICLE IV.

CONGENITAL SYPHILIS.

Infantile syphilis may be either inherited or acquired subsequent to birth. As, however, the characters of the latter form do not differ materially from those of acquired syphilis in the adult, we shall limit our description to hereditary syphilis.

Careful clinical observation appears to have clearly demonstrated the following facts with regard to the transmission of syphilis, in addition to the direct contagiousness of both the primary and secondary manifestations:

That the embryo in utero may be infected, if either of the parents have constitutional syphilis at the period of conception, no matter whether the disease be latent, or if secondary or tertiary symptoms are present. That if both parents are syphilitic the child will more surely suffer from the disease, and in a more severe form. That if the mother, though healthy at the time of conception, contract syphilis during the first six or seven months of pregnancy, the child will probably be infected. That when the mother infects the embryo, the disease is probably more severe than when the father alone is syphilitic, and thus such embryos usually perish, and are prematurely cast off by abortion, so that the great majority of children with congenital syphilis have inherited it from their father. While the last statement is almost universally admitted, there are some authors, as Hutchinson,[1] who do not admit the greater severity of the disease when the mother is the source of contagion. Finally, that a syphilitic father may infect the ovum without contaminating the mother's system, though the mother may subsequently herself be infected by the embryo.

In very many cases, though unfortunately not in all, the infected embryo perishes, and abortion follows. When, however, such infants are born living, they usually present no trace of syphilitic disease at birth, but may appear well-nourished and healthy. Occasionally, however, children have been observed who presented, at the time of birth, copper-colored blotches upon the skin, condylomata, or mucous patches.

In the majority of cases the first symptoms of the disease appear between the fifteenth and thirtieth days after birth, though in many instances also during the second month. Thus of 158 cases collected from various sources by Diday,[2] the disease showed itself—

During 1st month in	86
" 2d "	45
" 3d "	15
At 4th month in	7
" 5th "	1
" 6th "	1
" 8th "	1
" 1 year,	1
" 2 years,	1

So that 131 children out of 158 presented evident symptoms of syphilis before the end of the second month.

Among the earliest evidences of the disease are the signs of failing nutrition. The infant, who has grown well, and has been plump and apparently vigorous for a few weeks, begins to emaciate, the features become

[1] Art. Constitutional Syphilis, in Reynolds's Syst. of Med., vol. i, pp. 297 and 315.

[2] Infantile Syphilis (Syd Soc.), 1859.

pinched, the skin assumes a dry, sallow, shrivelled appearance, and presents patches of yellowish-brown discoloration, especially on the prominent parts of the face; the voice becomes feeble, whimpering, and plaintive, and the infant soon acquires a remarkable expression of premature old age.

The appearance of the skin has been most minutely described by Trousseau,[1] West,[2] Diday, and others, and is in a high degree characteristic of the disease.

In addition, however, to these general symptoms of malnutrition, there soon appear the signs of constitutional syphilis, familiarly met with in the adult, as well as some which are peculiar to the disease in infancy.

The symptoms now to be described belong partly to the secondary and partly to the tertiary stage, for it is a peculiarity of infantile syphilis that the evolution of the symptoms does not follow so orderly a course as in syphilis of the adult. The symptoms most frequently met with are certain affections of the skin and mucous membranes. Among the cutaneous eruptions, pemphigus is one of the most charcteristic. It is also the first eruption to appear, not rarely being present at birth, and never, according to Niemeyer,[3] commencing later than the end of the first week of life.

It usually appears first on the palms of the hands and soles of the feet, and may afterwards spread to various parts of the surface. It begins as small round spots, of reddish color, which becomes converted in a day or two into bullæ, filled with turbid fluid. These burst, leaving irritable excoriations, and are succeeded by fresh crops of similar vesicles. The early appearance of pemphigus is of most fatal import; though in some cases recovery gradually occurs in the course of a few weeks. The other forms of eruption usually occur after the general symptoms of malnutrition, above described, have appeared. At times the eruption consists of sharply defined patches of roseola or erythema of small size, of coppery or yellowish-red color, not disappearing upon pressure, and occurring usually upon the abdomen, the inner surface of the thighs, or the lower part of the thorax.

In other cases, the eruption assumes a papulated form, the papules being quite prominent, and usually presenting a superficial desquamation. A form of acne, attended with the appearance of indurated pustules which leave little depressed cicatrices, is not unfrequently met with; and so, also, vesicular and pustular eruptions occur in a good many cases. The most frequent of these eruptions is unquestionably the maculated form; while dry, scaly eruptions in particular are quite rare in infantile syphilis. In most cases the specific character of the eruption is manifested by the peculiar coppery color of the macula, or of the inflamed base of the papule, vesicle, or pustule. In other instances the specific character of the eruption must be inferred from the coexistence of other manifestations of constitutional syphilis.

The most frequent of these, next to the cutaneous eruptions, are the

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[1] Clin. Méd., 2ème ed , 1865, t. iii, p. 291.

[2] Dis. of Children (4th Am. ed.), 1866, p. 577.

[3] Textbook of Pract. Med. (Am. trans.), 1869, vol. ii, p. 706.

affections of the mucous membranes. Thus, coryza, of a serious and most obstinate form, is one of the most constant symptoms met with, and presents here all the characters fully described in our article upon that subject. The nasal mucous membrane is so much swollen that breathing and nursing are seriously interfered with. There is a profuse discharge from the nostrils, either of a thin, irritating fluid, which flows over the lip and excoriates it, or of a thicker pus, which tends to concrete and form thick, discolored crusts. The obstruction to respiration, and the accumulation of secretion in the nasal cavities, gives rise to a peculiar snorting or snuffing quite characteristic of the disease.

There is apt to be, at the same time, a superficial diffuse inflammation of the mucous membrane of the mouth and throat, which may extend into the larynx, causing, in conjunction with the coryza, great alteration in the cry or voice, which is hoarse, and has been under such conditions compared by West to the sound of a child's penny trumpet.

Despite the severity and obstinacy of the coryza, there comparatively rarely occurs any ulceration of the mucous membrane, or necrosis of the nasal bones, or of the hard palate. In a few cases, however, we have observed depression of the bridge of the nose in consequence of the destruction of the nasal bones and perforations of the septum between the nostrils or of the hard palate, and West records a case in which there was necrosis of the hard palate in a young infant.

Another very frequent symptom is the formation of rhagades or fissures at the junction of the mucous membranes and skin, as on the lips, and at the verge of the anus. These rhagades bleed upon any stretching of the parts, and by their laceration so much pain is caused that, when the mouth is affected, the child dreads to smile, talk, or suckle; and when they are seated on the anus, defecation is attended with extreme suffering. Occasionally rhagades form in the skin in the flexures of the joints, and especially in those of the fingers and toes.

Condylomata are also frequently present, and, like the rhagades, are most frequent at the orifice of the anus and mouth, though they may also form elsewhere upon the skin, as upon the vulva, between the scrotum and thighs, in the axillæ, and behind the ears.

In consequence, probably, of the softening and ulceration of these growths, large, sinuous, irregular ulcers may form in such positions, extending for some distance into the surrounding skin.

In a few cases, iritis occurs; and so too the deeper seated tissues of the globe, as the vitreous humor, retina, or choroid, may become inflamed.

Death very frequently ensues before the end of the first year, either in consequence of the severity of the coryza and the inability to nourish the little patient, or in consequence of the profound cachexia and anæmia, or the development of some of the visceral lesions, to be hereafter described. When, however, owing to judicious treatment, or the comparatively slight development of the early symptoms, the child survives, the disease frequently subsides about the end of the first year; but often, after remaining latent for a variable time, reappears in the form of tertiary symptoms. According to Hutchinson, this tertiary epoch may begin at any period

after the fifth year, but is commonly delayed till at or near the period of puberty. In addition to the traces which may remain of the earlier symptoms, such as little pits and scars upon the skin, alterations in the form of the nose from long-standing nasal obstruction, or actual disease of the nasal bones, there are several very characteristic symptoms amongst the later manifestations.

Among these is a peculiar alteration of the permanent incisor teeth, first described by Mr. Jonathan Hutchinson. Although we are not altogether disposed to attach the overpowering weight which Mr. Hutchinson does to the evidence furnished by this alteration of the teeth, of the existence of inherited syphilis, there is no doubt that it is an important sign, and we, therefore, quote in full his description of it (*loc. cit.*, p. 317):

"In these patients (those suffering with inherited syphilis), it is very common to find all the incisor teeth dwarfed and malformed. Sometimes the canines are affected also. These teeth are narrow and rounded, and peg-like; their edges are jagged and notched. Owing to their smallness, their sides do not touch, and interspaces are left. It is, however, the upper central incisors which are the most reliable for purposes of diagnosis. When the other teeth are affected these very rarely escape, and very often they are malformed when all the others are of fairly good shape. The characteristic malformation of the upper central incisors consists in a dwarfing of the tooth, which is usually both narrow and short, and in the atrophy of its middle lobe. This atrophy leaves a single broad notch (vertical) in the edge of the tooth, and sometimes from this notch a shallow furrow passes upwards on both the anterior and posterior surface nearly to the gum. This notching is usually symmetrical. It may vary much in degree in different cases; sometimes the teeth diverge, and at others they slant towards each other. In a few rare cases, only one of the upper central incisors is malformed, the other being of natural shape and size. It is only in the permanent set that such peculiarities are to be observed; the first set are liable to premature decay, but are not malformed."

Another valuable symptom of inherited syphilis at this stage, and one which never occurs in acquired syphilis, is a peculiar form of keratitis, or inflammation of the cornea, which has been termed *interstitial* or *syphilitic*. It also is usually symmetrical, and is attended by opacity of the corneæ from the formation of lymph in their substance. The inflammation usually subsides in a few weeks or months, leaving slight cloudy opacities here and there in the substance of the cornea.

Occasionally also there are symptoms indicative of grave visceral disease. The liver and spleen may be found enlarged and firm, and in such cases ascites is not rare. So, too, affections of the nervous system, usually limited to a single pair of cerebral nerves, as the auditory, and causing deafness, or the optic, and causing amaurosis, are met with in some instances.

Even now marked disease of the bones is rare, though nodes quite frequently form upon the long bones; and, in some few cases, the disease breaks out in the form of destructive lupus, or of serious disease of the bony tissues.

Morbid Anatomy.—The principal lesions found in the victims of inherited syphilis, are in connection with the liver and lungs; more rarely other organs, as the brain or thymus gland, present evidences of disease. The liver is at times enlarged, rounded, and indurated, apparently the result of diffuse subacute hepatitis, or of infiltration of the organ with the peculiar albuminoid substance, called "amyloid," by Virchow. It is comparatively rare in children to find gummy tumors developed in the substance of the liver, with thickening and cicatricial puckering of the capsule, as are so often met with in visceral syphilis in adult life.

In the lungs, gummy tumors of various sizes form, and usually present cheesy degeneration of their central portion; and there is at times also a form of consolidation, called by Virchow "white hepatization," which depends upon chronic catarrhal pneumonia, with infarction of the air-vesicles with epithelial cells, in a state of partial cheesy degeneration.

More rarely, gummy tumors have been found in the substance of the brain. The thymus gland is occasionally the seat of suppurative inflammation, so that, on section, abscesses may be detected in the substance of the organ. Of course in cases where periostitis, with the formation of nodes, has been present, the ordinary appearances of such lesions will be observed.

Diagnosis.—During the presence of the early symptoms, the diagnosis is usually made with ease, by observing the presence of pemphigus soon after birth; of other eruptions, with copper-colored discoloration of the skin, appearing a few weeks later; of condylomata and rhagades; and of coryza, stomatitis, and laryngitis. The general symptoms are also peculiar, especially the physiognomy and the discoloration of the skin. And we should, in addition, endeavor to confirm our suspicion by obtaining a clear history of the parents' condition at the time of conception.

During the later periods of the disease, at or after the period of puberty, the diagnosis is no less important, and far more obscure. We must now rely upon the history of the case, upon the condition of other children of the same family, upon the detection of traces of the earlier symptoms, upon the presence of the peculiar alteration of teeth described by Hutchinson, of interstitial keratitis, of nodes, or of a symmetrical affection of some of the cranial nerves.

In deciding between the inherited or acquired nature of any case, the points which will aid us are the existence of primary disease of the mother at the time of delivery (which is rare, and can rarely be discovered even if it have been present); the existence of secondary contagious symptoms on either the mother or the nurse who suckled the infant; the presence of notched incisor teeth or of interstitial keratitis, which are peculiar to the inherited form; and the symmetrical distribution of all the secondary and tertiary manifestations, which is asserted by Hutchinson to be also an attribute of inherited as distinguished from acquired syphilis.

Prognosis.—The most unfavorable conditions in inherited syphilis are, the infection of both parents; the appearance of the disease soon after birth, especially in the form of pemphigus; and the occurrence of rapid and extreme emaciation. On the other hand, if the father alone has sec-

ondary symptoms, and those of a mild character; if the disease do not make its appearance till the third or fourth week; if the general nutrition is not greatly impaired, and if proper treatment can be immediately instituted, the prognosis is favorable, at least as regards preservation of life.

TREATMENT.—If the previous children of a mother have proved syphilitic, it is well to subject her to a mild mercurial course during her pregnancy.

In the treatment of the infant, every care must be paid to supporting its strength by the most nutritious diet, if it is unable to suckle the mother. It is, however, improper to employ a wet-nurse, on account of the danger of her being infected by the child.

In regard to medicinal treatment, the use of mercury is universally recommended during the presence of marked symptoms. The mercurial may be given either in the form of hydrarg. cum creta; calomel; or bichloride of mercury, in solution in some aromatic water, or in syr. sarsæ. comp.; or, finally, it may be introduced into the system in the form of mercurial ointment by inunction. The most convenient mode of introducing it in the latter form is by smearing a flannel roller with mercurial ointment, and binding it around the child, whose movements cause its speedy absorption.

The dose of the mercurial should be small, and it is to be continued steadily, though with caution so as to avoid producing salivation, until a decided improvement in the symptoms manifests itself. During its administration it will frequently have to be temporarily discontinued, on account of gastro-intestinal irritation.

So soon as the mercury is stopped, we should order the iodide of potassium or iodide of iron, either one or both together being employed, according to the toleration of the stomach.

We should also recommend the use of cod-liver oil, and some preparation of cinchona, from an early period in the case; and even when the child suckles, a certain amount of Liebig's cold extract of meat, or of raw beef scraped finely and given as directed at page 410, should be administered.

The best local application to the sores is black-wash, though the condylomata usually require to be touched occasionally with solid nitrate of silver.

CLASS VII.

DISEASES OF THE SKIN.

INTRODUCTORY REMARKS.

It will be observed that, in regard to some of these affections, we have altered the arrangement which was adopted in the earlier editions of this book, while retaining the same general divisions of skin diseases: rashes, papules, vesicular, pustular, and squamous affections. For although none of the new classifications recently devised, some of them based upon the anatomical element of the skin affected, others upon the nature of the pathological process present, and others still upon the clinical relations of the various diseases, appear to us completely satisfactory; still the more rigid study of skin diseases has rendered necessary the removal of a number of eruptions from the classes where they were formerly placed. We follow then the example of Wilson, who retains the original classification of Willan, modified and expanded, however, so as to harmonize with the results of more recent observations.

The class which will be found to have been most changed is that of vesicular diseases, of which eczema, a disease formerly defined to be characterized by the presence of vesicles, was the type. It was long ago evident, however, that this was not a strictly correct definition, since in many cases of eczema, other elements of eruption besides the vesicles were present. And, accordingly, the term eczema is no longer restricted to a purely vesicular eruption, but is erected into a generic title for all affections which are characterized by redness, itching, infiltration of the skin, exudation on its surface, and the formation of crusts, whether the elementary lesion be an erythematous rash, a papule, a vesicle, or a pustule. In accordance with this, as will be seen more in detail under the head of eczematous affections, this class includes many cases of some affections, as impetigo, which were formerly classed among the pustules, and of others which were included among squamous diseases.

It would be worse than useless in a work like the present, which is necessarily restricted within certain limits as to size, to attempt a full description of all the diseases of the skin to which children are subject. Such a course would compel us to devote to more important matters than the affections of the skin, a much smaller proportion of space than they require and deserve. We shall therefore select only those cutaneous diseases occurring in early life, which are most important either from their frequency,

or because they present in children some particular aspects or peculiarities, which make it necessary that they should be studied separately from the same maladies in adults. Moreover, we shall treat of each one as it comes before us with greater or less copiousness of detail, according to its respective consequence to the medical practitioner, eschewing carefully any useless detail in regard to the more unimportant kinds, but endeavoring anxiously to describe with accuracy the history, diagnosis, and treatment, of such as demand a greater degree of consideration.

CHAPTER I.

RASHES.

ARTICLE I.

ERYTHEMA.

Definition; Frequency; Forms.—Erythema is a non-contagious exanthem, characterized by a slight and superficial redness of the skin, appearing in patches of irregular form and uncertain extent. It may or may not be preceded by or attended with signs of constitutional disorder. It is quite a *frequent* affection in some of its forms.

We shall describe three *forms* of the disease, restricting ourselves, as we have already said that we should, to those which seem particularly important in infancy and childhood. These forms are *Erythema Fugax*, *Erythema Intertrigo*, and *Erythema Nodosum*.

Erythema Fugax.—This form of erythema occurs chiefly in the course of various acute internal inflammations, and especially those which occur during dentition. It may occur during high febrile reaction brought on by any cause, especially in children having an active cutaneous circulation. We have observed it several times in the local inflammations accompanied with great disturbance of the circulation, and particularly in cases of severe catarrh occurring during dentition, and in attacks of severe simple angina. In these cases it appeared in the form of a bright red rash, resembling very much a mild scarlatinous eruption. It was seated upon the upper part of the front of the thorax, and upon the outer surfaces of the arms. The red flush disappeared readily under pressure, and flashed back the moment the pressure was removed. There was no swelling whatever attending it, and the color was never so bright as that of a severe scarlatina, nor so deep as that of erysipelas or roseola. It lasted only a few hours or half a day, and then disappeared without desquamation.

The chief point of interest in regard to this form of erythema, as it has come under our notice, has been the diagnosis between it and scarlet fever.

This is to be made out only by recollecting that it has made its appearance in the course of another disease, while the child is already suffering under some kind of sickness, which is not generally the case with scarlatina; by the less scarlet tint of the eruption, its more superficial character, and more limited extent; and lastly, by its short duration.

Erythema Intertrigo.—This form of erythema was for a long time, and is still by some, known by the single name of intertrigo. It occurs on the portions of the body exposed to friction by the contact of opposite surfaces, and to irritation from the passage over, or retention upon them, of the urinary secretion or the fecal discharges. The most common seats of it are, therefore, in the folds of the skin about the neck, in the axillæ, the groins, about the anus, in the cleft of the nates, and on the inside of the thighs.

As it appears in the creases of the skin about the neck, or in the axillæ, it may be a mere red blush lasting a few days, and then disappearing; or, after presenting this appearance for a short time, the inflammation may become much more intense, and occasion an excoriated condition of the surfaces attended with the discharge of a serous or a sero-purulent fluid; or, lastly, the inflammation may run into veritable ulceration, giving rise to extensive and very painful ulcers occupying the depth of the crease, presenting abrupt and jagged edges, and discharging very considerable quantities of pus. In these latter forms of the eruption it must be regarded as a true eczema, and, indeed, this form of erythema has been by some authorities transferred to the group of eczematous affections, under the name of eczema erythematosum. In one child, two months of age, of delicate constitution, and imperfectly supplied with food, we saw the last-described form of the disease occupying at the same time the groins, the axillæ, and the folds of the neck. The attack lasted two weeks, and very nearly proved fatal from the violent suffering it caused. In another child, not quite a year old, who was teething, it presented these characters in the neck and axillæ, while in the groins it was much less severe, the latter parts being merely excoriated.

Infants attacked with severe diarrhœa, with dysentery, or entero-colitis, and especially with that form of entero-colitis which so generally accompanies thrush, are very apt to have an erythema of the nates, genital parts, and the internal surfaces of the thighs. So common, indeed, is this occurrence that M. Valleix regards erythema of these parts as an almost constant accompaniment and even precursor of thrush. For our own part we have very often met with it in cases of diarrhœa in infants, even in those of very moderate severity, but we have never seen it precede the appearance of the intestinal disorder.

This form of erythema begins as a simple redness of the skin about the anus, between the buttocks, about the genital parts, and over the inside of the upper parts of the thighs. In a mild case of diarrhœa, and in a child properly cleansed after each evacuation by stool or urine, it will go no further than this: but in a severe attack of inflammatory diarrhœa, attended with frequent acid stools, and in a case in which proper cleanliness is not attended to, the long-continued contact of the discharges and soiled

napkins will often cause the erythema to assume very distressing features. The redness extends in such instances along the legs to the feet; small papules, more or less numerous, make their appearance upon the inflamed skin; these are converted into pustules and then into ulcerations, and if the case goes on unchecked, the ulcerations become larger, run together, and present raw, deep red, and bleeding surfaces, sometimes of considerable size. Very often the ulcerations present a grayish plastic exudation upon their surfaces. When these conditions present themselves, the case has passed into an exudative form, and is properly to be regarded as an eczema papulosum or pustulosum. After cicatrization there remain, at the points where the ulcerations had existed, reddish and copper-colored spots, which do not disappear for a considerable length of time. This form of erythema rarely ceases entirely until the diarrhœa which has occasioned it has itself been cured.

Erythema Nodosum generally occurs in feeble and delicate children. We have never met with it under five years of age. It may develop itself upon different parts of the body, but occurs in by far the greater part of the cases on the fore part of the legs, or over the anterior edge of the tibia. We have only twice seen it elsewhere, and then it was situated upon the outer surfaces of the arms and forearms. It is preceded usually for several days by general indisposition, by lassitude, thirst, loss of appetite, and some feverishness. It appears in the form of red spots of an oval shape, somewhat elevated in the centre, and which increase gradually in size. After a short time these patches become decidedly elevated above the surrounding surface, and in passing the hand over them they give the sensation of nodosities. They increase gradually in size, so as to measure from a few lines to an inch or an inch and a half long, by half an inch or an inch broad, when they present the appearance of reddish tumors, somewhat painful to the touch, and having an obscure feeling of fluctuation, as though about to suppurate. This, however, they never do, but after a short time they diminish in size, their red color changes into a bluish or livid tint, they soften, and finally disappear entirely in about twelve or fifteen days. We have met with five well-marked cases of this disease. Three occurred in girls between six and twelve years of age, and two in boys of the same age. They all appeared to depend on derangement of the digestive function, attended with a somewhat impoverished state of the blood, and general debility.

Diagnosis.—The only disorders with which erythema could be confounded are erysipelas, roseola, or scarlatina, and this could happen only in regard to the erythema fugax. From erysipelas it may be distinguished by the superficial character of the eruption, the absence of swelling and of smarting and burning pain, and by the slighter severity and much shorter duration of the symptoms in erythema. Another important feature is the peculiar, abrupt, well-defined, and slightly elevated margin which marks the edge of the erysipelatous rash, and which does not exist with the same distinctness in erythema. Lastly, the singular regularity observed by erysipelas in its gradual extension from place to place, is altogether unlike the march of erythema, which shows itself suddenly, or in a few hours,

over large surfaces, and, after lasting some hours or a few days, quickly disappears.

In roseola the peculiar deep rose-tint of the rash will serve to distinguish between it and the lighter red tint of erythema.

The mild character of the general symptoms, and the absence of throat affection in erythema, will prevent any one who is careful from mistaking the disease for scarlatina.

Erythema intertrigo cannot be mistaken for any other disease, and if the course and peculiar local characters of erythema nodosum be borne in mind, it also may be easily recognized. The only thing with which the latter might be confounded is phlegmonous erysipelas, but if the mild character of the general symptoms in erythema nodosum, the distinctly circumscribed form of the tumors, and the fact that the disease never terminates by suppuration, are recollected, there need be no difficulty in making the diagnosis.

Prognosis.—Erythema is a very mild disorder in a large majority of the cases. The only conditions under which it proves serious are when the intertrigo attacks children laboring under chronic entero-colitis, or those affected with severe thrush connected with gastro-intestinal inflammation, when it cannot fail to increase the sufferings and danger of the patient; or, when it implicates, as we have seen it do in two instances, extensive portions of the cutaneous surface, involving the folds of the neck, armpits, groins, and genital organs, and this, too, without any other signs of disorder of the digestive apparatus than those showing functional derangement. In one of these cases the extent and depth of the ulcerations were so great, and the resulting suffering and constitutional distress so severe, as to have very nearly destroyed the life of the infant, who was but two months old at the time of the attack.

Erythema nodosum would almost certainly excite some uneasiness in the mind of a practitioner unacquainted with its real nature and probable course, and not only so, but it would prove tedious and difficult of cure, unless treated in the proper way. When managed correctly, however, it almost always gets well without any difficulty.

Treatment.—Erythema fugax requires no special treatment. The disorder which has occasioned it is the point to which our attention must be turned, and not the eruption, which is a mere consequence.

Ordinary, mild cases of intertrigo require no other measures than attention to strict cleanliness. The irritated parts must be carefully washed two or three times a day, and if the nates, genital parts, and thighs are concerned, the washing must be repeated after each evacuation of urine or stool. After this the parts should be dusted with fine starch, with the powder of chalk or lycopodium, or with calomel, which, in our hands, has answered best of all, or else be well anointed with some mild ointment, the best of which is, in our opinion, Goulard's cerate. The washing ought to be performed with a fine soft sponge and warm water. The sponge is far better than the cloth generally employed, because, with the former, the cleansing can be effected by pressure, whilst with the latter it is necessary

to use a kind of wiping or rubbing process, which cannot fail to irritate the inflamed and tender surfaces.

When the surfaces have become excoriated or ulcerated, attention to cleanliness is as important as ever. The application of the drying powders generally employed by the public becomes, under these circumstances, insufficient, and often rather injurious, except, indeed, in cases in which the excoriation is very slight; here the lycopodium powder, or very fine starch or magnesia will sometimes answer a good purpose. When the excoriation is severe, and when ulceration is present, we have never obtained any good effects from powdering; on the contrary, it has often proved injurious, and is at least troublesome and annoying from the incrusting of the powder about the ulcer. We prefer, therefore, very greatly, when ulceration is present, to dress the part with simple cerate, Goulard's cerate, Turner's cerate, or with ointment of oxide of zinc. The ointment should be applied on a fine rag greased on one side, the rag being doubled and interposed in such a way between the opposite surfaces of inflammation as to be accurately applied to the whole extent of the disease, and thus prevent all friction or even contact of the opposite sides. These compresses ought to be changed three or four times a day, and all the discharges gently but carefully washed off by *pressure* with the sponge between each change of dressing.

Whilst this topical treatment is being carried out, constant attention must be paid to the state of the digestive function. It is scarcely necessary to apply this remark to cases occurring in the course of thrush or entero-colitis; but there is another class of cases that we have met with, in which, though the intertrigo is severe and obstinate, lasting as much as two, three, or four weeks, the signs of gastro-intestinal disorder are so slight as to pass unnoticed unless carefully inquired into. Thus they may consist merely in the fact that a child has a few more stools per day than usual, or that the stools are more liquid than they should be, or that they exhibit marks of derangement of the digestive process by the appearance in them of imperfectly digested curd of milk, or by their green color and sour smell. Whatever be the character of the derangement of this function, as shown by the general appearance of the child, its appetite, degree of thirst, or the appearances presented by the stools, we should always endeavor to rectify the disorder, and if the attempt prove successful, we shall often see the intertrigo vanish at once, while before it had resisted all the means employed for its cure.

Erythema nodosum occurs generally, as already stated, in feeble children, and is usually accompanied with constipation or unhealthy stools, and slight febrile reaction. The proper treatment is a laxative at the beginning of the attack, and again in the course of the disorder, if necessary; rest in bed, or on a sofa, which is very important; and, after the operation of the laxative, the administration of tonics, and the use of a light but strengthening diet. The best tonic, as a general rule, is quinia. If this is not liked, or if there be anything in the case to contraindicate its employment, we may substitute the compound tincture of bark, in the dose of fifteen or twenty drops, three times a day. If the child is pale

and anæmic, iron is the proper remedy. It should be given in connection with the tincture of bark, or with small doses of brandy, when the appetite is poor, and the strength and spirits of the child much below their natural level.

Topical remedies are not necessary as a general rule. When, however, the local symptoms are severe, or there is much heat or pain in the tumors, they should be kept covered with compresses moistened with some kind of mucilage, or with lead-water and laudanum.

ARTICLE II.

ERYSIPELAS.

Definition; Forms; Frequency.—Erysipelas is a specific, acute, febrile, non-contagious exanthem, characterized by a deep red rash, attended with heat and swelling of the skin, sometimes with inflammation of the subjacent cellular tissue, and terminating generally in resolution, but sometimes in suppuration or gangrene. The disease is very variable as to its extent, and has the peculiarity of spreading from place to place, the part first attacked recovering, whilst the neighboring surface is becoming affected.

The disease, as it occurs in children over six months of age, presents the same characters as in adults, and requires therefore no particular attention in this work. In younger children on the contrary, and especially in the new-born infant, it is different in several particulars from that of older children or adults, and this we shall attempt to describe. The form which occurs in new-born infants, has been technically named erysipelas neonatorum.

Erysipelas is a rare disease in private practice, particularly amongst families in easy circumstances. In lying-in and foundling hospitals, on the contrary, it is of frequent occurrence, and it is not uncommon in hospitals for children and in the children of the poor. We have ourselves met with but four cases of erysipelas in children under six months of age, whilst we have met with seven in older children.

Causes.—The erysipelas of young children almost always starts from some previously existing cutaneous inflammation, the most frequent seats of which are the umbilicus during the process of separation of the cord, the irritated folds of the skin existing in erythema intertrigo, the inflammation accompanying the vaccine disease, and that which exists in the eczematous and impetiginous eruptions of the scalp, ears, and face. In a large majority of the cases observed in new-born children, the disease begins upon the abdomen, and generally at the umbilicus. In those which occur in children at the breast, it may show itself at any of the points above mentioned.

The disease occasionally follows vaccination. We have ourselves met with three instances, in two of which the erysipelas broke out about the eighth day; and in the third on the tenth day. In none of these cases could there be any doubt as to the purity of the vaccine virus used. In two, the disease extended over the greater part of the cutaneous surface, lasting three weeks, but terminating favorably in both cases. In the third case, it extended over the whole of the vaccinated arm, then attacked the upper part of the trunk, the face, and the right arm, and terminated fatally in the second week.

But, though erysipelas commonly starts from, and may at first view seem to be produced by these different local irritations, it is impossible to suppose that they can be anything more than the exciting agencies or causes, which bring into action a disease of which the seeds already exist in the economy. We must, therefore, in order to understand the real mode of causation of erysipelas, seek for the conditions that give rise to this predisposition to the malady, without which the above-mentioned exciting causes would rest without effect. These conditions are either a general epidemic constitution of the air, affecting certain districts of country, and acting more or less upon all classes of the community, but with especial force upon the destitute and miserable; or else a local epidemic constitution, such as that often occasioned by the unfavorable hygienic conditions of hospitals, and particularly of lying-in and foundling hospitals, or that not unfrequently determined by the same causes in the crowded and miserable habitations of the poorer classes of the inhabitants of large towns and cities.

Symptoms.—Infantile erysipelas is not generally preceded by any constitutional symptoms. The appearance of the eruption is usually the first sign of the disease. So soon, however, as the eruption appears, or very soon after, the child is attacked with fever, marked by frequent pulse, heat and dryness of the skin, restlessness and insomnia, and thirst. In the form of the disease which occurs in very young infants and in hospitals, or amongst the lower classes of the population, the eruption almost always begins upon the abdomen, and very generally at the umbilicus, whence it extends to the rest of the trunk, to the genital parts, and sometimes to the inferior extremities. Even under the circumstances just mentioned, however, the eruption sometimes commences upon the face or upon the limbs. In children over two weeks of age, and in those observed in private practice, the disease may begin upon any part of the surface. It very often commences in the neighborhood of a vaccine pock, in a patch of erythema intertrigo, whether this be seated on the neck or about the pelvis, or it may appear first upon the face, or upon one of the extremities, without any apparent exciting cause, and extend thence with greater or less rapidity to other parts of the body.

The form of the disease which occurs in very young infants, and which is by far more frequent in lying-in and foundling hospitals than under any other circumstances, begins almost always, at least when of a severe type, on the abdomen. It attacks hearty as well as more delicate children, and is generally very rapid in its progress. The erysipelatous surface is at

first of a bright-red and shining appearance, but soon assumes a purplish hue, and as this occurs, becomes exceedingly hard to the touch, and somewhat, though not very much swelled. As the case goes on, unless resolution, which is a rare event, should take place, or death occur at an early period, the purple color deepens into livid, vesications occur, the cellular tissue is destroyed, and in many instances extensive gangrene takes place, so that the scrotum has been seen to "become black and slough away, leaving the testicles bare, and hanging loose by the cords." (Maunsell and Evanson.) In a case that occurred to one of ourselves in private practice, the disease began on the ninth day at the umbilicus, and involved the soft tissues of the anterior wall of the thorax and abdomen. The skin sloughed in several places, exposing the muscles; and at one point, just below the epigastrium, perforation of the abdominal wall occurred. Death occurred on the fifteenth day of the disease. In this form of infantile erysipelas, examination after death almost always discloses severe and extensive peritoneal inflammation, a condition which cannot fail, of course, to add greatly to the danger of the disease.

But infantile erysipelas does not always exhibit these violent characters, though whenever it occurs in infants under a year old it must be regarded as a very dangerous affection. When it attacks children over two weeks or a month old, it usually starts, as has been stated, from the neighborhood of a vaccine pock, from the inflamed surfaces of intertrigo or those of eczematous or impetiginous eruptions, or it begins without evident cause, as in adults, on the face, or on some part of the extremities. It appears first in the shape of a bright-red inflammation of the skin. After a short time the erysipelatous surface becomes tense, shining, very hot, slightly swelled, and painful to the touch. Pressure causes the color to disappear, but this rapidly returns when the pressure is removed. Coincidently with the appearance of the cutaneous redness the child is seized with fever, restlessness, and severe thirst. From the spot first attacked the disease extends rapidly to the neighboring surfaces, from the neck and arms to the head and trunk, and from the groins or genital parts to the rest of the trunk and to the inferior extremities. When it begins upon the face, it extends to the scalp, and may thence travel over the whole surface, or it may remain limited, as it often does in adults, to the head alone. In one case that we saw, in an infant three weeks old, in which it began upon the face, it extended gradually over the whole cutaneous surface, and yet the child recovered. In another, two months old, it began upon the bridge of the nose, and from thence extended over the whole head, but did not reach the trunk or limbs. In a third case, a vaccinated arm was attacked with erysipelas on the eighth day of the vaccination. The disease extended down to the fingers, and upwards to the shoulder. From the shoulder it spread gradually over the whole trunk, and down the whole length of both lower extremities. As it was subsiding on the feet, it appeared on the arm opposite the one first attacked, and then attacked the corresponding side of the head, where it ceased. The child finally recovered after an illness of three weeks.

As the peculiar inflammation spreads to the neighboring surfaces, the

parts first attacked lose their red color and swelling, and undergo a process of desquamation. In some instances, the inflammation has caused suppuration of the subcutaneous cellular tissue, so that even when the greater part of the surface first attacked has ceased to present the peculiar characters of the erysipelatous inflammation, there remain behind abscesses of greater or less extent. Thus, in one of the cases that came under our own notice, when the erysipelas had left the head and thorax, and was confined to the pelvis and inferior extremities, there were two abscesses on the scalp, and one over the right pectoral muscle, whilst all the skin between the abscesses had regained its natural appearance, with the exception of the desquamative process, which was going on as usual. In another, but rarer set of cases, the inflammation sometimes returns to the parts over which it has already passed.

The swelling which accompanies this disease is usually of an œdematous nature,—the œdema being most marked in the hands and feet, and upon the face, whilst upon the trunk it is much less considerable.

The general symptoms consist at first, as already stated, of those indicating a strong febrile reaction. If the case goes on favorably these symptoms continue until the disorder terminates. But when the disease is severe, and especially when it ends in vesication, in extensive destruction of the cellular tissue, or in gangrene, the general symptoms are much more violent, marking thereby the gravity of the attack. The face and lips become pale, and the tongue and mouth dry. The child is in a state of constant agitation at first, and expresses its uneasiness and suffering by incessant moaning or crying, but, after a time, it becomes heavy and drowsy from exhaustion. The pulse is very frequent and feeble; diarrhœa and vomiting make their appearance, and the child dies at last in a state of profound debility; or convulsions occur towards the last, and terminate the case, as they so often do in the diseases of infancy and childhood.

The *duration* of erysipelas in children is extremely uncertain, and depends very much upon its form. In that which occurs in the new-born child, or within one or two weeks after birth, it sometimes proves fatal within seven days according to Canstatt (*Handbuch der Med. Klinik*, 2d ed., vol. ii, p. 264). M. Bouchut (*Mal. des Enf. Nouv.-Nés*, p. 532) gives as an approximation to the ordinary duration of infantile erysipelas, between four and five weeks, and states that this is also the result arrived at by M. Trousseau. In one of the cases alluded to by us, in which the disease extended over the whole cutaneous surface, the duration was four, while in another it was three weeks; in the one in which the eruption was limited to the head, the duration was a week. In the seven remaining cases, the disease was limited to the nose and eyelids, or the face and scalp, and lasted from three to ten days.

Diagnosis.—The diagnosis is very easy. The peculiar shade of the red color, the presence of decided though moderate tumefaction of the affected part, the severity of the general symptoms, and the characteristic erratic mode of extension from surface to surface, all assist to render the diagnosis very clear to those who have a proper amount of medical knowledge.

Prognosis.—Erysipelas is always a dangerous disease in young children. The precise degree of danger in individual cases will depend chiefly on two circumstances: first, the age of the subject; and second, the hygienic conditions under which the disease occurs. It is exceedingly dangerous in new-born infants, so much so indeed that M. Bouchut declares that they all die (*loc. cit.*, p. 532). This is in all probability almost strictly true of the cases which occur in infants only a few days old, particularly when they take place in lying-in hospitals, or even in private practice, during the prevalence of an epidemic of puerperal fever. The disease is always very dangerous in hospitals, even in infants over two weeks old. Yet it would appear not to be so grave as represented by M. Bouchut, who thinks that very few indeed have been cured even at that age; for, of thirty cases in infants between one day and a year old observed by Billard at the Foundling's Hospital of Paris, sixteen, or only one more than half, proved fatal. Schwebel reports 54 deaths in 86 cases (Meissner, *Kinderkrankheiten*, 3d ed., vol. i, p. 372).

In private practice, erysipelas, as it occurs in children between two weeks and a few years old, is a dangerous malady, but yet is far from being so in the same degree as in the new-born infant, and in hospitals. We have already stated that we have seen four cases in young infants; one nine days old, in whom the disease proved fatal in fifteen days; one three weeks old, in whom the disease lasted four weeks, and travelled over the whole cutaneous surface; another ten weeks old, in whom also it travelled over the greater part of the cutaneous surface; and a fourth two months old, in whom it remained limited to the head. These last three recovered. Again, we have seen seven cases of erysipelas of the face or head in children between seven months and twelve years old, and these also ended favorably. It must be recollected, however, to account for these recoveries, that they all occurred in hearty children, and under the most favorable hygienic conditions met with in private practice. To conclude, MM. Rilliet and Barthez report nine cases of erysipelas of the face in children, all of whom, with three exceptions, were over five years of age. Five of the nine cases were idiopathic; in four the disease complicated other affections. All of the spontaneous and one of the complicated cases recovered. The two others, both of which occurred in subjects laboring under measles attended with pneumonia, proved fatal.

Treatment.—The treatment of erysipelas in new-born infants, especially when the subjects of the disease are the inmates of a hospital, and when it occurs coincidently with a puerperal fever epidemic, is, as may be learned from the almost certain fatality of the disorder, exceedingly hopeless. M. Trousseau (Barrier, *Traité Prat. des Mal. de l'Enfance*, t. ii, p. 560) has made trial unsuccessfully of emollients in every form, of fomentations, lotions, baths, and of ointments containing sulphate of iron. "I have tried," he says, "surrounding the whole body and limbs with blisters in the form of strips; the erysipelas has passed over the obstacle. I have applied without success blisters upon the surfaces already invaded by the inflammation. I have obtained no advantage from mercurial ointment or from baths containing corrosive sublimate." He even tried the applica-

tion of the actual cautery in points where the disease was beginning, but without effect. So, too, with methodical compression.

Underwood says that "upon the complaint being first noticed in the British Lying-in Hospital, various means were made use of without success; the progress of the inflammation has seemed, indeed, to be checked for awhile by saturnine fomentations and poultices, applied on the very first appearance of the inflammation; but it soon spread, and a gangrene presently came on; or where matter has been formed, the tender infant has sunk under the discharge." He adds that he then proposed bark, to which sometimes a little confectio aromatica was added, and that from that period several cases recovered. After this, linen compresses, wrung out of camphorated spirit, were applied in the place of the saturnine solution, and proved successful in several instances in checking the inflammation. "Nevertheless, the greater number of infants attacked with this disorder sink under its violence, and many of them in a very few days." (*Treat. on the Dis. of Children*, Am. ed., by Dr. Bell, from the 9th Eng. ed., p. 103.) In a note to the above, Dr. M. Hall states that fomentations of extract of poppies diffused in warm water, and poultices consisting of the same fluid and crumbs of bread, proved beneficial in many instances. Dewees recommends the application of a blister, when the erysipelas is so situated as to allow the whole surface of inflammation and a portion of the neighboring healthy surface to be covered by the plaster. When this cannot be done, he prefers the use of the strong mercurial ointment, which must be applied over the whole of the eruption, and partly upon the healthy skin, and renewed as often as the part becomes dry.

It is very difficult amidst the variety of advice given by different writers, and especially when we reflect upon the great mortality of the disease under every kind of treatment, to determine which to select. For our own part, we should prefer the use of cooling emollient applications during the first part of the attack, whilst the skin is of a bright red color, hot, and shining. When the circulation becomes languid, and the color of the eruption is disposed to deepen from red to purple, we should suspend the use of the emollient applications, and employ instead the lotion of camphorated spirit recommended by Underwood; the camphorated tincture of soap, which we have known to be of great service in the erysipelatous inflammations occurring in patients of broken-down constitution, and which is to be applied three or four times a day by means of a soft sponge; or lastly, we would make trial of Kentish's ointment, a remedy found of great service by the late Dr. Charles D. Meigs, in the erysipelas of children (*North Amer. Med. and Surg. Journ.*, vol. vi, p. 77). This ointment he prepared by rendering basilicon ointment soft (not fluid) with spirit of turpentine. It is rubbed upon the inflamed part with the fingers, the anointing being "repeated often enough to keep the part always very thinly covered." The internal treatment should consist in attention to the state of the bowels, which are to be kept soluble by the mildest laxatives, without being purged, and in a resort to tonic and stimulating remedies upon the very first approach of symptoms indicating exhaustion. The best remedies of this class are proper diet, wine whey, small quanti-

ties of brandy, and bark in connection with minute doses of carbonate of ammonia.

In addition to these, the tincture of the chloride of iron, whose remarkable and almost specific influence upon the course of erysipelas in more advanced life is so well established, should be given in large doses, proportioned to the tender age of the patient. Thus we may give two or three drops every three hours to an infant of a month old, as in the following formula:

℞.—Tr. Ferri Chloridi, ... f℥ss.
Acid. Acetic Dil., ... f ℥ss.
Liq. Ammoniæ Acetat., ... f℥j.
Syr. Simp, ... f℥ss.
Aquæ, ... ad f℥iij.—M.
S.—A teaspoonful every three hours.

When the inflammation has gone on to the production of subcutaneous suppuration, it becomes still more important to sustain the forces of the constitution, by giving the infant a healthy and abundant breast of milk, and by the internal use of brandy in small quantities, of bark, or better still, of quinia in combination with small doses of carbonate of ammonia. At the same time the suppurating surfaces must be well fomented, and dressed with warm poultices, and, when necessary, laid open by careful incisions, observing the precaution to cause as small a loss of blood as possible. If the case occur in a hospital, or in a child placed in unfavorable hygienic conditions, let the following statement of M. Barrier (*loc. cit.*, t. iii, p. 562) be borne in mind: "However much the life of an infant be threatened by erysipelas, if we can but persuade a wet-nurse to take charge of it, the pure air of the country is often seen to replace most advantageously all other therapeutical resources."

As the preceding remarks have been restricted to the form of the disease which occurs in infants under two weeks of age, we have now to make some observations on the cases which occur in older children.

The disease is still, even at this latter age, a very dangerous one, though much less so, certainly, than in the new-born child. We have been deterred from the use of depletion in any form by two reasons,—the fear of exhaustion, which is so apt to occur in the disease, and the apprehension lest the leech-bites or cup-marks, in the case of local depletion, might prove new foci of the erysipelatous inflammation. The only internal remedies necessary in the beginning, are such laxatives as may be required to keep the bowels soluble when they are bound, such as shall correct acidity or diarrhœa when either is present, and those which promote an open state of the skin, and a free discharge of the urinary secretion. For the latter purpose we know none better than the solution of the acetate of ammonia, and the sweet spirit of nitre, about twenty or thirty drops of the former, with five of the latter, in sweetened water, to be repeated every two or three hours. The tincture of the chloride of iron should also be given, in the combination before recommended, in large doses, as three to six drops,

every three hours, at the age of one or two years. Should the attack be attended by any symptoms of prostration, or at a later period of the disease, when the child begins to emaciate and grow feeble, its strength must be carefully supported by the use of proper diet, and of stimulants and tonics. The only proper diet for nursing children is, of course, breast-milk: for those who have been weaned, the diet should consist of preparations of milk, light animal broths, or beef tea. The best stimulants are five or ten drops of brandy, five drops of aromatic spirit of hartshorn, or a quarter or sixth of a grain of carbonate of ammonia, in weak syrup of ginger, to be administered four or five times a day, or more frequently, when the forces of the child are greatly prostrated. The proper tonic is from a quarter to half a grain of extract of bark, or half a grain of quinia, in some suitable vehicle, every three or four hours.

The best local treatment is, in our opinion, cooling or tepid emollient applications, as slippery elm bark, marsh-mallow, or flaxseed tea, during the first few days, whilst the reaction is marked, and the calorification of the body high. Somewhat later, when the strength begins to be reduced, and the color of the eruption to deepen, we should make use either of mercurial ointment, which is highly recommended by some, or of the Kentish's ointment, or camphorated tincture of soap, to which attention has already been called. We would here propose the trial of an ointment which we have found not only soothing and comforting to the child, but also of manifest curative efficacy in the violent cutaneous inflammation of scarlatina. It consists of one ounce of fresh cold cream, rubbed up with a drachm of glycerin. It should be smeared over the inflamed surface several times a day, and need not interfere with the use of emollient applications. In scarlatina it has been most useful in reducing the burning heat of the eruption, and in softening the harsh and distended skin, and by these effects has aided greatly in moderating the severity of the general, and especially of the nervous symptoms.

In children over two or three years of age, erysipelas must be treated on the same principles as in adults, by light but nourishing diet, and rest in bed, by the internal use of laxatives occasionally, of full doses of the tincture of chloride of iron, and of febrifuges, and by the external application of emollient infusions, so long as the symptoms remain acute and the strength unreduced. But when, after a time, the fever begins to subside, or the child begins to show signs of debility and a tendency towards the typhoid condition, we must endeavor to maintain the life-actions in a proper degree of energy by a more nourishing and abundant diet, by the prudent administration of bark or of quinia, and even by the use of brandy and ammonia, should the strength of the patient be disposed to give way suddenly or rapidly. Under these circumstances, moreover, the best local application will be either the Kentish's ointment, or the camphorated tincture of soap.

ARTICLE III.

ROSEOLA.

Definition; Synonyms; Frequency; Forms.—Roseola is a non-contagious, fugacious exanthem, characterized by rose-colored patches, of irregular size and shape, which are unaccompanied by elevations or papules, and the appearance of which is preceded and accompanied by febrile symptoms.

It is often called in this country scarlet rash, and under that title supposed to constitute a very mild form of scarlatina. It is sometimes called also French measles, and rubeola sine catarrho. By some writers, as Duhring, roseola is included under the general term of Erythema.

Roseola is of rather *frequent* occurrence amongst children, though more rare than either measles or scarlet fever.

There are three *forms* of the disease met with in children, roseola æstiva, roseola autumnalis, and roseola annulata. As the two former, however, present no differences of any importance, we shall describe them under one head, whilst the latter, quite unlike the other two, requires that we should describe it apart.

Causes.—Roseola may occur at all *ages* of infancy and childhood, and at any *season*, but is most common in summer and autumn. It has been known to prevail as an *epidemic*, but has never been thought *contagious*. It may attack the same individual on several different occasions, one attack not preserving from repetitions. The variolous eruptions are sometimes preceded by roseola, and in some children it makes its appearance on the ninth or tenth day of the vaccine disease. Of the various causes that we have known to produce it, the most frequent is certainly derangement of the digestive function during the first dentition. It is said also to be occasioned by sudden changes of temperature, by violent exercise, and by the use of cold drinks while the body is heated and moist with perspiration; causes which strongly indicate that the nervous system is closely connected with its production.

Symptoms.—Young children who have been suffering for a few days with disorder of the digestive function, often exhibit a slight roseolous eruption, lasting twenty-four or thirty-six hours, and then disappearing. The eruption in this mild form of the disease appears suddenly, often in the course of a single night, covering the trunk or even the whole surface with numerous patches, nearly circular in shape, or in irregular, broad, and waving lines, situated close together, and yet distinct, and of a light rose color. In another, and rather more violent form, occurring especially during dentition, the eruption appears after vomiting, fever, diarrhœa, and slight nervous symptoms, or possibly after slight convulsions, with the characters above mentioned, except that the rash is deeper in color, greater in extent, and that it lasts generally a longer time—two, three, or four days. Again, in a yet more marked form, the roseola æstiva and autum-

nalis, the disease is preceded by certain symptoms which it is important to note. It begins with more or less chilliness, alternating with heat, with loss of strength and spirits, with headache, restlessness, sometimes mild delirium, and even, it is said, though we have never seen them, with slight convulsive phenomena. At the same time there is some febrile reaction, marked by accelerated pulse, heat and dryness of the skin, thirst and loss of appetite; the digestive function is shown to be deranged by the presence either of constipation or diarrhœa. After these symptoms have continued for two, three, four, or even six or seven days, the eruption appears first upon the face and neck, whence it extends in twenty-four or forty-eight hours to the rest of the body. The rash resembles very closely, in some cases exactly, that of measles. It is in the form of irregularly circular and rather large patches, at first of a red, but soon changing to a deep rose color, and separated from each other by portions of healthy skin. The eruption is sometimes accompanied by itching, and sometimes by stinging pain, and the febrile symptoms generally continue, though moderated in degree, after the appearance of the rash; while in other instances the fever disappears entirely from that moment. The rash lasts between one and two or three days, as a general rule, and fades away gradually until it has entirely disappeared. In some cases it comes and goes alternately for a week after its first appearance.

Roseola Annulata is a curious and interesting form of the disorder, from the singular and beautiful appearance of the bright rose-colored rings which constitute the eruption. We have seen but a few examples of this variety, while we have met with a large number of cases of the other forms. It must, however, be of rare occurrence, since MM. Guersant and Blache state that they have never chanced to meet with it, though they have seen a large number of roseolous eruptions (*Dict. de Méd.*, t. xxvii, p. 626).

This variety of roseola appears in the form of rosy rings, or circles, whose centres retain the natural color of the skin. The favorite seats of the eruption are the abdomen, loins, buttocks, or thighs, or it may cover the greater part of the body. In one case that we saw, the eruption covered the face, neck, and trunk. In another it was seated upon the face, trunk, and upper extremities. The rings are at first not more than one or two lines in diameter, but they enlarge gradually until their centres measure as much as half an inch in diameter. In some instances two or three rings surround one another, the skin in the intervals between them still retaining, however, its natural appearance. The disease is, when accompanied by symptoms of reaction, usually of short duration. The cases which occurred to ourselves lasted only three days, and were accompanied by decided febrile symptoms, together with signs of digestive derangement. It sometimes assumes a chronic form, the eruption fading in color in the morning, and increasing again and causing heat of skin, in the evening.

Diagnosis.—Roseola æstiva might be readily mistaken by a careless observer for measles or scarlatina, and especially for the former. We have no doubt whatever that cases of roseola are often regarded, under the title

of scarlet rash, as examples of a very mild form of scarlatina, a misapprehension which will explain some at least of the supposed instances of second attacks of scarlet fever in the same individual. This is a mistake, however, that ought not to occur, and need not, if the following characters of the two diseases are properly understood. The rash in scarlatina is, in the first place, of a much brighter tint, and it is more persistent and more uniformly spread over the surface than in roseola. When we come to analyze the characters of the two eruptions, there are other distinctions between them which assist greatly in making the diagnosis. In scarlatina, the eruption is composed of very large patches, or it is absolutely uniform, and evenly distributed over large surfaces, as over the whole trunk, or over the flexor or extensor aspects of the limbs. It is seen to be composed, too, when minutely examined, of an aggregation of very minute red points, which are dotted so closely together as to present the appearance of a general scarlet blush. In roseola, on the contrary, the rash is composed of irregularly circular, crescentic, or waving patches, with portions of skin between of a natural or nearly natural color. The patches, moreover, are of a different tint from that of scarlatina, being of a deep rose, instead of a bright red or scarlet color, and they cannot, upon close examination, be resolved into the minute dotted points which make up the scarlatinous eruption. When we add to these circumstances the facts, that in roseola there is no faucial inflammation, that the pulse has not the great frequency almost invariably present even in very slight cases of scarlet fever, that all the general symptoms are much less strongly marked, that no desquamation takes place in roseola, and that the duration of the attack is much shorter, we think we have points of difference between the two, quite numerous and marked enough, to render the differential diagnosis easy to a careful observer.

It has always seemed to us impossible to distinguish with certainty between roseola and measles by the eruption alone, and we find that MM. Rilliet and Barthez are also of this opinion (*Mal. des Enfants*, t. i, p. 732). We are told by writers that in roseola the patches composing the eruption are more distinct, larger, paler, and more irregular in shape than in measles, and that they are separated by intervals of healthy skin; but we are quite satisfied that, in some cases witnessed by ourselves, these differences were not sufficient to distinguish them. The diagnosis is to be made by attention to the following points: by the absence of catarrhal symptoms in roseola, by the slighter severity of all the general symptoms, and by the much shorter duration and greater irregularity of the initial phenomena, which latter seldom last in roseola more than one or two days, and consist of symptoms of gastro-intestinal derangement, whilst in measles they last three and almost always four full days, and consist of very strongly marked catarrhal or respiratory symptoms, with very slight signs of gastro-intestinal derangement.

Roseola annulata is so peculiar and characteristic in all its appearances as to prevent its being mistaken for any other disease that we are acquainted with.

Prognosis.—Roseola is probably never dangerous to life. If it ever

seems to be so, it must be in consequence of its occurring in connection with severe internal disease.

Treatment.—The only treatment necessary in roseola is attention to diet; the correction by that means, or, if necessary, by a mild laxative, by some antacid preparation, or by a mercurial dose, of the gastric or intestinal disorder; rest in bed, or seclusion in a chamber with a properly regulated temperature; and the use of mild diaphoretics and cooling demulcent drinks.

ARTICLE IV.

URTICARIA.

Definitions; Synonyms; Frequency; Forms.—Urticaria is a non-contagious exanthem, characterized by hard elevations upon the skin, of uncertain size and shape, and of a reddish or whitish color, or, more frequently, partly red and partly white; the eruption is generally of short duration, is almost always accompanied with intense heat, and violent itching and burning, and is preceded by more or less marked signs of gastro-intestinal disorder.

Its most common title is that of *nettle-rash*. The mild, discrete form of the disease is generally called *hives* in the nursery. It is sometimes described under the name of *essera*. It is of very *frequent* occurrence amongst children in a mild shape. We have seldom seen in early life the abundant and severe eruption covering the greater part of the surface, which is met with in adults.

The most common *form* of urticaria in adults is well known to be the *urticaria febrilis*, which is an acute disease of short duration. Two other forms of the disease, the *urticaria evanida*, and *tuberosa*, are occasionally met with in adults, though they are both rare. In children, by far the most frequent form of the disease that we have seen is one in which there is scarcely any fever whatever, and in which the eruption is moderate; the urticaria febrilis is, however, not at all uncommon in early life, while, on the other hand, we have never met with an instance either of urticaria evanida or tuberosa at the age referred to.

Causes.—Children possessing a fine and delicate skin, especially when they are at the same time endowed with a highly nervous temperament, are particularly predisposed to attacks of urticaria. The only other causes that we are acquainted with are the functional disorders of the digestive apparatus which occur in the spring and summer seasons, the influence of dentition, derangement of the gastric functions from the use of improper food, and lastly, the ingestion of certain articles of diet, which have been proven by long experience to be apt to occasion attacks of the disease. Of the articles last referred to, those which most frequently produce this effect

are crabs, the eggs of certain kinds of fish, certain crayfish, and some kinds of smoked, dried, or salted fish.

Some children are exceedingly liable to the appearance upon different parts of the body of a few patches of urticaria. Very slight disturbances of the gastric functions, a very warm day, or excessive clothing, will occasion in such subjects an attack of the disorder, whilst in many others again, the disease is never seen under any circumstances, or only at rare and long intervals.

Symptoms.—The form of the disorder most commonly met with in children, in which there is neither fever nor other marked signs of disorder of the general health, is the disease generally described under the title of *lichen urticatus*, but which ought, it seems to us, to be considered as one of the varieties of urticaria, under the name of urticaria papulosa. This eruption consists of large inflamed papules, which are irregular in shape, being either rounded or oblong, projecting most in the centre, and which appear suddenly, without any or with only slight prodromic symptoms. The papules are of a bright red color, excepting in their projecting central portions, where they are whitish or of a very pale red tint. The eruption is accompanied with a smarting and burning pain, and with the most violent and annoying itching, which the child endeavors to allay by frequent and often rude scratching, in consequence of which the summits of the papules are often torn and present little crusts of dried blood. It is very fugacious in its character, appearing suddenly, lasting for a few hours or several days, and then disappearing entirely, or recurring again after a short time in the same or in new places. It terminates finally, after from a few days to several weeks, by resolution or by a slight furfuraceous desquamation. The most common seats of the eruption in children are the face, about the buttocks, or upon the thighs, or upper part of the arms.

This is the form of the disease we have met with in infants, and in children under two and three years of age. It is, as already stated, of very slight consequence, being merely annoying and never dangerous. In young infants it occasions sometimes much crying and irritability, which can be explained only by the discovery of the eruption.

The *urticaria febrilis* is usually, but not always, preceded for a few hours or two or three days, by feverishness, and by more or less marked signs of gastric disorder, such as nausea, chilliness, headache, and languor. In other instances the fever and the rash occur at the same time. The eruption begins with a sense of itching, and with heat and burning of the skin, and soon after there appear on the shoulders, loins, inside of the arms, and about the thighs and knees, reddish and solid elevations, irregular in outline, but generally roundish or oblong. The latter shape is the one the elevations most frequently assume, and it is from the resemblance which they bear in this form to the marks left by the stripes from a rod or whip-lash, that they are often called weals. The elevations project a good deal above the surrounding surface, forming knots or ridges; their size is variable; they have hardened edges; they are reddish in color, except over the central and most projecting part, which is generally, and always when the swelling is considerable, whitish in its tint; and they are sur-

rounded by a narrow areola of a bright red or scarlet color. The amount of the eruption is very uncertain, the elevations being sometimes separated by considerable intervals of healthy skin, while in severe cases they are extremely numerous, and from their confluent character in such attacks, give to the part upon which they are seated, a nearly uniform red color, and occasion at the same time a very decided puffing and swelling of the skin.

The eruption, when at all considerable in degree, is attended with violent itching and burning. The former is often so severe and troublesome as to occasion the most distressing irritation to the patient, precluding all comfort or quiet. It is increased by heat, and especially by that of the bed. The patches of eruption which appear first do not continue throughout the disease, but, after lasting from a few minutes to a few hours, fade away, and are replaced by new and successive crops. During the attack, the patient is usually more or less feverish, and he suffers from languor, loss of appetite, furred tongue, and the usual signs of gastric derangement. The symptoms subside gradually, so that, after a period varying from two or three days to a week, the disorder has entirely disappeared, leaving behind no traces, except, in a few instances, a slight desquamation.

When this form of urticaria follows the ingestion of certain articles of food, the eruption usually appears within a very few hours after the meal, being preceded and accompanied by nausea or vomiting, pain and distress in the epigastric region, giddiness, headache, and feverishness.

In cases where the cause persists, and especially among children of the poorest classes, who live in squalor, or at least under any unfavorable hygienic conditions, the disease may assume a chronic form. The individual weals are more persistent, and the rude scratching and absence of cleanliness aggravate the eruption and modify its character.

Diagnosis.—There can be no difficulty in recognizing a case of urticaria. The peculiar characters of the eruption, and especially the size, shape, and color of the solid elevations of which the patches consist, the violent itching and burning which accompany it, and its fugacious character, render it unlike any other cutaneous disease, and ought to prevent any mistake as to its nature.

Prognosis.—Urticaria is probably never dangerous in children. If it be accompanied by symptoms of a threatening or alarming character, these are dependent rather upon the gastric disorder, which is the cause of the urticaria, than upon the latter affection itself. We have never known it to be more than troublesome and annoying.

Treatment.—There are but two really important indications for the treatment of this disease: to atttend to the state of the digestive functions, and to allay, by proper means, the distressing irritation occasioned by the itching and burning of the eruption.

In the mild form of urticaria, called in the nursery, "hives," and in scientific language, lichen urticatus, the only treatment necessary is careful regulation of the diet, and the use of means proper to correct any evident derangement of the digestive functions. The food should be light

and digestible, but at the same time nourishing. Milk, bread, light meats, and the plainest vegetables, form the proper diet for children over three years of age. Under that age, milk preparations, bread, and in those over a year old, light broths, ought to constitute the diet. In a large majority of such cases, no drug whatever ought to be given. The only ones likely ever to be required are occasional mild laxatives or gentle mercurials, when constipation is present, and some of the antacids, as very small quantities of magnesia or carbonate of soda, or lime-water and milk, when the stomach is acid. To allay the itching and consequent restlessness of the child, the patches of eruption should be well and frequently dusted with toasted rye or wheat flour, which are often very successful. Washing the eruption with salt and water, when the cuticle is not broken, is sometimes very soothing, and, when the patches are of small extent, this may be done without any impropriety. Dr. Watson speaks well of a lotion ("first recommended by Wilkinson"), composed of a drachm of carbonate of ammonia, a drachm of acetate of lead, and eight ounces of rose-water.

In the urticaria febrilis the treatment must depend upon the cause of the attack. When it follows upon the eating of some unwholesome food, we must rid the stomach of the offending substance by an emetic, unless nature has already caused its rejection by spontaneous vomiting. When this end has been gained, it will be proper to give some kind of cathartic medicine, and the best is castor oil, as the mildest and most certain, in order to insure the discharge of the whole of the aliment which has been causing the mischief; or small doses of blue pill; or hydrargyrum cum cretâ, with rhubarb, where there are present any signs of hepatic derangement. After this the only treatment necessary will be the use of cooling and demulcent drinks, containing perhaps a little sweet spirit of nitre; rest in bed, or at least seclusion in the house, for a few days; and careful regulation of the diet. The latter ought to be very light during the continuance of the eruption, consisting merely of milk and bread, or of some kind of gruel or plain broth; after the cessation of the disease, it should be augmented only with due care and quite gradually. To allay the itching and burning of the eruption, and the general distress of the child, the best remedy is a warm bath carefully administered. This may be repeated in six or eight hours if necessary, and between whiles the surface should be dusted with rye or wheat flour, as above recommended.

CHAPTER II.

VESICLES.

ARTICLE I.

ECZEMATOUS AFFECTIONS.

As already stated in our introductory remarks on skin diseases, the idea of eczema is no longer restricted to a disease characterized by the formation of vesicles, but embraces all the numerous affections which present redness of the skin, frequently punctated; itching, infiltration, and exudation on the surface, with the formation of crusts. So far, indeed, from vesicles being characteristic of it, it may be said, and especially in regard to eczema in children, that its rarest form is that which is attended solely with their formation. The elementary lesions which may be present at the beginning of the attack, are either erythema, papules, vesicles, or pustules, and the disease is divided accordingly into eczema erythematosum; eczema papulosum, which embraces eczema lichenoides, and eczema prurigosum; eczema vesiculosum, the typical eczema of Willan, one of the rarest of all its varieties; eczema pustulosum, or impetiginoides, which includes impetigo; and eczema squamosum, which is usually of the chronic form, and resembles, in many cases, psoriasis. It is indeed called psoriasis by Dr. Wilson, who gives the name "*alphos*" to that scaly disease, which is still, by most authorities, and especially by Hebra, designated as psoriasis.

It not unfrequently happens, also, that the various elementary lesions enumerated above may be present at the same time on a patch of eczematous eruption, so that a case which has begun as eczema erythematosum, or vesiculosum, may present the development of papules or pustules, or thick scabs, and thus become converted into the pustular or squamous form. This tendency for the blending of several elementary lesions in the same eruption, and especially for the conversion of the eruption into the pustular form, is very markedly seen in cases of eczema of children.

Eczema is also divided, according to its course, duration, and stage, into acute and chronic.

Eczema shows, moreover, an especial tendency to attack certain parts of the surface, and presents various peculiarities in the different localities; in children, it frequently occurs on the scalp and face, though it extends over the entire surface of the body far more frequently in them than in adults.

The special forms of eczema which will be here described, are simple

acute eczema; eczema of the scalp, and of the face; eczema pustulosum, or impetigo; eczema papulosum; and chronic eczema, or eczema squamosum.

Causes.—The causes of these affections are, to say the least, very obscure in most cases. It is probable that some peculiarities of constitution predispose to it, and particularly the lymphatic temperament, or the scrofulous or tubercular diathesis. Exposure to unhealthy hygienic conditions, as want of cleanliness, insufficient or improper food, and crowded or ill-ventilated habitations, also render the system more prone to the development of eczema.

In those who are thus predisposed, any trifling irritation may prove sufficient to provoke the eruption. One of the most common and undoubted of these is the influence of the process of teething, and the majority of cases of eczema in children occur during either the first or the early part of the second dentition. In like manner the application of irritants of any kind to the skin, or the inflammatory action set up by vaccination, may serve as an exciting cause. It is remarkable, also, what slight irregularities in diet, or alterations in the quality of the mother's milk, will, under such circumstances, induce an attack. Indeed, the use of artificial food in infancy, by disordering the digestive function, and impairing nutrition, may be regarded as a frequent cause of the disease.

Symptoms.—We have already alluded to the fact, that in the eczema of young children, as indeed is true, to a less degree, of the disease at all ages, we constantly meet with the most varied forms of eruption in the same case; and have the opportunity of watching the development of papules, vesicles or pustules, until a case which has begun as one of erythematous eczema, presents the characters of the papular, vesicular, and ultimately of the pustular form. The predominance of one or the other of these typical forms of eczema is determined by the temperament and general condition of the child, and the grade of inflammatory action present.

Eczema simplex, or *vesiculosum*, may occur on any part of the body, but in children is most frequent on the face and arms. The eruption appears, without any precursory symptoms, as an erythematous patch, which is red and itchy, and may present slightly raised pimples, and being rubbed and scratched, soon presents the formation of numerous, closely aggregated, exceedingly minute vesicles, containing a transparent limpid serum. After a short time the contained fluid becomes turbid and then milky, and is either absorbed, while the vesicles shrivel up and disappear by a slight desquamation, or else the fluid escapes by the rupture of the vesicles, and little thin scales follow, which are detached before long from the surface beneath. The eruption is attended with more or less itching and smarting, but does not generally give rise to constitutional symptoms. The vesicles are generally renewed by successive crops; so that, though the case may terminate in from two to three weeks, it is apt to continue for two or more months.

Eczema papulosum.—In the same way as the above form of eczema is characterized by the formation of vesicles, there are other cases where the eruption principally consists of papules, associated with erythematous

patches. These papules do not remain dry and without exudation as in the typical forms of lichen and strophulus, but soon present a slight clear or turbid serous oozing, and thin scaly desquamation of the epithelium. At the same time there will usually be found, on other parts of the body, patches of more fully developed eczema. The papules in eczema infantile may either be firm, small, and conical, as in lichen agrius, or softer, and more broad and flat, as in some forms of strophulus.

Eczema pustulosum or Impetiginoides.—Under this head we will describe the affection usually styled impetigo, and formerly classed among the pustular diseases of the skin, but which possesses peculiarities which have induced dermatologists to transfer it to the group of eczematous affections.

It may be described as a form of eczema characterized by the production of psydracious sero-pustules, containing a thin purulent fluid, which either break and discharge, or dry up and form thin amber-colored or more thick yellowish-brown crusts.

The eruption usually begins as a reddened patch, studded with slightly raised pimples. As the inflammation increases, the cuticle is often raised into more or less well-defined vesicles, or the surface becomes excoriated, and there is a discharge of turbid or whitish-yellow secretion; the skin now becomes infiltrated, and numerous rather small pustules, containing a light-colored pus, form on the red swollen surface. Not unfrequently there are vesicles on the same patch, surrounding its margin. These pustules are usually broken by scratching or by friction against the dressings, and their contents dry up, forming amber-colored or brownish crusts. Frequently, also, blood is mingled with the discharges, and the crusts become dark-colored, or at times positively black.

The crusts separate in a few days, the time varying according to their firmness and thickness, and leave the surface reddened, but without any permanent scar. Frequently, however, the disease passes into a chronic form; the eruption retreats to certain seats, as the scalp, or the flexures of the joints, where the skin remains somewhat infiltrated, while the cuticle is rough, scaly, and constantly desquamates, either in the form of a fine furfuraceous exfoliation, or of scales of considerable size.

There are in reality but two specific varieties of this form of eczema, impetigo figurata and impetigo sparsa, so named from the manner in which the pustules forming the eruption are arranged. From the greater frequency and severity of the disease, however, as it appears upon the scalp in young children, it has become customary to describe it, when seated upon that part, under a different title.

Eczema capitis is often met with in infants at the breast during the first dentition, and at later periods of childhood in those who are scrofulous, or who are placed in unfavorable hygienic conditions. It may be confined to a small portion of the scalp, or it may cover the head, and extend to the face and neck; or again, it may be limited entirely to the latter localities, when it constitutes eczema of the face. In both cases, the eruption is very apt to run into the pustular form, constituting the disease known as impetigo capitis.

When mild in its features, it consists of an eruption of numerous small

vesicles or sero-pustules, spread over certain portions of the scalp, to which it may remain limited; or it may cover the face at the same time, or it may attack alone the forehead, temples, and, perhaps, portions of the cheeks. It is attended, under these circumstances, with very slight redness and heat of the integument. The sero-pustules discharge their fluid contents and form thin crusts, which gradually fall off, leaving slightly reddened or excoriated surfaces, which soon disappear, or are followed by fresh crops of eruption, destined to pass through the same changes as the preceding ones.

In more severe cases the disease may be confined either to the scalp or face, or it may, as stated above, exist upon both simultaneously. The eruption presents different appearances in these two situations.

When seated on the scalp, it is often called by the English, milky crust or milk-crust, crusta lactea, tinea lactea, and porrigo larvalis; and by the French, croûte de lait and gourme.

On the scalp, as already said, the eruption may be either partial or general. It may consist at first of disseminated minute vesicles, which break, and form thin, lamellated crusts, of a yellowish or brownish color; or of pustules, yellowish-white in color, and of small size, seated on an inflamed base. The surface affected is at first small, but the eruption gradually extends to surrounding parts. It is attended with great heat and itching; and, as the disease advances, the scalp becomes very much inflamed, red, tense, swollen, and painful. The eruption is now more completely pustular, and as the pustules open or are torn by the uncontrollable scratching, they discharge an abundant thin sero-pus, or even a thick and viscid fluid, which glues the hairs together, and hardens into uneven brownish-yellow crusts. If the scalp is not kept clean by constant washing or by emollient applications, the crusts increase rapidly in thickness by successive discharges of fluid from the pustular surface beneath, until at length the whole of the diseased part is covered with thick, heavy, rough, and adherent crusts, of a brownish or yellowish-white color, or at times of a positive black from the admixture of blood which oozes from the inflamed surface, torn by the nails of the little sufferer.

When neglected, the crusts become more and more thick, and from the heat of the head and exposure to the air, they undergo partial decomposition, and exhale a fetid, sickening odor, of the most disgusting kind. Among the children of the poor and destitute, lice often form in abundance, and add to the repulsive character of the disease. At first, the crusts are somewhat soft and moist, from the percolation through them of the fluid exuded beneath; but as they become more abundant and thicker, their outer surface becomes dry and sometimes very friable. The secretion from the inflamed surfaces often makes its way under the crusted mass above, and, flowing down over the forehead and behind the ears, irritates the parts that were before healthy, and thus extends the disease.

When the crusts are removed by any means, the surface of the eruption is found to be red, shining, wet, and discharging an abundant purulent or sero-purulent fluid, which escapes from minute excoriated points, dotted thickly over the inflamed scalp. The scalp is at the same time tumefied,

tender to the touch, and abscesses may form beneath it. The lymphatic glands, as the occipital, submental, or cervical, are frequently enlarged, and at times suppurate.

When the disease has lasted a considerable length of time, it tends to assume a chronic form. The inflammatory action extends to the hair-follicles, and often occasions partial loss of hair over larger or smaller surfaces. This kind of alopecia is not, however, permanent. The hair-bulbs are not destroyed, but merely inflamed, so that the hair grows again after the cure of the disease. The tissues of the scalp remain thickened, but the amount of the secretion diminishes; and the painful irritation and itching are less troublesome. Under these circumstances, the crusts are less thick and massive; they become lighter, thinner, and are more easily detached. The epidermis is dry, uneven, and rough, and there is a continual desquamation of fine furfuraceous particles, constituting a form of pityriasis capitis, or of epithelial scales of various sizes, resembling a case of psoriasis.

On the *face* (*Eczema faciei*), the disease usually shows itself first on the forehead and cheeks, to which parts it may remain limited, or whence it may extend to the lips, chin, ears, and neck. The nose and eyelids are seldom attacked, though we have occasionally seen the upper eyelids slightly affected.

The disease begins by the appearance of minute vesicles or sero-pustules on a patch of reddened and slightly swollen skin; there is also excessive pruritus. When the eruption is scanty, and rather vesicular, and the degree of inflammation slight, the cuticle breaks, and there is a discharge of a thin, turbid, serous fluid, which dries into delicate scales, or thin lamellated crusts.

When the accompanying inflammation is more severe, however, the eruption is more truly pustular, the pustules being numerous and rather large, and the discharge copious, so that when the formation of crusts is not interfered with by topical applications, or by the scratching of the child, large portions of the affected surface become covered with thick yellowish, brownish, or brownish-red crusts, which present the general appearance of a mass of incrustation, broken by cracks and fissures into portions of very irregular size and shape.

In the milder cases, when the scales drop off, the skin may appear reddened and moist, or may seem to be covered with a very delicate, shining epidermis, which is perfectly dry or presents tiny drops of serum or minute cracks. In the more severe cases, if the crusts are detached from any cause, the skin beneath appears red, swollen, inflamed, and wetted with a more or less abundant sero-purulent fluid, sometimes mixed with blood, that oozes from numerous small points on the excoriated and inflamed surface. The eruption is attended with severe itching and smarting, to relieve which the child often tears the affected surface with the nails, so as frequently to remove the crusts, wound the skin beneath, and cause more or less bleeding from the part.

In this more severe form, when the discharge forms a thick discolored scab covering the scalp or face like a mask, the disease has received the

names of porrigo or impetigo larvalis, which are less accurate than eczema larvale. It corresponds to the impetigo figurata, as met with in other parts of the body.

When the eruption is more scanty and developed in small groups on the scalp alone, the discharge is less copious, and soon concretes into dry, friable, brownish crusts of irregular shape, some of which are very adherent, matting together a larger or smaller number of hairs, while others are broken into small and dry fragments, which have been compared to particles of mortar dispersed among the hair. Many of the pustules in this variety are formed at the base of the hairs, so that these particles of crust, being pierced by the hairs, have somewhat the appearance of a string of rude beads. This form of the disease has been known as tinea, or impetigo, or porrigo granulata; but for the sake of uniformity, it might be styled eczema granulatum. It corresponds to the impetigo sparsa, as met with on other parts of the body.

Eczema larvale, whether confined to the scalp or face or existing on both parts at once, causes, when it exists in the acute form, much distress and annoyance to the child. The heat and tension of the part, and particularly the itching, occasion much restlessness and irritability; they make the child cross and peevish, disturb its sleep, and sometimes cause slight febrile attacks, which debilitate and injure the health. Indeed, when the disease has lasted a considerable time, it often induces extreme anæmia and impairs severely the general nutrition of the child. In other cases, however, the general health remains perfect,—all the functions of the body going on well, notwithstanding the local distress and irritation. The lymphatic glands situated behind and in front of the ear, and those on the back and front of the neck often inflame, enlarge, are frequently hard and painful to the touch, and in a few instances suppurate, though the latter occurrence is not frequent.

The *duration* of eczema larvale is very variable in different cases. Mild cases, and particularly those in which the eruption is confined to a limited extent, often get well, or are readily cured in two or three months. When, on the contrary, the disease is severe and extensive, the duration is much longer, seldom less, according to our experience, than several months or even one or two years. In most cases, however, the intensity of the disease varies from time to time, so that at one period it may seem to be subsiding rapidly, or it may even disappear almost, or be very greatly ameliorated, only to break out again with renewed violence under the influence of some exciting cause, as the cutting of new teeth, some change in the weather or season, or some alteration in the health of the child which cannot be explained. This affection is, as already stated, almost entirely confined to the age of dentition. The disease often begins some months before the appearance of the first teeth, and though it generally ceases or is cured before the termination of dentition, we have known it to run on unchecked three months after the conclusion of that process and then to be removed only by medical treatment.

Eczema granulatum is comparatively a slight disorder, and is usually much more under the control of remedies and of much shorter duration.

There is a local variety of eczema which requires a brief allusion. It is known as eczema tarsi and affects the edges of the eyelids, especially in strumous children, in whom it is often associated with strumous ophthalmia. It is attended with the formation of pustules at the openings of the hair-follicles, itching, thickening of the eyelids from infiltration, the formation of crusts, and a tendency to adhesion of the edges of the lids together, especially in the morning after they have been in contact during sleep. If not cured by appropriate treatment, it frequently leads to distortion of the hairs, which assume abnormal directions in their growth, and to inversion or eversion of the lids.

Eczema impetiginoides also presents itself in other parts of the body under the same two forms of impetigo figurata and sparsa which have been described as occurring on the head. We have, indeed, more than once alluded to the tendency of eczema in children to develop itself in different parts of the surface, at times occupying almost the entire cutaneous surface, and presenting all its varieties at one and the same time.

Impetigo figurata, when seated on the trunk or limbs, usually presents a large eruptive surface. On the arms we have seen it extend from the shoulders to the hands, and, as a general rule, it has been most severe on the outer portions of the limbs. On the trunk and lower extremities it has usually affected surfaces of much less considerable size, and has commonly appeared in a patch of an irregularly oval shape, and of four, five, or six inches in diameter.

In these localities it presents much the same appearances as those already described in the account of eczema capitis.

Impetigo sparsa, which is the scattered form of the eruption, is quite a common affection in children of all ages. It differs from impetigo figurata in the arrangement of the pustules, which, instead of being confluent or grouped closely together, appear singly or in small clusters. It most frequently appears on the face and scalp, but is also met with on the extremities, being not unfrequent in children, according to Wilson, on the hands and feet.

The eruption appears as small yellow pustules, seated upon an inflamed base, and attended with more or less itching. The patch frequently presents a surrounding circle of confluent vesicles or phlyctenæ. The pustules soon break and discharge a sero-purulent fluid, which hardens into a rugous, more or less projecting, friable crust, seeming to consist of different layers superimposed one upon the other. When the crusts fall, or after their removal by topical means, there remains beneath an inflamed surface, which may be either excoriated, giving issue to additional fluid and a renewal of the crusts, or dry, and disappearing little by little by the gradual fading away of the red color of the spots.

Eczema Chronicum.—Eczema infantile, if left to itself, has no natural tendency to cure, but usually becomes chronic, as in the adult.

When the disease passes into this form, no matter what may have been the original type of the eczema, the eruption gradually assumes uniform and characteristic appearances. The various forms which have already been described are then to be regarded as varieties of acute eczema, while

the chronic form is common to them all, and represents the condition into which all the acute varieties may merge.

The skin in chronic eczema is either very much inflamed and thickened, presenting excoriations with deep cracks and fissures, which pour out an abundant ichorous secretion, or, more frequently, the inflammation is less severe, there being much less heat, redness, and infiltration of the skin, fewer excoriations and cracks, and a smaller amount of effusion. The affected surface is, in these cases, dry and parched, and constantly throws off a fine furfuraceous desquamation, as in pityriasis, or scales of dried cuticle of various sizes, as in psoriasis.

This form is most common on the scalp, behind the ears, about the neck and upper part of the trunk, and in the flexures of the joints. It usually lasts for months, and is difficult of cure. It is attended with severe itching, which is sometimes so troublesome as to occasion the most distressing and uncontrollable restlessness at night.

Not rarely also, on the application of any exciting cause, the eruption will spread from the spots where it has been lurking in the chronic form, and invade more or less of the surface, assuming all the appearances of acute eczema.

Diagnosis.—It must be borne in mind, in making the diagnosis of eczema, that its characteristic symptoms, which are present in varying proportion in nearly every case, are redness and infiltration of the skin, attended with marked itching; and exudation on the surface, with the formation of crusts.

Eczema simplex when seated on the hands and between the fingers, may be mistaken for scabies. The distinction can, however, be made by attention to the following points: the vesicles of eczema are flattened and aggregated; in scabies they are acuminated, isolated, and entirely distinct. There will also be frequently found, in scabies, vesicles on the hips where the hand of the nurse from whom the child has caught the disease has been placed to support it. In scabies, also, the vesicles present little red lines, running off from their margins, and marking the course taken by the acarus; and lastly, in that disease careful search will almost always enable us to detect the insect or its ova, which are infallibly characteristic of the disease.

From sudamina, with which eczema vesiculosum might perhaps be confounded, the latter disease may be distinguished by the facts that the vesicles constituting sudamina are much larger, that they are discrete and scattered, that they are associated nearly always with profuse perspiration, and that they are unaccompanied by an inflammatory state of the skin or by itching.

Eczema impetiginoides, especially when affecting the scalp, might possibly be mistaken for favus, from which, however, it may readily be distinguished by the facts that, in the latter disease, the pustules are imbedded in the epidermis, and that the crusts present a peculiar bright yellow color, and are of an umbilicated or cup-like shape.

Favus is also followed by incurable alopecia and is contagious, and microscopic examination will detect the peculiar fungus, the achorion,

upon which it depends, in all of which circumstances it differs entirely from eczema.

Prognosis.—Eczema infantile is rarely dangerous to life, though it sometimes occasions much distress to the health by the suffering, irritation, and especially by the loss of sleep, which it entails. In one instance, however, that came under our observation, of very severe eczema larvale combined with extensive impetigo figurata, in a child a few months old, the disease ended fatally some weeks after the child had been put under the charge of a homœopathic practitioner.

In the prognosis given by the physician, especially in the instance of extensive eczema pustulosum, he should never forget to refer to its probably long duration, and to its disposition to return even after an apparent cure has been effected. It often lasts, in this way, for many months, and sometimes for one or two years or even longer. This difficulty of cure, and obstinate tendency to recur, are often owing to its dependence on some constitutional disturbance, or upon derangement of the digestive system. It ought, therefore, to be looked upon as the expression of a general disorder; and its cure will at times be found to depend upon the removal of the constitutional fault.

It is on this account that the opinion has long been popularly entertained, that extensive eczema should not be treated by severe local remedies, since, if suddenly arrested by such means, the disease might fall with all the greater severity upon parts more important to life.

We no longer, however, attach any importance to this popular apprehension, and always endeavor to secure as rapid a cure as possible, by appropriate general and local treatment.

Treatment.—The remarks which have been already made in connection with the causes and constitutional character of many skin diseases, will readily suggest the indications which are to be followed in treatment. It is necessary to remove the constitutional disturbance which may be the essential cause of the affection, to allay the local distress, and to promote the healthy vigorous nutrition of the skin. These principles, which guide the practice of most dermatologists, are especially insisted on by Mr. Erasmus Wilson, who gives to *elimination* the first place; to *alleviation of local distress* the second; and to *restoration of power* the third. There are, however, some high authorities who regard the constitutional treatment in cases of eczema as of very secondary importance, and rely almost exclusively upon local measures. Our own observation has convinced us that the most rapid and certain cures can only be effected by a judicious combination of general and local remedies, either of which, however, may under special circumstances, assume peculiar and paramount importance.

The general treatment of eczema must depend on the state of health of the patient at the time, on the extent and activity of the eruption, and on its acute or chronic character.

In mild cases which show but little disposition to extend, and are not attended by much irritation, regulation of the child's diet, and the use of the most simple bland applications, will be sufficient.

When the disease is more extensive and attended with much irritation, it is necessary to examine carefully into the state of the digestive function, and if this be in any way disordered, to endeavor to restore it to a more healthful condition.

When the child is teething, the gums ought to be examined, and, if found swelled or inflamed, they should be lanced as often as necessary. The diet must be properly regulated, the food being changed if that which has been previously taken is found not to be well and completely digested.

Constipation, if it be present, must be overcome by altering the diet, or by the administration of rhubarb, small doses of magnesia, Rochelle salts, or sulphur. Purgatives have been strongly recommended by some writers in the treatment of eczema pustulosum, but we should advise their use only when constipation is present, and in hearty, vigorous children. In most cases, the gentlest laxatives, given merely to regulate the bowels, are to be preferred.

If there are evidences of acidity of the stomach, it is well to employ some of the various preparations of the alkalies.

So also when diarrhœa is present, it should be treated by attention to the diet; and by the administration of a weak castor-oil emulsion, containing small quantities of laudanum, when the stools are feculent, but small, frequent, and attended with griping; when they are thin and watery, greenish, and composed in part of mucus, the following prescription will often prove very useful:

℞.—Tr. Krameriæ, ... ʒj.
Tr. Opii, ... gtt. vj.
Sodæ Bicarb., ... ℈j.
Syrup Zingib., ... ʒvij.
Aquæ, ... ʒij.—M.

S.—A teaspoonful two or three times a day, for children of one and two years old.

When the eruption has persisted for some time, and tends to become, or has actually become, chronic, resort must be had to remedies which are capable of modifying the constitutional condition of the child. In many such cases, the child shows evidences of impaired nutrition, and is weak and debilitated; so that the remedies clearly indicated are those which will tend to invigorate the general health and aid in the restoration of power.

The remedy which extensive experience has led us to regard as the most useful in all such cases of chronic eczema is *arsenic*. The preparation of arsenic which is best adapted for administration to children is Fowler's solution; which we are in the habit of giving in combination with iron, as in the following formula:

℞.—Liq. Potassæ Arsenitis, ... ♏ xvj ad xxxij.
Vin. Ferri Amari,
Syr. Tolutani, āā, ... ʒj.
Aq. Carui, ... ʒij.—M.

Dose.—A teaspoonful thrice daily, directly after food, for an infant from six months to a year old.

We have never known any serious inconvenience to follow the administration of this remedy, the only annoying symptoms occasionally produced being slight gastric irritation and diarrhœa, and a little puffiness of the eyelids. By giving it immediately after taking food and properly diluting it, it rarely causes any gastric irritation, and even should it do so, the symptoms rapidly disappear if the remedy be temporarily suspended, or given in a smaller dose or less frequently. The mother or attendant, should, therefore, be carefully instructed to instantly suspend its administration upon the appearance of any disturbance of digestion. The puffiness of the eyelids, which is one of the earliest and most characteristic symptoms of the physiological action of arsenic, is of no alarming import, and the remedy need not be instantly suspended on account of its appearance: though it is more prudent, at least, to reduce the dose and frequency of administration, and to watch carefully for the occurrence of any further signs of the overaction of the drug.

The period of continuance of this treatment must depend upon the state of the eruption, and the manner in which the arsenic is tolerated; if necessary, however, and if it causes no gastric irritation, it may be continued for many weeks or months.

In cases which persist despite local treatment and the internal administration of arsenic, we have frequently found the use of cod-liver oil followed by marked benefit. It may be given combined with the arsenic, or, if the stomach will not tolerate it in an undisguised form, in the form of an emulsion with aromatics, as already recommended at page 363.

In cases attended with marked anæmia and debility of constitution associated with a scrofulous tendency, we have obtained good results from the administration of the syrup of the iodide of iron. This may be given in combination with the compound syrup of sarsaparilla, in the dose of from gtt. ij to gtt. v of the former, diffused in from a quarter to a half teaspoonful of the latter, three times a day, for children of one or two years of age.

It is recommended by some authors to administer calomel in considerable and frequently repeated doses in severe eczema. Mr. E. Wilson advises 1 gr. of calomel rubbed down with 1 gr. of white sugar or sugar of milk, as the dose for the youngest infant; for a child one year old, a grain and a half; for a child two years old, 2 grains; this dose being repeated once a week or oftener, according to circumstances. We have not, however, found any necessity for employing calomel as an element of our regular treatment, resorting to minute doses of it or of blue pill only when the stools are whitish or clay-colored and offensive; under which circumstances it has almost always been productive of good effects.

The diet should be nutritious and strengthening, but, at the same time, light and of easy digestion.

If the appetite is weak and capricious, tonic remedies, as tincture of bark, or quinia, in combination with the ferruginous preparation employed, ought to be administered.

In rare cases, where the patient is of full habit, of gross development, and of florid complexion, the diet must be somewhat restricted, and a

moderate use of cathartic remedies, as small doses of saline laxatives, of blue pill and extract of taraxacum, or of sulphur, resorted to.

Local Treatment.—In mild cases, when the patches of eruption are small, and with very little disposition to extend, and the degree of inflammation is slight, a cure may often be obtained with great ease by the application, twice or thrice a day, of an ointment composed of one part of ung. hydrarg. nitratis to three or four parts of simple cerate, or lard; of weak tar ointment; or of the benzoated oxide of zinc ointment, as recommended below; or it may even be sufficient simply to wash the eruptive patches with cool water several times a day, and to anoint them in the evening with ointment of cucumbers.

When the disease is attended with much irritation, the application of compresses repeatedly wet with cold water, or with some emollient decoction, as of marshmallow root, flaxseed, sassafras pith, or slippery-elm bark, or the use of warm bread and water poultices, are frequently of the greatest service in reducing the heat and irritation, and arresting the progress of the eruption.

The compresses must be repeatedly wetted with the cool applications, to prevent the temperature of the liquid from being raised by the heat of the body. They may be retained upon the part for several hours at a time, or throughout the day, as they may be found to suit the eruption, and during the night may be substituted by a dressing of benzoated oxide of zinc ointment.

When warm, moist applications, as poultices, are employed, they should always be covered with oiled silk to prevent them from drying.

The application which we have used with most marked and uniform advantage, and which we believe to be the one best adapted to the forms of acute eczema, is the benzoated oxide of zinc ointment,[1] applied in the manner directed by Mr. Erasmus Wilson.

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[1] We quote from Mr. Wilson (Diseases of the Skin, 7th Amer. ed., 1868, p. 771), the precise directions for preparing this ointment:

Bell's Formula.

Unguentum Oxydi Zinci, Benzoatum.

℞.—Adipis preparati, ... ℥vj.
Gummi Benzoini, Pulveris, ... ℥j.

Liquefac, cum leni calore, per horas viginti quatuor, in vaso clauso; dein cola per linteum, et adde

Oxydi Zinci, Purificati, ... ℥j.

Misce bene, et per linteum exprime.

If it be desired to make this ointment rather more stimulating, we may add a little alcohol, as in the following:

Unguentum Oxydi Zinci, Benzoatum, cum Spiritu Vini.

℞.—Ung. Oxydi Zinci, Benzoati, ... ℥ij.
Spiritûs Vini rectificati, ... f℥ij.

Misce, ut fiat unguentum.

Instead of spirit of wine, spirit of camphor, distilled glycerin, liquor plumbi

He directs "that the ointment should be applied abundantly, and gently distributed upon the surface until every part of the eruption has a complete coating; the ointment should be applied night and morning, and if accidentally rubbed off, or used upon parts exposed to the air and friction, it may be repeated more frequently. When once applied, the ointment should be considered as a permanent dressing to the inflamed skin, and never removed until the skin is healed, unless special conditions arise which render such a process necessary." To secure the permanent contact with the skin, he recommends that pieces of linen rag, or a small garment of linen, be kept constantly upon the parts covered with the ointment.

In cases where the disease has lasted some time, and the discharge has dried, so as to form more or less thick and hard crusts, it is absolutely essential to get rid of these entirely before any of the applications to be hereafter recommended can be efficiently applied. This is especially the case in eczema capitis, when masses of scabs have been allowed to collect and mat the hair together. The removal of these crusts is best effected by the use of thick, moist, and soft poultices, which, when applied to the head, should be inclosed in a fine linen rag, in order to prevent the matter of which the poultice may be composed from adhering to the hairs. Over the outside of the poultice should always be placed an oiled silk covering, to preserve it moist and soft. The poultice may be made of almost any unirritating material usually employed for such purposes. One of the best is that made of stale bread and water, with the addition of a little washed lard or hot almond-oil to keep it soft. The water is preferable to milk, as the latter often sours soon after being applied. Another excellent poultice is one made of ground slippery-elm bark, mixed with a little flaxseed or Indian meal, to give it a slightly greater consistence. Each poultice may be allowed to remain on the part for three or four hours.

After the crusts have been entirely removed, and the inflammatory condition diminished by means of the emollient applications above recommended, the latter may be dispensed with entirely, or during the greater part of the day; or they may be used only during sleep, at which time they are usually best submitted to by the child. At this stage of the disease it becomes proper to make use of different lotions and ointments intended to modify the action of the diseased skin.

The number of local remedies recommended in the books for eczema in its various forms is, however, so enormous, that we shall refer only to those which we have ourselves made trial of and found useful, or which come from such sources as entitle them to our attention.

The choice between the use of lotions or ointments must depend very much upon trials made in each particular case, since it will be found that some are irritated by all, even the mildest ointments, and bear lotions only, while in other instances exactly the opposite occurs.

Amongst the lotions, the most soothing and beneficial are a weak solu-

diacetatis, Peruvian balsam, or the juniper tar ointment, may be combined with the benzoated ointment of oxide of zinc, in the same proportion as above, one drachm to the ounce.

tion of borax containing morphia; weak lead-water; a sulphuro-alkaline lotion, as the following:

℞—Potass. Carbonat., ... ℥ss.
Sulph. Sublimat., ... ʒj.
Aquæ Fluvial., ... f℥viij.
Ft. Sol.

Or weak solutions of bichloride of mercury, gr. ss. to f℥j, as Van Swieten's liquor:

℞.—Hydrarg. Chloridi Corros., ... gr. xviij.
Alcohol, ... f℥iij.
Aquæ Destillat., ... f℥xxix.
Ft. Sol.

These lotions may be applied on pledgets of lint wetted with them, or, if such prolonged applications prove irritating, they may be used by merely washing the part with them for a quarter of an hour each time.

We have ourselves usually found that ointments afford more relief in such cases, and the one which we think the most appropriate, is the ointment of the benzoated oxide of zinc, rubbed down with a little alcohol. Among the other ointments highly recommended, are those containing oxide of lead or calamine, or citrine ointment diluted with two or three parts of simple cerate.

When the eruption is confined to a rather small surface and is not very acute and rapid in its progress, or when the activity of the inflammation has been somewhat subdued, more powerful local remedies may be employed. Among these may be mentioned a saturated solution of borax in dilute acetic acid; stronger solutions of corrosive sublimate; solutions of nitrate of silver, of from 2 to 10 grains to the ounce; or such ointments as the citrine, either pure or mixed with an equal amount of lard or simple cerate; or, ointments containing protiodide of mercury:

℞.—Hydrarg. Protiod., ... gr. xij.
Camphoræ, ... gr. v.
Axungiæ, ... ʒj.—M.
Apply twice daily.

Or, calomel:

℞.—Hydrarg. Chlor. Mitis, ... ℈j.
Camphoræ, ... gr. v.
Glycerinæ, ... fʒj.
Ungt. Aquæ Rosæ, ... f℥j.—M.

Tar ointment, or either of the zinc ointments, may also be used.

After the activity of the inflammation has been diminished by treatment or by time, and the disease tends to pass into a chronic form, it becomes necessary to make use of more stimulating applications than those just named. The best of these remedies are those which contain alkaline substances, tarry substances, or mercury.

The remedy from which we have obtained the most beneficial effects in such cases, is the *spiritus saponatus kalinus* of Hebra, which is prepared by dissolving soft (potash) soap in alcohol (in the proportion of two parts of the soap to one of alcohol), filtering the solution, and scenting it with spiritus lavandulæ, or any other aromatic spirit:

℞.—Saponis Mollis, ... ℥ij.
Alcoholis, ... f℥j.
Misce, et cola.

In the use of this application it is essential, as directed by Hebra, that the soap should be firmly rubbed into the eruptive patch by means of a piece of flannel or a brush, till the accumulated masses of epidermis are removed, and a little blood is seen to ooze from the red base which has thus been exposed.

Other ointments and lotions containing alkaline substances are also recommended, such as those containing carbonate of potash, gr. xx to xxx to ℥j of lard (Neligan), or caustic potash, gr. ij to gr. x to f℥j of water. This latter application is especially useful in cases where the eruption is confined to limited patches, and is attended with much infiltration of the skin. If the stronger forms of the solution are used, they should, after being applied quickly by means of a brush, be washed off by a large brush wetted with pure water.

Tarry applications also are among the most useful in the chronic form of eczema. They may be made in the form of ointments, as the officinal tar ointment, or the following, recommended by Rilliet and Barthez as successful in their hands:

℞.—Vini Opii, ... f℥ss.
Picis Liquidæ, ... ♈vjss.
Axungiæ, ... ℥j.—M.

Or, they may be combined with an alkali, as soft soap, as is done in Hebra's tinctura saponis viridis cum pice; which is made by adding one part of tar to three of the spiritus saponatus kalinus.

The tarry ingredient in these may be either *common tar; oil of cade* (oleum cadinum, huile de cade), a product of the dry distillation of the wood of the *Juniperus oxycedrus; oleum fagi*, obtained from the beech; or *oleum rusci* or *betulæ*, which comes from the bark of the *betula alba*.

When used in the form of soap, it should be rubbed firmly over the affected surface, or even be allowed to dry on.

Dr. Duhring, of Philadelphia (*Dis. of the Skin*, 1876, p. 191), recommends in cases of localized eczema, with much infiltration of the skin, the use of an ointment or lotion containing caustic potassa in addition to tar. The amount of potash must be carefully regulated by the susceptibility of the skin, as much irritation may follow if too large a proportion be used.

The forms of *mercury* best adapted to this stage are the nitrate, the protiodide, and the mild chloride, which may be combined with lard in

a larger proportion than that recommended for an earlier stage of the disease.

In cases of eczema tarsi, attended with infiltration of the eyelids, McCall Anderson recommends that the eyelashes should be extracted, the eyelids everted and a solution of caustic potash grs. v or x to f℥j applied and quickly washed off by a large brush. Care should be observed in case the edges of the eyelids are adherent in the morning, not to separate them rudely, but to moisten them with tepid water or milk and water, so as to soften the crusts. Afterwards an application of citrine ointment, diluted with about two parts of lard, should be made along the edges of the lids night and morning.

ARTICLE II.

HERPES.

Definition; Varieties; Frequency.—Herpes is a non-contagious cutaneous disease, characterized by an eruption of vesicles assembled in groups on inflamed surfaces, of irregular size and shape, which are separated from each other by perfectly healthy portions of skin. The disease is usually acute in its course, seldom lasting more than two or three weeks, but it is not, as a general rule, accompanied by any severe constitutional symptoms. The separate vesicles composing the eruption last about ten days, and then disappear by the absorption of their contents, by the drying up of the contained fluid without rupture of the vesicles, or by the rupture of the vesicles, the escape of the fluid, and the formation of thin, brownish, or yellowish scabs.

There are several different varieties of herpes, which have been well divided by Mr. Wilson into two groups, the *phlyctenoid* and *circinate*. The phlyctenoid group is characterized by the irregularity of form exhibited by the eruption, and includes the variety called herpes phlyctenodes, and the local forms, called according to their seat, labialis, nasalis, palpebralis, auricularis, præputialis, and pudendalis; whilst the circinate group is characterized by the arrangement of the vesicles in circles, and includes the herpes zoster and iris. Of these different varieties we shall describe, as of importance in children, only the *phlyctenodes*, *zoster*, and *iris*. Herpes circinatus, formerly included in this group, will be found described in the article on tinea.

Herpes is quite a frequent disease in children, though one rarely of any considerable importance.

Causes.—The causes of herpes are often obscure and uncertain, and in many cases entirely inappreciable. The disease is most common in persons who possess a delicate and irritable skin. The most frequent and most clearly ascertained cause is some disturbance of the digestive functions, and when there exist, in connection with this condition, irritations

or inflammations of the respiratory mucous membrane, it is especially apt to be developed. Herpes phlyctenodes often follows exposure to a hot sun, while herpes labialis is frequently caused by exposure to a cold wind, especially when this occurs immediately after leaving a heated room. The latter variety also frequently accompanies coryza, angina, and stomatitis, and appears often as a critical eruption in the course, and particularly at the termination, of fevers, catarrhs, and visceral inflammations.

The usual exciting causes of the disease are irregularities in diet, exposure of the body while in a heated state to cold and damp, local irritants, malarial disease, and bilious disorders of all kinds.

The cause of herpes zoster is peculiar. The eruption appears, in nearly if not quite all cases, to be dependent upon a morbidly irritable state of some nerve-trunk; which may be the result of simple or rheumatic inflammation, of pressure, of mechanical irritation, etc.

Herpes Phlyctenodes. — This variety of herpes, unlike the other forms of the disease, may appear upon any part of the cutaneous surface, and does not assume a determinate shape. It may appear, indeed, upon several parts at the same time. It is usually, however, met with upon the upper parts of the body, and particularly the cheeks, neck, chest, and arms. It is rare to observe it on the lower extremities.

We believe it to be a rare affection amongst the children of families in easy circumstances. The only examples that we have seen have been the result of poisoning by the different kinds of Toxicodendron.

Symptoms.—The eruption appears in the form of vesicles, usually of very small size, looking like mere points, or attaining sometimes the size of a pea, which are seated in groups or clusters on inflamed patches of the skin, varying in size from that of a dollar to that of the palm of the hand. Sensations of heat, smarting, and itching, are often felt in the part where the eruption is about to show itself; and within a day, usually, after these symptoms have been observed, or without them, the disease makes its appearance, exhibiting one or more red and inflamed surfaces, of an irregular or rounded shape, dotted over with projecting, globular vesicles, which are hard, resisting, and, on the first day, transparent, but which become, in the course of a day or two, turbid or lactescent. The red color of the eruptive patch generally extends a short distance beyond the vesicles: the integument between the different patches retains, however, in all cases, its healthy color and character. A sense of smarting and itching accompanies, as well as precedes, the eruption. On the second day of the eruption, the number of vesicles gradually increases, and they become full and distended. About the third or fourth day, the vesicles have become very turbid, and they begin to shrink. About the seventh or eighth day, they are usually transformed, by the drying up of their contents, into thin, brownish crusts, which fall off by desquamation about the tenth or twelfth day. There also remains, for a few days after the disappearance of the eruption, some redness of the surface, which subsides little by little.

This variety of herpes is never accompanied by constitutional symptoms

of any severity. A very slight febrile reaction, some languor, loss of appetite, and thirst, are the only ones worthy of note.

Herpes Labialis.—This is the most frequent of all the varieties of the disease. It is, as its name implies, a disease of the lips. Usually it is seated upon the line of junction of the mucous membrane with the integument; but it may affect either the former or latter alone. Though generally confined strictly to the lips, the eruption, in some instances, extends to the cheeks, chin, or alæ of the nose.

The disease begins generally with redness, heat, smarting, and painful tension of the portion of the lip upon which the eruption is about to appear. After a few hours, or a day, vesicles begin to show themselves upon the inflamed spot, and there is then observed a red, swollen, and shining point, upon which is seated a group of vesicles. The tumefaction and redness commonly extend some distance beyond the vesicles. The latter develop themselves rapidly, until five or six small, rounded vesicles, filled with a transparent fluid, are seen. The vesicles remain solitary, or several may unite together to form one of considerable size. After the complete development of the eruption, the burning pain which existed at first commonly subsides. The contents of the vesicles soon become turbid and lactescent, and are converted, by the third or fourth day, from a serous into a sero-purulent fluid, at which time, also, the accompanying redness and swelling have, in great measure, disappeared. Soon after this, brownish crusts are formed by the drying up of the fluid of the vesicles, and these drop off usually about the seventh or eighth day. A slight redness remains for a short time at the point of eruption, and then disappears entirely.

Herpes Zoster.—This variety of herpes is known also by the names of Zona and Shingles. It is of much less frequent occurrence, in this city, in children, than either the herpes labialis or circinatus. We have seen but few examples of it in children, though Rilliet and Barthez state that they met with this form and the herpes labialis more frequently than any other.

The name of the disease, herpes zoster, the latter word signifying a girdle or belt, is derived from the fact that, when it attacks the trunk the eruption appears in the form of a half zone, surrounding half the body.

The most frequent seat of zona is the base of the thorax, the disease extending usually, in the form of a cincture, from the mesial line in front to the same point behind. It may, however, be developed either above or below the part just named, and, under these circumstances, is apt to extend towards or down the arm, or towards the thigh and down the leg. Still more rarely, it has been observed upon the neck, face, or scrotum. It will be found to nearly always follow the course of some nerve tract; and is usually confined to one side of the body. The zone formed by the eruption is not composed of a continuous line of vesicles, but is made up of distinct patches of eruption, all following the same general direction, but divided from each other by portions of healthy integument. The eruptive patches may be very closely approximated, or they may be separated by considerable spaces of skin untouched by the disease.

The disease is acute in its character, lasting, as a general rule, from one to three or four weeks.

Shingles appear first, after some previous smarting and burning in the skin, and neuralgic pains which may have lasted one or two days, in the form of irregular patches of a vivid red color, more or less widely separated from each other, and developed, one after the other, until one-half the body is girdled by the eruption. In some instances, the disease appears simultaneously at the two extremities of the zone, and is terminated by the gradual formation of successive patches between these two points. Soon after the appearance of the inflamed patches, numerous small, white projections can be seen, by careful examination, upon the red surfaces; these increase rapidly in size, and are soon converted into distinct, transparent vesicles. The vesicles augment in size, and arrive, in the course of three or four days, at their fullest development, when they are about as large as small or large peas, or, in some few instances, much larger. At this stage of the eruption, the red surface upon which each group of vesicles is seated extends a slight distance beyond the patch, thus forming a kind of areola.

After pursuing the course just described during four or five days, each group of vesicles begins to subside. The redness of the inflamed patch diminishes; the vesicles shrink, and become shrivelled; their contents, which were transparent at first, become opaque, and finally they dry up and form small, dark-brown scabs, which fall off about the tenth or twelfth day, leaving behind reddish spots, which disappear little by little.

The constitutional symptoms of herpes zoster consist usually of slight feverishness, languor, and the signs of gastro-intestinal irritation. The local symptoms are pungent and burning pain at the beginning of the eruption, and more or less severe tension, and sometimes acute pain, in the part upon which the disease is seated, which latter lasts, in some instances, throughout the course of the disorder, or even for some considerable time after it has disappeared. This neuralgic pain which appears to be dependent on the implication of a nerve-trunk varies much in intensity, being at times slight, and at others very intense.

Herpes Circinatus.—This variety of herpes has been called also ring herpes, herpetic ringworm, and vesicular ringworm; it will be found described under the name *tinea circinata* in the article on parasitic diseases of the skin.

Herpes Iris.—This is a very rare variety of herpes, and one that we have met with in children in but two instances, although according to Duhring (*op. cit.*, p. 228) it is comparatively frequent in children and young people. It begins with small red spots, which are soon surrounded by four or five rings of different shades of redness. About the second day of the eruption, the central red spots present in their centres one or more vesicles, and on the third and fourth days, vesicles of very minute size generally appear on the outer concentric rings. After two or three days, the fluid contained in the central group of vesicles, which was transparent at first, becomes turbid, and about the fifth or sixth of the eruption, it is absorbed, and the disease terminates by a slight desquamation. The

vesicles formed on the outer ring undergo the same changes as those described as occurring on the central ones. In some instances, the vesicles open, and their contents escaping, form small, thin, and brownish scales, which fall off in ten or twelve days.

Herpes iris may attack any part of the body, but is most frequently developed upon the face, hands, fingers, and neck.

According to some dermatologists, as McCall Anderson, herpes iris is a parasitic disease and merely a form of tinea versicolor. This view however does not appear to us to be correct.

Diagnosis.—The diagnosis of herpes is seldom attended with any difficulty. The small size of the vesicles, their globular shape, their number, their aggregation upon distinct patches of inflamed integument, and the slight degree of constitutional disturbance attendant upon the disease, all render the eruption unlike any other cutaneous affection, and therefore easy of recognition.

Herpes phlyctenodes might possibly be confounded by an incompetent observer with pemphigus. The recollection that the eruption in pemphigus consists of distinct bullæ, much larger, of course, than the vesicles of herpes, while that of herpes phlyctenodes consists of numerous vesicles, much smaller than the bullæ of pemphigus, and closely dotted over isolated red patches, will always serve to distinguish the two affections. It might be mistaken also for eczema, when the vesicles of the latter are disposed, as sometimes, though rarely, happens, in groups. The distinction may be made, however, by attention to the facts that the eczematous vesicles are redder, less elevated, scarcely transparent, and that, though arranged in groups, they are confluent, whilst in herpes they are always distinct.

Herpes labialis is not likely to be mistaken for any other eruption. Herpes zoster may always be distinguished by the peculiar belted form assumed by the eruption, by the arrangement of the eruption in the course of some nerve-tract, and by the neuralgic pains which attend it.

There is but one disease with which herpes iris is likely to be confounded,—roseola annulata. The entire absence of vesicles in the latter affection will always, however, enable us to make the distinction.

Prognosis.—The *prognosis* of herpes is always favorable. It is never in itself a dangerous disease, though the variety called zona often causes much suffering, and is moreover usually the expression of a considerable disturbance of the general health.

Treatment.—The different varieties of herpes seldom require more than the mildest treatment. In all, attention should be paid to the general health. The diet must be regulated according to the state of the digestive function. When constipation is present, especially if there be some febrile reaction at the same time, gentle laxatives ought to be administered, such as sulphur, magnesia, syrup of rhubarb and magnesia, or castor oil. If the skin be sallow, the tongue heavily coated, the breath foul, and the stools scanty and light-colored, or very offensive, small doses of blue pill in combination with rhubarb, or followed by rhubarb and magnesia, would be the most appropriate remedy. Excessive or frequently-repeated doses of any purgative ought to be avoided, as the de-

bility and gastro-intestinal irritation that so often follow such practice, are more injurious than the original disease.

The local treatment of herpes is important, and is, indeed, in many cases, all that is necessary.

Herpes phlyctenodes requires nothing more than mucilaginous lotions, an occasional warm bath, or the frequent moistening of the eruption with a liniment made of equal parts of lime-water and sweet-oil. Herpes labialis, if it demand local treatment at all, may be relieved by the use of any mild lip-salve; a very good ointment is one composed of equal parts of Goulard's cerate and simple cerate, with a few drops of glycerin. Mr. Wilson recommends the following ointment:

℞.—Unguent. Flor. Sambuci, ... ℥j.
Liq. Plumbi, ... f℥j.—M.

During the early stage of herpes zoster, the local treatment should be such as will tend to allay inflammation and relieve pain. These effects may be obtained by applying compresses moistened with some kind of mucilage, such as barley-water, or decoction of flaxseed or slippery-elm bark, or with simple cold water, or with weak lead-water and laudanum. When the eruption is followed by excoriations or ulcerations, and the pain is severe, the latter may be allayed by the use of an ointment consisting of equal parts of Goulard's cerate and lard, either alone, or containing two or three grains of opium, or half a drachm of the watery extract of opium. Underwood recommends, when the discharge has subsided, and the scabs have formed and become adherent, that they should be anointed twice daily with the ung. hydrarg. ammoniat. It is, however, necessary to also employ some internal treatment to relieve the neuralgic pains, which are so prominent a symptom. For this purpose, opium must frequently be employed. We have also found that the combination of iron, quinia, arsenious acid and belladonna has afforded marked relief in some cases. Phosphide of zinc has been highly recommended by Ashburton Thompson in doses of one-third of a grain for an adult. The employment of a galvanic current, applied along the tract of the affected nerve has proved very beneficial.

Herpes iris seldom requires any treatment. If any be determined on, it should consist of alkaline lotions, or of water rendered slightly astringent by the addition of alum, or sulphate of zinc.

ARTICLE III.

SCABIES.

Definition; Synonyms; Frequency.—Scabies is a contagious eruption of the skin, characterized by the formation of papules, vesicles, or pustules; the vesicles being pointed, generally discrete, and usually pre-

senting small red lines, of one or several lines in length, running off from them. The eruption is attended with severe itching, and is caused partly by the presence in the skin of a small insect, called the *acarus scabiei*, and partly by the scratching which the intolerable itching provokes.

Causes.—Itch is a contagious malady, and is in all probability caused only by contact, either immediately with some person laboring under the disease, or with articles of clothing worn by an infected individual.

It is much more frequently met with amongst the poor and destitute, whose habits are uncleanly, who live closely packed together in small and inconvenient houses, and in whom, therefore, the means of communication are more abundant, than amongst the easy classes of society, whose habits, and, consequently, liability to contact, are the opposite of those just named. It is, however, comparatively rare in the United States, and particularly in this city: thus Duhring met with but 12 cases out of 2472 consecutive cases of skin disease.

The disease usually appears in children in from four to five days after the exposure to contagion. In healthy, sanguine children, it often shows itself within a shorter time—after two days—while in those who are feeble and weakly, the period of incubation may be even longer than four or five days.

Symptoms.—The first symptoms of itch appear in the part to which the cause, a contagious contact, may have been applied. In infants at the breast, it is usually first developed on the hips and thighs, as it is those parts that are most constantly in contact with the nurses who carry the child, and from whom young children generally receive the infection. In older children, the disease commonly appears first on the wrists and between the fingers, and extends thence more or less quickly to the flexures of the elbows, and to the axillæ and abdomen. It rarely or never attacks the face in adults; but in children, even this part is not, according to M. Richard, exempt. (*Trait. Prat. des Mal. des Enfants*, p. 590.)

The disease is always attended with severe itching, which, in infants, causes uneasiness and fretfulness, and, in older children, violent scratching. The itching is increased by the heat of the bed-coverings, and is, therefore, most troublesome at night. The eruption appears in the form of more or less numerous vesicles, which are small, discrete, acuminated, and transparent at the top. The vesicles are at first of a faint rose color, and they contain a viscid transparent serum. Their number is variable, being sometimes very abundant, and at others sparse. They either open spontaneously, or are soon broken by the fingers or clothes, and are followed by small, thin, slightly adherent scabs. In some instances the action of the nails causes slight effusions of blood, which dry into small bloody scabs, like those of prurigo, thus embarrassing to a certain extent, the diagnosis of the disease. Sometimes, particularly when the inflammation attendant upon the eruption, or that caused by scratching, is marked, there are, intermingled with the psoric vesicles, pustules of impetigo, or perhaps papules of lichen, which tend, like the sanguine crusts just alluded to, to render the diagnosis difficult. Indeed it is not strictly correct to define scabies,

as was formerly done, as a vesicular affection, since the eruption is papular in a very large proportion of cases.

When a recent vesicle is carefully examined, there may generally be observed running off from it, in a straight, curved, or zigzag direction, a whitish or reddish line, like that produced by the scratch of a pin. This line marks the course of the fecundated female of the acarus scabiei in its burrowings under the epidermis, and is called the cuniculus, or burrow. It varies in length from one or two, to five or six lines. At the point where it terminates opposite to the vesicle, there is usually to be seen a small rounded projection, deeper in color than the rest of the cuniculus, beneath which lies the insect. The acarus can often be found at this spot, and removed, by carefully introducing horizontally under the epidermis the point of a small needle, and by manipulating so as to take off a small layer of the epidermis. The insect clings to the point of the needle, and can then be extracted from its lodgment.

The number and extent of the vesicles vary greatly in different subjects. In some they are confined to limited surfaces, while in others, and particularly in robust, sanguine children, and in those who are neglected and imperfectly cleansed, they extend to many different parts, or over the greater part of the body.

Itch occasions in children much irritability and suffering, and when neglected may injure seriously the general health, and cause emaciation and debility.

The acarus scabiei is an arachnoid insect, varying, according to Mr. Wilson's measurements, between $\frac{1}{144}$ and $\frac{1}{77}$ of an inch in length, and between $\frac{1}{303}$ and $\frac{1}{93}$ of an inch in breadth. It is of a whitish and shining color, when examined with the naked eye, of a globular form, and is provided with eight legs, four anterior and four posterior. A most accurate and minute account of the structure of the insect is given by Mr. Wilson in his work on diseases of the skin (7th Amer. ed., p. 739). Besides the female, which is found as before stated, at the extremity, the cuniculus contains a varying number of ova, rarely more than twelve or fourteen; there are in addition numerous little oval or round blackish spots, which are supposed to be excrement. These ova are about $\frac{1}{300}$ of an inch broad, and $\frac{1}{120}$ of an inch in length, though their size varies according to their age. After the escape of the acarus the shell appears shrivelled, with two slits in it.

Diagnosis.—The most characteristic marks of itch are the presence of the cuniculi and of the insect which causes the disease. If the acarus or its ova can be extracted from the skin, there will remain, of course, no doubt; and if the cuniculi be distinct and numerous, the diagnosis becomes almost as certain as when the insect itself is obtained. Before endeavoring to detect the cuniculi, it is always advisable to make the patient wash the part thoroughly.

In doubtful cases, it has been recommended by Gull and Hilton Fagge to search for the ova in the crusts or the thickened and undermined cuticle in the neighborhood of the vesicles. In order to detect these, a small piece of the crust should be boiled in a solution of caustic soda, ʒss.

to f℥j of water, until it is in great part dissolved; the fluid should then be allowed to settle, the supernatant part decanted and the deposit examined, which will, in cases of true scabies, be generally found to contain larvæ, ova, or egg-shells.

When, on the contrary, the insect cannot be found, and when the cuniculi are absent or not distinct, the diagnosis becomes more uncertain. The diseases with which it is most likely to be confounded are eczema simplex, prurigo, and lichen simplex. From the former it may usually be distinguished with certainty by attention to the following points. In eczema the vesicles are flattened, or globular, scarcely raised above the surface, and they are collected together in clusters; in itch they are acuminated, elevated, and either entirely distinct, or much less confluent than in eczema; in eczema there is a sensation rather of pricking than itching, whilst in itch the sense of itching is severe and distressing; and lastly, itch is communicable by contact, whilst eczema is never contagious.

Prurigo begins with papules, which always remain such. The scabs in prurigo are small and black, consisting of coagulated blood, caused to exude by the rubbing off of the top of the papule; while in scabies the scabs are more like thin, yellowish, and friable scales. The seat of the two eruptions is different. Prurigo is developed upon the back, the shoulders, and upon the extensor surfaces of the limbs; while itch appears first about the thighs and buttocks, between the fingers, or about the flexures of the joints. Lastly, prurigo is never, itch always, contagious.

Lichen simplex is a papular disease, in which the papules are closely agglomerated, while in scabies the papules, if present, are conjoined with vesicles, and are discrete. Lichen sometimes affects the hands, and might then be mistaken for itch; but in the former the eruption affects the dorsal surface of the hands, while in the latter it appears in the interspaces of the fingers. Lichen is never attended, as itch always is, by severe pruritus. Attention to these points of difference will almost always render the diagnosis of the two diseases very easy and certain.

When, as sometimes happens, scabies is intermingled with other eruptions of the pustular, papular, or vesicular kind, the diagnosis can be arrived at with certainty, only by careful attention to the cuniculi, or by the detection of the insect. When neither of these characteristic conditions are present to mark the true nature of the disease, there will always remain some doubt as to the diagnosis.

Under these circumstances, however, it is advisable to treat the case as one of scabies, since the specific remedies for this affection will not be injurious, even if they do not speedily cure the eruption.

Prognosis.—Itch is a mild disease, which never disturbs the health seriously.

Treatment.—If the inflammation produced by scratching be very severe, it may be necessary to allay it by emollient applications, though this rarely happens.

In children, as in adults, the best treatment of itch is the use of sulphur by inunction. The ungt. sulphuris of the American Pharmacopœia, consisting of one part of sulphur to two of lard, should be well rubbed into

the skin before a fire, morning and evening, for two days. The child should be kept in a flannel gown, and in bed, during this treatment. On the morning of the third day, the skin may be washed clean with soap and water, or by immersion in a warm bath. This plan rarely fails to effect a cure. Should it happen, however, to fail, the treatment must be repeated. Before the application of this or any of the other ointments, the surface should be well scrubbed with soap and hot water, so as to cleanse and soften the skin.

It also increases the effect of the sulphur, to conjoin with it some alkaline substance, as in the various sulpho-alkaline ointments and lotions, of which the following are among the best:

Ung. Sulphuris cum Potassa (Wilson).

℞.—Sulphuris Sublimati, ... ℥j.
Potassæ Carbonatis, ... ℥ij.
Unguenti Benzoati, ... ℥v.
Olei Anthemidis Essentialis, ... f℥ss.—M.

Helmerich's Formula.

℞.—Sulphuris Sublimati, ... ℥ij.
Potassæ Carbonatis, ... ℥j.
Adipis Preparati, ... ℥viij.—M.

Vlemingkx's Formula.

℞.—Calcis Vivi, ... ℥ij.
Sulphuris Sublimati, ... ℥iv.
Aquæ Fontanæ, ... f℥xx.

Boil in an iron vessel, and stir with a wooden spatula to a perfect union.

These are all quoted in the proportions directed for adults, which are much too active to be applied to the delicate skin of children; they should therefore be diluted one-half at least.

Anderson recommends the use of oil of cade or tar, combined with the sulpho-alkaline ointments.

As the use of the sulphur ointment is sometimes objected to in private families, on account of its disagreeable odor, various substitutes have been recommended. Mr. Wilson states that he found camphor dissolved in oil, in the proportion of one drachm to the ounce, answer every purpose of eradicating the disease; and Dr. Coley (*Prac. Treat. on Dis. of Children*, Phil. ed., 101) speaks highly of an ointment composed of a drachm of iodide of potassium to an ounce and a half of lard, of which a little is to be applied all over the body, except the head and face, every night.

Ointments containing carbolic acid or petroleum are also used with good effect.

The use of stavesacre and hellebore has lately been revived, and apparently with good success; and Anderson highly recommends an ointment made by melting together one part of liquid styrax with two of lard.

The disease rarely requires any constitutional treatment. If, however, any complication exist, or the general health be deranged in any way,

such measures as may be necessary for the removal of either of these conditions should be employed, in connection with those proper for the specific disease.

CHAPTER III.

BULLÆ.

ARTICLE I.

PEMPHIGUS OR POMPHOLYX.

Definition; Synonyms; Varieties; Frequency.—Pemphigus is an eruptive disease, characterized by the presence on one or several parts of the body of more or less numerous bullæ of considerable size, nearly always isolated, resting upon circular or oval erythematous patches, about as large or somewhat larger than the bases of the bullæ themselves. The bullæ form in the course of a few hours, and contain at first a limpid serum, which soon becomes reddish or turbid; they terminate by desiccation and the formation of thin crusts, or by rupture and the escape of their contents, when there remains behind a superficial ulceration.

Authors formerly described numerous varieties of this disease, and gave to some of them the title of pompholyx. Of late years, however, these have been reduced to a few forms, and we shall confine our remarks to those most apt to occur in children. The only variety which is really important in children is the pemphigus acutus. The pemphigus chronicus, a dangerous and not unfrequent variety in old people, is so rarely met with in early life, as to make it unnecessary for us to describe it. Another species of bullar eruption, formerly called pemphigus infantilis, is now more properly classed as rupia escharotica, under which title we shall give an account of it.

Pemphigus is not unfrequently met with in young children who become the inmates of hospitals, almshouses, and foundling hospitals, and amongst the poor and destitute classes of large cities. Still it cannot be said to be a frequent disease.

Causes.—The causes of pemphigus are often obscure or entirely inappreciable. It is usually supposed, however, to depend, in children, upon the influence of the act of dentition, on disturbances of the gastro-intestinal tube brought about by improper food or overfeeding, and on general disorder of the nervous system. It is one of the most frequent eruptions in congenital syphilis (see p. 877), and is not rarely present at birth in such cases.

Symptoms.—Acute pemphigus may be confined to a very small portion of the cutaneous surface, or it may affect several regions of the body at

once. It is usually attended with symptoms of constitutional disturbance, which, especially in very young infants, may be slight, consisting merely of general uneasiness, languor, and some acceleration of the pulse; or they may be severe, exhibiting in such cases a dry and burning skin, frequent pulse, thirst, and loss of appetite.

After the above constitutional symptoms have lasted one, two, or three days, the eruption makes its appearance in the form of small circular red spots, which increase in size, and soon exhibit a bleb or bulla rising in the middle or over the whole of the red spot. The vesicle commonly appears a few hours after the red patch, and consists of an elevation of the cuticle by an effusion of serum beneath it. The bulla rapidly distends by the increase of the serous effusion, until it attains the size of a pea, a hazelnut, or a large walnut. It is of a circular or oval form, and may be confined to the centre of the erythematous surface on which it rests, being surrounded in such cases by a more or less wide red line of inflammation, or it may occupy the whole or nearly the whole of the red patch, under which circumstances it entirely conceals the latter, or is surrounded by a very narrow red ring. The color of the areolæ around the bullæ is very bright during the first day of the eruption, while the integument between remains perfectly healthy.

The fluid contained in the bullæ soon becomes turbid; the bullæ become wrinkled, and usually burst after one or two days, and are replaced by thin yellowish or brownish scabs. The crusts begin to form before the redness of the integument has disappeared. In some instances the bullæ do not break, but their contained fluid becomes yellowish in color, and then turbid; it diminishes by absorption, and, at the end of about a week, dries into a thin dark-colored scab. The crusts usually fall off in the course of two or three weeks, leaving the skin beneath of a reddish color, but in other respects healthy. The whole duration of the disease is commonly from one to three weeks, the time in each case varying with the mode of the eruption; when all the bullæ appear simultaneously, seldom lasting more than one or two weeks; while in cases in which they appear at successive periods, lasting three or even four weeks.

Diagnosis.—The diagnosis of pemphigus acutus is seldom difficult. The large isolated bullæ, seated on inflamed patches of the integument, filled with transparent serum, and followed by thin lamellated scabs, are unlike any other kind of eruption. From rupia, the other form of bullar disease, it is to be distinguished by the smaller number of blebs in the former, by their greater flatness, and by the facts that these are followed by true ulcerations, and by thick and prominent scabs.

Prognosis.—Acute pemphigus is rarely dangerous when it exists without complications. When, however, it is very extensive, and accompanied with severe constitutional symptoms, and particularly when it exists in connection with other diseases, or occurs in a child whose health has been broken down by unwholesome hygienic influences, it may assume a dangerous character, and the prognosis should, therefore, always be guarded under such circumstances.

Treatment.—Simple acute pemphigus requires, as a general rule, no other treatment than attention to diet, and regulation of the digestive function. When constipation is present, this should be overcome by means of simple enemata, or by the use of some mild laxative, as manna, spiced syrup of rhubarb, or very small doses of castor oil. If the discharges be too frequent, they should be restrained by the use of opium in doses proportioned to the age of the child. In young infants, it will often be found that the gastro-intestinal secretions are of an acid and irritating character. This condition may be treated with small doses of paregoric or laudanum, combined with lime or magnesia-water, or with soda. The diet must be managed according to the state of health of the child. For an infant, a good breast of milk is, of course, the best treatment in the world. For older children, the diet ought to be light and unirritating, but, at the same time, nourishing and strengthening.

The local treatment should consist, in the early stage, of an occasional warm bath. When the bullæ have fully formed, they ought to be punctured, and the fluid gently pressed out, care being taken not to remove the cuticle, as this forms the best possible dressing for the inflamed integument. When the bullæ are followed by excoriations, these may be dressed with an ointment consisting of equal parts of Goulard's cerate and simple cerate, made a little soft by the addition of glycerin, or with carrot or elder-flower ointment, or with Turner's cerate. Much relief may also be gained from the use of water dressings by means of cloths.

When the child shows signs of debility during the progress of the disease, and also when the eruption tends to assume a chronic course, the treatment ought to be tonic and invigorating. It should consist in the use of a nutritious diet, and in the exhibition of tonics, as Huxham's tincture of bark, in small doses, quinia, arsenic, cod-liver oil, or in the use of wine-whey, or small quantities of brandy.

ARTICLE II.

RUPIA.

Definition; Varieties.—Rupia is an eruptive disease, characterized in its early stage by distinct, somewhat flattened bullæ, of more or less considerable size, containing at first a serous, and then a purulent or blackish fluid: at a later period the disease exhibits very thick scabs, and still later, ulcerations.

There are three varieties of this eruption: *rupia simplex*, *rupia prominens*, and *rupia escharotica*. The latter variety was formerly described under the title of *pemphigus infantilis*, and *pemphigus gangrenosus*, and is known in Ireland under the different names of white blisters, eating hive, and burnt holes. It is the most important variety of the disease in young children.

Causes.—Rupia is most apt to occur in weakly, badly nourished, and scrofulous children, and seems to depend, therefore, upon that state of debility and exhaustion of the general health, which results from exposure to unfavorable hygienic conditions, which follows exhausting diseases, or which exists as a consequence of some hereditary taint.

Symptoms.—*Rupia simplex* begins almost always on the inferior extremities, or more rarely on the trunk or arms, without previous inflammation, in the form of small, flattened bullæ of about three or four lines in diameter. The bullæ contain at first a serous and transparent fluid, which soon becomes thicker, and is converted into pus. At an early period they shrink and become wrinkled, their contained fluid hardens and is converted into rough, brownish scabs, which are always thicker at the centre than on the edges, and which leave beneath, after their fall, superficial ulcerations. These ulcerations either soon cicatrize and disappear, or are covered by fresh scabs. After the fall of the final scabs, there yet remain, for some time longer, dark-brown or livid spots, which gradually fade and disappear.

Rupia prominens exhibits the same general characters as the preceding variety, but with more marked and peculiar features. The eruption commences with a circumscribed inflammation of the skin, on which inflamed spot soon appears a bullæ filled with yellowish serum, or sometimes with a blackish fluid, which rapidly hardens into a brownish or blackish wrinkled crust. The crust is surrounded by an erythematous areola, formed by the extension of the cutaneous inflammation beyond the circumference of the scab. Upon this areola a fresh elevation of the cuticle, by purulent deposit, often takes place, which, by its desiccation, adds to the size of the crust. This successive increase at the margin of the scab enlarges it in breadth, and, at the same time, raises the height of its centre, so as to give it a peculiar and characteristic appearance, and causes it to resemble very closely the shell of a limpet or oyster. The scabs thus formed usually adhere to the surface beneath with much tenacity, and remain attached for a variable, and, as a general rule, considerable length of time. When at length they fall off, or are removed, there are left beneath ulcers of variable depth and extent, which are either covered by fresh crusts, or, as more frequently happens, remain open, presenting a foul surface of a livid red color, which thickened edges. The ulcers are difficult to heal, and, after cicatrization, leave livid or purplish stains, which often remain for months. The number of bullæ is usually small, there being generally one at its height, and one or two about to appear, or on the decline.

Rupia Escharotica.—This variety of rupia, formerly described as belonging to the class pemphigus, and then called pemphigus infantilis and gangrenosus, differs in some respects from the other varieties of rupia, and particularly in the absence of the thick and projecting crusts, which characterize rupia simplex and prominens. It occurs chiefly amongst cachectic children, appearing usually in the period between birth and the first dentition. It is seated generally upon the neck, chest, abdomen, scrotum, or inferior extremities.

The eruption begins in the form of purplish or livid spots, raised slightly above the level of the skin. Upon these spots the cuticle is soon elevated by a serous fluid, so as to form small bullæ, which become rapidly larger, until they attain their full size. The bullæ are smaller than in the other varieties of rupia; they are irregular in shape, flattened on the top, and are surrounded by purplish areolæ in the early stage of the eruption; the fluid they contain becomes, at an early period, turbid and dark-colored, or almost black. The bullæ soon wrinkle, burst, and leave ulcerated surfaces, which are painful, often covered with sloughs, secreting a sanious and fetid pus, and difficult of cure.

Soon after the formation of the ulcers, a fresh crop of bullæ, forming a new eruption, often appears and passes through the same phases as the first, thus prolonging and extending the disease. This form of rupia is attended with much pain, with fever, sleeplessness, restlessness, and often ends fatally from the severe and continued irritation kept up by the disease. In cases ending favorably, the process of cicatrization is always slow and difficult.

Diagnosis.—Rupia is likely to be confounded only with pemphigus and ecthyma. Pemphigus is to be distinguished from rupia by the larger size and greater distension and prominence of its bullæ; by the fact that the contained fluid of the latter is serous and transparent in pemphigus, instead of being turbid and sanguinolent, as in rupia; by the different character of the crusts, which, in pemphigus, are thin and lamellated, while in rupia they are thick and rugous; and, lastly, by the deep and unhealthy-looking ulcerations that follow rupia.

Ecthyma is unlike rupia in being a pustular disease from the first. Moreover, the pustules of ecthyma are surrounded by a highly inflamed areola, which is not the case in rupia, while the crusts in the former disease differ from those in the latter, in being smaller, harder, more irregular, and more adherent.

Prognosis.—Rupia simplex and prominens, though tedious and slow of cure, seldom prove fatal, while rupia escharotica is always dangerous, and in very weakly children, especially when these are exposed to bad hygienic conditions, very generally ends unfavorably.

Treatment.—The most important point in the treatment is to attend to the hygienic state of the patient. When the child is living in an unhealthy house, or a close and confined room, it should be removed, if possible, to a more salubrious position, or to a larger and well-ventilated room. The diet ought to be such as to invigorate the strength, and promote the nutrition of the body. For an infant who is fed upon artificial food, or who is suckling a nurse of doubtful health, the best remedy in the world is a fresh and full breast of milk. If a nurse cannot be procured, the diet must be most carefully regulated in accordance with the principles already detailed in full in the article on thrush, at page 324. While the diet is thus attended to, it is necessary to watch the state of the digestive organs, and if there be either constipation or diarrhœa, these must be overcome by suitable remedies. Tonics and stimulants are always advisable in this disease, and may consist either of brandy or wine, given

alone, or in connection with Huxham's tincture of bark, extract of cinchona, small doses of quinia, iron, cod-liver oil, or any other remedy of this kind that may be preferred.

Rupia simplex and prominens are to be locally treated in the early stage by opening the bullæ so soon as they form, and covering them with dry lint and a light bandage, or with the water-dressing. The ulcerations that follow the bullæ may be treated with Goulard's ointment, applied on pieces of fenestrated lint, and by washing occasionally with lime-water, or with weak solutions of alum, copper, zinc, or nitrate of silver. At a later period of the disease, when the ulcerations are covered with the characteristic thick crusts, these are first to be removed by means of poultices of bread and water, or flaxseed meal, and the surfaces beneath them treated with the applications recommended above. When the ulcerations are very obstinate and difficult to heal, they should be modified by occasional touchings with nitrate of silver, either pure or in strong solution, or with dilute nitric or muriatic acid.

Billard recommends that the ulcerations should be dusted with powdered alum or cream of tartar, and Rayer also speaks very highly of the last-named application.

Dr. Stokes found that the best treatment in epidemic rupia escharotica was an ointment of the scrophularia nodosa, made by stewing the small leaves of the plant in as small a quantity of unsalted butter as may be sufficient to prevent their scorching. The ointment is to be warmed until it becomes quite thin, and then applied by means of a brush, after which the surfaces are to be covered with lint smeared with the same ointment. The dressing is to be renewed every six hours.

CHAPTER IV.

PUSTULES.

ARTICLE I.

ECTHYMA.

Definition; Synonyms; Varieties.—Ecthyma is an eruption characterized by prominent, rounded, and usually discrete pustules of considerable size, with hard and inflamed bases. The pustules are followed by thick, brownish crusts, which leave on their fall a reddish mark, or more rarely a superficial ulcer or a true cicatrix.

Ecthyma has been called also phlyzacia. There are two varieties of the disease to which children are subject, *ecthyma vulgare*, or *acutum*, and *ecthyma infantile*.

Causes.—The most frequent causes of ecthyma are the application of

irritating substances to the skin, such as croton oil and tartar emetic ointment, and the presence of other eruptions upon the skin, particularly small-pox, measles, scarlet fever, herpes, or scabies. The causes just named give rise to the variety called ecthyma vulgare, which, it may be well to state in this place, is of an acute character, and has therefore been called by some writers ecthyma acutum. The other variety of the disease, ecthyma infantile, is a chronic affection, and occurs almost always in feeble, badly nourished, and cachectic children, and in those whose health has been injured and broken down by exhausting diseases, and particularly by disorders of the gastro-intestinal apparatus.

Symptoms.—*Ecthyma vulgare* occurs most frequently on the extremities and neck, and more rarely on the trunk of the body. It appears in the form of small, red, and circumscribed spots, projecting above the surface of the skin, hard to the touch, and accompanied by smarting and often severe pain, and by soreness on pressure. The centre of the spots is soon elevated into a pustule, filled with a purulent fluid. The size of the pustules varies, but is usually about that of half a pea. Each pustule is generally surrounded by a hard base of a bright red color, constituting an areola, while, in some instances, the whole of the red elevation is covered by the pustular formation. The pustule remains unchanged usually for three or four days, and more rarely for a week, and is then converted, by the drying up of the effused fluid, into a thinnish brown scab, which drops off after a few days, and leaves a congested purple spot that remains for some time longer. In other instances, the pustule breaks and leaves a small ulceration which terminates with a slight cicatrix. The eruption is commonly successive, and is seldom accompanied by any febrile reaction.

Ecthyma infantile is much more frequently met with than the other variety of the disease, and occurs in a single, or oftener in successive eruptions, in feeble, badly nourished, and cachectic children. It appears on the neck, shoulders, arms, and chest, and especially upon the lower extremities. It is often connected with some chronic disorder of the digestive or respiratory apparatus, and is developed during the state of debility and exhaustion to which children are reduced by those affections.

The pustules of ecthyma infantile are of variable size, some being small, and others as large or larger than a sixpence. They are circular in form, and surrounded by an areola of a red or purplish tint; the fluid which they contain is generally not very thick, and is of a dark and sanguinolent appearance; they terminate by the formation of a dark and adherent crust, by absorption of the contained fluid and a kind of desquamation, or by a bloody excoriation, or true ulceration, which are followed by a deep stain upon the skin or a true cicatrix.

Diagnosis.—Ecthyma is more likely to be confounded with rupia than with any other disease. The pustular character of ecthyma from the very beginning, will, however, almost always enable us to distinguish it from the broad and distended bullæ of rupia, filled with seropurulent fluid; and the difference between the two becomes still more marked, when we recollect the hard and inflamed bases on which the pustules of ecthyma rest, and the shapeless crusts and superficial excoriations of that disease,

instead of the projecting, rugous, and imbricated scabs, and deep ulcerations of rupia. Ecthyma is not at all likely to be mistaken for the small and numerous pustules of impetigo, or the umbilicated ones of small-pox.

PROGNOSIS.—Ecthyma is never a dangerous disease in itself. If any danger accompany it, it arises rather from the enfeebled and disordered state of the general health under the influence of which it is produced, than from any injury caused by the eruption. The prognosis must depend, therefore, upon the state of the general health existing during the attack of the disease.

TREATMENT.—In both varieties of ecthyma, attention to the general health of the patient constitutes the most important point in the treatment. In the acute form, mild laxatives, small doses of some alterative, as the hydrargyrum cum cretâ or sulphur, the use of a nutritious and wholesome, and especially of an unstimulating diet, and the local application of mucilaginous infusions, or of a mild and cooling ointment, as Goulard's cerate, Turner's cerate, or the carrot, cucumber, or elder-flower ointments, with occasional warm bathing, are all that the case demands. In the ecthyma infantile, the attention of the physician should be directed towards the restoration of the general health, which, as stated above, is always more or less deteriorated. As this deterioration depends usually upon the exposure of the child to unwholesome hygienic influences, and a consequent unhealthy state of the digestive and nutritive functions, it is of primary importance that these should be early attended to. The patient ought to be placed in a healthy and well-ventilated apartment; the clothing must be regulated according to the age of the child, and the season of the year; and, what is most important of all, the diet ought to be such as is digestible, suitable to the age, and, at the same time, nourishing and strengthening. The internal remedies must consist of tonics in all cases, and when the digestive power and general strength are reduced much below the normal standard, of stimulants. The best stimulant is old and pure brandy, either given mixed with water, three or four times a day, or combined with the food. The best tonics are, in most cases, some preparation of iron, and the one we prefer is the iodide, given mixed with syrup of ginger, or, when the bowels are not too irritable, with small quantities of the compound syrup of sarsaparilla, or cod-liver oil. When, for any reason, iron is not given, quinia, or extract of cinchona, may be substituted. While these remedies are being employed, or prior to their administration, the gastro-intestinal functions ought to be carefully regulated by the use of mild laxatives when the bowels are constipated, or by some kind of astringent when they are loose and disordered.

The external or local treatment must consist in the use of mild demulcent applications, or of soothing or cooling ointments, during the pustular stage of the eruption. When unhealthy excoriations or ulcerations follow the pustules, these may be brought into good condition by the employment of weak solutions of nitrate of silver or sulphate of zinc, or of a very weak lotion of nitric or muriatic acid.

CHAPTER V.

PAPULES.

ARTICLE I.

STROPHULUS.

This is a form of papular eruption which some writers regard as a variety of lichen, giving to it the name of *lichen strophulus*. It, however, differs somewhat in its characters from the lichen of the adult, and, as it is peculiar to children, deserves a separate consideration.

Strophulus is a disease affecting chiefly infants at the breast, characterized by a more or less extensive, and sometimes a general eruption of papules, which are whiter or redder than the surrounding skin, and are accompanied by more or less irritation and itching.

Its causes are various disturbances of the digestive apparatus in very young infants, and in older ones the effort of the first dentition. Tilbury Fox (*Skin Diseases*, New York, 1873, p. 155) regards strophulus as the result of hyperæmia of the sweat glands, and inclines to consider it as due to excessive clothing, to overheated rooms, changes of weather, etc.

Varieties and Symptoms.—The *strophulus intertinctus*, or *red gum*, consists of an eruption of prominent pimples of a vivid red color, scattered here and there over different parts or the whole of the body, and intermingled with small erythematous patches. The eruption remains upon the skin for some time, the papules disappearing and reappearing in successive crops, for a week or two, or more, until they terminate by desquamation. It is most common upon the cheeks, backs of the hands, and forearms.

In *strophulus confertus*, the papules are much smaller, more closely aggregated, much more numerous, and more confluent, than in the first variety, and they constitute a more severe eruption. It may be distributed over the whole surface, but is more commonly limited to a single spot, or to several regions, as the face, breast, or arms. The eruption is less vivid, but more lasting than that of the strophulus intertinctus, and usually reaches its height in twelve or fourteen days, and then subsides.

In *strophulus volaticus*, the papules, which are of a vivid color, are disposed in small, not very numerous, circular groups, scattered over the surface of the body, but met with most frequently on the cheeks and arms. The ephemeral character, which is its only distinguishing feature, does not justify us in regarding strophulus volaticus as a distinct variety.

The two remaining varieties, *strophulus albidus*, or *white gum*, and *strophulus candidus*, are both characterized by whitish instead of red papules.

In the former, the papules are white, minute in size, and surrounded each by an areola of a faint red color; they appear usually on the face, neck, and breast, and continue for some length of time. According to Tilbury Fox, the term strophulus is a misnomer as applied to this form, which he regards as a sebaceous disease. In strophulus candidus, the papules are much larger, broader, more hard and tense, and are unaccompanied by any redness. They last usually about a week. This eruption is most common during dentition.

Diagnosis.—There is no difficulty in distinguishing strophulus, as it is the only papular eruption to which infants are subject. The absence of general symptoms and the extreme mildness of the disease are amongst its chief characters. It must be remembered that we only regard such papular eruptions as are unassociated with exudation or eczematous patches elsewhere on the surface as true instances of strophulus, since papules in all respects resembling those of this disease are to be frequently observed in cases of eczema papulosum.

Prognosis.—The eruption is never attended with any danger. If severe symptoms happen to coincide with it, they must depend on some other causes than the cutaneous affection.

Treatment.—As a general rule, strophulus needs no treatment whatever. In infants within the month, the irritation of the skin, if it be such as to disturb the comfort of the child, may be allayed by the use of the tepid bath, and by dusting with some mild powder, or by anointing with cold cream, glycerin and cold cream, simple cerate, or cocoa-butter. When any marked disturbance of the digestive apparatus is present, this should be attended to by the administration of mild laxatives, and of tonics, with some preparation of iron, as the tartrate or superphosphate.

In older children, in whom the disease appears to be associated with dentition, the local means spoken of above may be employed, while, at the same time, the gums should be lanced, if necessary, and any gastro-intestinal disturbance removed by appropriate treatment.

ARTICLE II.

LICHEN.

In children the lichenoid eruption takes so constantly the form of strophulus, that we deem it unnecessary to give a separate description of the former disease, with the exception of one of its varieties, the lichen tropicus. No doubt cases of lichen simplex do occasionally occur in children as they approach the age of adolescence, but since the disease resembles so closely in its characters, and requires the same treatment as strophulus, what has been said in regard to that disease will perfectly well apply also to lichen. Of lichen agrius, a not uncommon and severe form of the eruption in adults, we have never seen an example in a child.

Lichen Tropicus, or Prickly Heat.—This is a form of lichen simplex which occurs principally in hot climates, and during the hot summer season of the more southern temperate climates. It is a very common eruption at all ages of childhood, from early infancy upwards, in this city, and in most of our Middle and Southern States, and is commonly known by the name of prickly heat. Tilbury Fox (*op. cit.*, p. 484) regards it as essentially a congestion or inflammatory affection of the perspiratory follicles, and differing therefore entirely from true lichen.

The chief *cause* of lichen tropicus is apparently the action upon the cutaneous surface of a high temperature, aided, no doubt, by the disturbances of the digestive function so apt to occur under the influence of that condition of the atmosphere. Very warm clothing, and particularly the presence upon the skin of thick rough flannels, is apt to develop the eruption.

Symptoms.—The eruption of prickly heat consists of numerous small papules, few of them being larger than a pin's head, scattered more or less thickly over the affected surface. The pimples are of a red color, which is more or less bright in tint, according to the extent and intensity of the eruption. The skin between the papules retains its natural appearance when the eruption is but slight or moderate; but when this is copious and severe, it assumes a faint reddish appearance, owing no doubt to the activity of the circulation in the part.

The eruption is most abundant on the parts covered by the dress, or rubbed by the edges of the dress, particularly about the neck, upper part of the chest, and on the arms and legs. We have sometimes seen it covering the greater part of the body. It is always attended with more or less itching, burning, and pricking, which, in older children, causes much fretfulness and scratching, and, in those who are younger, restlessness, worrying, and more or less disturbance of the sleep. The disorder usually remains stationary for several days, and then disappears gradually without desquamation or other change in the skin; or, it subsides and increases, or disappears and returns, with the rising and falling of the temperature, or without any very evident cause, until at last it ceases, not to appear again. When the eruption lasts many days, it is almost always accompanied by a slight scaly desquamation of the tops of the pimples.

The *diagnosis* of this form of eruption is never difficult. Its occurrence during hot weather, the character of the papules, their minuteness and abundance, and the entire absence of constitutional disturbance, will always render it easy of recognition.

Treatment.—Lichen tropicus is usually regarded as a salutary eruption, and as therefore not to be interfered with by treatment likely to repel it. In fact, it never needs any treatment, except when very abundant, and when it annoys the child by the heat and itching it occasions. Under these circumstances, the skin should be dusted with rye-meal, or anointed two or three times a day with some mild ointment, as, for instance, one consisting of glycerin and cold cream or lard, or the benzoated zinc ointment; or, the child may be bathed once or twice a day in warm water containing bran, slippery-elm, or some other mucilaginous substance.

ARTICLE III.

PRURIGO.

DEFINITION; FREQUENCY.—Prurigo is characterized by an eruption, more or less extensive, of isolated papules, which, larger than those of strophulus, unattended with any change in the color of the skin, and developed usually on the extensor surfaces of the limbs, give rise to the most violent and distressing itching, a symptom which constitutes one of the most marked features of the disease. Wilson includes it among the nervous affections of the skin, and attributes it usually to nervous debility, with an impaired state of the nutrition and innervation of the skin.

Prurigo is a rare disease in this city amongst the children of the middle and upper classes, since we have seldom met with it. In Europe, it is described as occurring in the children of the poor, though it is much less common than the eruptive diseases already treated of. Doubtless it occurs in this country also, but with the exception of a case reported by Wigglesworth, of Boston (*Amer. Jour. of Syph. and Derm.*, vol. iv, 1873, p. 21), we have not found any original account of it in the works of American writers. Duhring (*op. cit.*, p. 252) states that the disease is extremely rare and almost unknown in the United States.

CAUSES.—The only well-ascertained causes of the disease are the unfavorable hygienic conditions which exist amongst the destitute classes of society,—damp and ill-ventilated dwellings, unwholesome food, especially the use of salted meats and fish, and want of cleanliness as to person and clothes.

SYMPTOMS.—The papules of prurigo are small, but slightly prominent, and attended with moderate itching, constituting the *prurigo mitis;* or they are larger, more projecting, and attended with the most violent pruritus, forming the *prurigo formicans.* The papules are usually of the color of the skin, except when they have been torn by the nails, and are generally seated upon the outer surfaces of the limbs, and the upper part of the trunk.

When the itching is severe, the tearing of the papules by the nails causes the escape of a small drop of blood from the tops of many of them. The blood dries and forms so many small black crusts crowning the summits of the papules, a peculiarity which constitutes one of the most distinctive features of the disease. The papules terminate by absorption or by a slight desquamation. After the disease has lasted some time, the skin acquires, partly from the constant and violent scratching, a peculiar thickened and harsh character, which is most marked on the lower extremities.

The *duration* of the eruption is very uncertain. In acute cases, when properly treated, it may end in a few weeks, though it often, and indeed more generally, lasts for several months or years, or even through life.

DIAGNOSIS.—The only diseases with which prurigo is likely to be confounded are strophulus or lichen. It may be distinguished, however, gen-

erally with ease, by the facts that the papules of prurigo are larger, less numerous, and more extended, than those of strophulus or lichen; that in the latter diseases the papules are never crowned by the small black crusts of prurigo, and they are never attended with the same violent itching as the former.

From pruritus, it is to be distinguished by the absence in the former affection of papules, as well as of thickening and roughness of the skin. The regions affected in pruritus are also quite different from those most frequently involved in prurigo.

Prognosis.—Prurigo is never perhaps a dangerous disease, though usually a very troublesome one from the severe irritation which attends it, from its not unfrequently obstinate resistance to treatment, and its disposition to relapse. According to Duhring, it is perhaps curable in children, but scarcely so when it has lasted until adult life.

Treatment.—The internal treatment of prurigo in children should consist in the use of sulphur, given alone or in combination with magnesia, of demulcent drinks, of mild laxatives when there is constipation, and of such remedies as may be rendered necessary by any disordered state of the digestive function. The diet must be carefully regulated. It ought to be nourishing and sustaining, but at the same time light and easy of digestion. In obstinate cases, recourse must be had to the administration of arsenic, cod-liver oil, iron, and other powerful nutrient and alterative remedies.

In addition to the internal treatment, simple warm-water baths, or emollient baths of flaxseed, bran, slippery-elm, or marsh-mallow, should be made use of in the early stage of the disorder. At a later period, alkaline baths, containing from three to eight ounces of carbonate of potash to each bath, according to the age, are recommended by Cazenave and Schedel. To allay the cutaneous irritation, mild ointments are often found useful. Billard employed with success, in a child six months old, inunctions with the oil of sweet almonds. Soaps or lotions, containing juniper tar or carbolic acid, are excellent anti-pruriginous applications; and relief will frequently be obtained from the application of a dilute solution of chlorinated soda. When the case is obstinate, resisting emollient and alkaline baths, sulphurous baths must be made use of.

CHAPTER VI.

SQUAMÆ.

The various forms of scaly disease, psoriasis, pityriasis, and ichthyosis, are so much more rare in children, and therefore so much less important practically, than the various eruptions we have thus far considered, that we deem it unnecessary, in a work limited in extent like this, to attempt a detailed account of them. We shall make merely a few observations on

each, referring the reader, should he desire further information, to the special treatises upon diseases of the skin.

Psoriasis is, in our experience, a very rare disease in children, though we have met with a few cases of it. It is met with in two forms, the *psoriasis diffusa* and *guttata*, of which the former is said to be the more frequent.

Psoriasis diffusa appears in the form of patches of rather large, but very variable size, of irregular shape, and covered with thin scales of dried epidermis, which are constantly falling off and being renewed. When the scales are removed, the surface of the eruptive patch is seen to be of a dull red color, somewhat rough, and raised above the surrounding skin. In severe cases, as the disease occasionally occurs in young children, the skin presents numerous chaps and fissures, and is often excoriated more or less by the dress, or by the neighboring surfaces. From the excoriations is sometimes poured out an unhealthy secretion, which hardens and forms scabs.

Psoriasis guttata appears in small, reddish, and rounded elevations, more elevated at the centre than the circumference, and of different sizes; from that of the head of a pin, as mentioned by Billard, to that of a large pea, as seen by ourselves, and which become covered very soon after their appearance with fine, minute and whitish scales.

A third variety, *psoriasis inveterata*, a severe, obstinate, and inveterate disease, as met with in adults, is very rare, if not unknown, in children.

Treatment.—In recent cases, psoriasis is to be treated with simple warm-water or emollient baths, and with mild liniments or ointments, such as oil of sweet almonds, glycerin alone, or glycerin mixed with cold cream or simple cerate. In more chronic cases, the local treatment is the only one which promises any certain success. The particular mode of local treatment which we have found most successful is that recommended by Hebra, a short account of which will be found in our remarks on the treatment of chronic eczema.

The carbolic acid soap, dilute citrine ointment, or weak solutions of caustic potash when there is much infiltration of the skin, are all serviceable applications in the chronic form of the disease.

In all cases the digestive function must be carefully attended to, any disorder that it may present being removed as rapidly and effectually as possible by the proper remedies.

In cases where the eruption persists despite the use of local applications and attention to the digestive functions, the child should be placed upon the use of the ferro-arsenical mixture.

Pityriasis is a slight scaly disease, which may attack the head only, or extend to other parts of the body. In children, however, it is generally confined to the scalp, and may be recognized by the existence on the part of innumerable small, thin, whitish, furfuraceous scales, which form a thin or thicker covering for the scalp, in proportion to the amount of care bestowed on the cleansing of the head. The scales of epidermis are easily rubbed off, and the surface beneath is rarely found to present even the slightest inflammation.

It is a disorder of minor importance, and seldom requires other treatment than some mild lotion or ointment, and strict cleanliness. When, however, it persists, the child should be placed upon the use of the ferro-arsenical mixture internally, and applications of dilute citrine ointment should be made to the patches of eruption.

Ichthyosis is an eruptive disease in which there appears on various parts, and usually over the larger portion, of the skin, epidermic patches or squamæ, that are hard and dry, and of more or less considerable size. The patches are generally of a dirty gray or earthy color; they exfoliate, and leave the skin beneath more or less thickened and roughened, but never inflamed. The disease is unattended with either heat, pain, or itching. It is ordinarily congenital, and is extremely obstinate, lasting many years or even persisting during life.

Billard recommends, however, in the ichthyosis of new-born children the use of warm and emollient baths, frictions, with oil of sweet almonds or olive-oil, acidulated drinks, and perfect cleanliness.

In older children, baths, either simple or medicated, should be freely used in order to assist in removing, by maceration, the thickened layers of epidermis. Vapor baths are especially recommended by Duhring. Subsequently the removal of the hypertrophied epiderm should be still further secured by inunctions with strongly alkaline soaps or lotions, then mild alterative applications should be made to the exposed new skin beneath.

CHAPTER VII.

DISEASES OF THE SKIN NOT CLASSIFIED AMONGST THE PRECEDING.

SECTION I.

PARASITIC SKIN DISEASES.

General Remarks.—The diseases now regarded by many authorities as due to the presence of a vegetable parasite upon the skin are as follows:

1. Tinea Favosa or Favus, ... Parasite: Achorion Schœnleinii.
2. Tinea Tricophytina, { Tinea Tonsurans (Ringworm of scalp), Tinea Circinata (Ringworm of body), Tinea Sycosis (Ringworm of beard), } Parasite: Tricophyton.
3. Tinea Versicolor (Chloasma, Wilson), . . . Parasite: Microsporon Furfur.
4. Tinea Decalvans (Alopecia Areata), ... " Microsporon Audouini.

There are several questions, however, in regard to these affections upon which doubts still exist, and which are of so much importance as to demand a brief examination.

In the first place, it can scarcely be doubted by any one familiar with the use of the microscope, and who has taken the trouble to examine the subject, that parasitic fungi are found with remarkable constancy in the eruptions of these diseases. The opinion advanced by Wilson (*Br. and For. Med.-Chir. Rev.*, 1864, and *Diseases of the Skin*, 7th Amer. ed., p. 614), that the structures found in these cases, are due to a peculiar "granular" degeneration of the normal elements of the part, owing to which they lose their power of developing into healthy epithelial structures, but retain their power of proliferation, appears to us opposed to all sound reason and accurate observation.

In addition, however, to the evidence furnished by the chemical and microscopical examination of the growths in question, their fungous nature is shown by the facts that they can be cultivated after removal from the body, and that the diseases with which they are associated are contagious and can be communicated by inoculation to healthy persons, or even to some of the lower animals.

In searching for these growths, the scrapings from the surface of the diseased spot, or the hairs which traverse it, may be taken for examination; but before subjecting them to microscopic study, they should be treated with dilute acetic acid to render them more translucent, and subsequently with a little sulphuric ether to remove the fatty granules which often obscure the fungus.

The structures which the fungi affect are the hairs with their follicles, and the epidermis.

The special alterations which the hairs undergo will be detailed under the head of the different diseases; the fungus gains entrance to the follicle, penetrates the bulb of the hair, insinuates itself between its longitudinal fibres, thus splitting it up and rendering it brittle. In the epidermis the fungus is said at first usually to appear beneath the superficial layer, until, by its development, it causes such irritation as leads to the exfoliation of this layer, when it reaches the surface and then multiplies rapidly.

The objection which has been based upon this fact, that the growth cannot be a parasitic one, does not seem to us of much force, since it is easy to account for the introduction of such extremely minute bodies as the spores of these fungi beneath the superficial layer of the cuticle.

Admitting then the presence of these parasitic growths, a more interesting question arises in regard to the relation which exists between them and the diseases with which they are associated; whether, that is, they are essential to, and actually the causes of the respective diseases, or are merely accidental, and are present only because they find a suitable nidus for development in the diseased skin. Opinions are at variance upon this question, but there are at least two considerations which render it probable that the fungi are essential rather than accidental productions. The first of these is, that they are present in the early stages of the disease, before any considerable inflammatory change has occurred, and that in proportion as suppuration ensues they diminish in abundance. And, secondly, that,

as already stated, they are capable of transmission to perfectly healthy persons by inoculation.

There can, however, be no doubt that the development of the fungus, under ordinary circumstances, is greatly favored by the constitutional condition of the patient and the state of the cutaneous surface. Thus it is especially in children of a delicate or strumous constitution, that these various diseases are most frequently met with; and when, in addition, personal filthiness with inattention to properly combing and cleansing the hair, and changing the clothing, are combined, the spores find the most favorable conditions possible for their rapid development.

There remains the further question, upon which authorities are still divided, whether there are various fungi concerned in the production of these diseases, or whether the apparently different species are merely different stages of a single fungus. For the sake of greater ease of reference and comparison, we will here give a brief description of their characteristic appearances.

Fungus of Tinea Favosa.—In the earliest stage of development of the favus crust, it is still covered by the superficial layer of epidermis; but later, when this is ruptured, it presents an envelope of a sulphur-yellow color, which on microscopic examination shows a homogeneous or finely granular substance. The interior, of a pale white color, is the true favus matter, and consists of the sporules, thalli, and mycelia of a fungus named the achorion Schœnleinii, in honor of Schœnlein, who first fully described it.

The sporules are of a rounded, or more frequently of an oval form, and have well-marked edges, and a homogeneous and slightly opalescent interior. Their average diameter is about $\frac{1}{3000}$th of an inch. Many of these sporules are seen to be grouped together, while some are more elongated and present a contraction in the middle; others are nearly triangular in form, with rounded angles; others, yet more elongated, are marked with several contortions. Some sporules, completely formed, seem to have a double envelopment membrane, and others present in their interiors something like a nucleus.

There are also present numerous diaphragmated tubes, formed by the development and confluence of the sporules, which are either simple or present ramifying branches. These tubes vary in diameter from $\frac{1}{1000}$th to $\frac{1}{1500}$th of an inch, and are either empty or have granular contents. Amongst the sporules and mycelia, especially towards the circumference of the cups, may be seen a considerable number of molecular granules, which are probably imperfectly developed sporules.

Fungus of Tinea Tricophytina.—The next parasite, the *tricophyton*, is that which produces tinea tonsurans, tinea circinata, and tinea sycosis.

The microscopic characteristics of this parasite, as first described by Malmsten, in 1845, and since confirmed by numerous observers, are very numerous rounded or oval sporules, about $\frac{1}{7000}$th of an inch in diameter, which are isolated or united together into chains, and a comparatively small number of mycelial threads.

Again, the parasite, which by many observers is believed to cause tinea

versicolor, is the *microsporon furfur*, discovered by Eichstädt, in 1846. This fungus presents numerous rounded spores, and long tubes. The spores are about $\frac{1}{3000}$th inch in diameter, and are frequently collected together in large clusters, like bunches of grapes (Anderson). Some of the tubes observed are simple, and others jointed.

In regard to the parasitic nature of alopecia areata, there is great doubt, and even so warm a supporter of the fungous origin of the other diseases we have mentioned as Dr. Anderson, does not allow it.

Numerous observations have been made which go to show the existence of a very wide range of variation as regards form in these fungi; and have led some observers to assert not only the identity of these particular forms, but indeed to refer all varieties of epiphytic fungi to some one central type.

The evidence upon which this view rests, mainly drawn from the results obtained from germination of the various fungi, and from the study of their transitional forms, cannot at present be considered conclusive; and further investigation of the question is demanded.

It is, however, thought by some high authorities, that no doubt can be entertained in regard to the identity at least of the parasites which produce the various forms of tinea, including the achorion of favus, the microsporon furfur of tinea versicolor, and the tricophyton of the various varieties of ringworm. The most complete exposition of the arguments upon which this view is based, will be found in Dr. Tilbury Fox's admirable treatise on skin diseases of parasitic origin (London, 1863).

On the other hand, some eminent dermatologists believe that the fungi which produce these diseases, are essentially distinct. The arguments upon which they base this opinion may be briefly expressed as follows, in the language of Dr. Anderson (*loc. cit.*, p. 170).

That in all cases of successful inoculation with the achorion, tricophyton, and microsporon furfur, the same parasitic disease has been produced as that from which the parasite was taken. That of the innumerable cases occurring in the human subject, illustrative of the contagious nature of favus, tinea tonsurans, and tinea versicolor, there is no authentic case in which one of these diseases gave rise to one of the others.

That the difference in the appearance of the eruptions, when fully developed, is so very striking as to lead to the belief that they are produced by separate parasites.

That there is no authentic record of the transition of one of these diseases into one of the others.

That the microscopic differences between the three fungi are in many cases sufficient to base a correct diagnosis upon.

That of the numerous instances on record of the transmission of tinea favosa, and tinea tricophytina, from the lower animals by contagion or inoculation, favus has always given rise to favus, and tinea tricophytina to tinea tricophytina.

We regard then the parasitic nature of these affections as undoubted, but more extended observation is necessary before the relations of their respective fungi can be determined.

ARTICLE I.

TINEA FAVOSA OR FAVUS.

Favus is a parasitic disease of the scalp, long confounded by different writers with other and very dissimilar affections of that part. In consequence of this confusion it has received a great variety of names, of which the most generally known are porrigo and tinea. In adopting the above title, we follow the example of Erasmus Wilson and other recent authorities, amongst the English, and of MM. Rilliet and Barthez, Gibert and Rayer, amongst the French.

Definition; Synonyms; Varieties; Frequency.—Favus is a specific contagious eruption of the scalp, characterized by inflammation of the hair-follicles dependent upon the presence of a peculiar fungus, the achorion Schœnleinii. It is distinguished at first by small yellow pustules, countersunk in the skin; these are soon converted into yellow cuplike crusts, which adhere often for a very long period. It usually causes permanent loss of hair at the affected part.

The disease is described by most of the former English writers under the title of porrigo, but as several other eruptions have been included under the same name, we think it best to follow the example of Mr. E. Wilson, and call it favus. By MM. Biett and Cazenave it is designated, after Willan, porrigo favosa and porrigo scutulata. MM. Rayer and Gibert, as above mentioned, give it the name of favus.

There are two varieties of favus, the *favus dispersus*, the porrigo favosa of most writers, and the *favus confertus*, the porrigo scutulata of many observers.

The disease is much less frequent than eczema of the scalp, but is nevertheless constantly met with amongst the crowded populations of Europe. In this country it is more rare, and amongst the middle and upper classes, at least of this city, is almost unknown, since we have never met with a case of it in our own private practice, though we have occasionally seen it in the hospitals here.

Causes.—The only well-ascertained exciting cause of favus is generally thought to be *contagion*, a quality of the disease acknowledged by most observers, though denied by Mr. E. Wilson, who considers its cause a debility of nutritive vitality, allied with struma. It may be propagated by direct contact of the diseased with a healthy skin, or by means of combs, brushes, or other articles of the toilet; and it is also probable that the spores may be carried by the atmosphere so as to communicate it by infection. It has been frequently propagated by direct inoculation,—by Remak, Bennett, Hebra, Bazin, Gruby, Köbner, etc.

Favus is also said to be met with in the lower animals, and especially amongst mice and cats; and cases are on record which render it highly probable that it may be communicated from them to the human subject.

It occurs at all seasons, attacks either sex indifferently, and is met with

at all ages, but is especially frequent in children and young people, and, indeed, when met with in adults, is usually found to have commenced in early life, and to have persisted for years. Certain conditions act as predisposing causes in its production, and may alone, perhaps, give rise to its development. These conditions are unhealthy hygienic influences, as unwholesome and insufficient food, poverty, filth, and the living in low, damp, and ill-ventilated dwellings. It is met with most frequently in persons of feeble, lymphatic, and especially in those of scrofulous constitution, though, be it remarked, it occurs also in persons of strong and vigorous health.

Among those who believe in its truly parasitic nature, there are some, as Devergie, who believe that it may be spontaneously generated, the parasite originating in the body of the affected person. One of the facts upon which the theory is based is the asserted occasional cure of the disease by internal remedies, but we believe that these can only relieve it by fortifying the system, and so removing the conditions which favored the development of the parasite.

Symptoms.—Favus Dispersus, or Porrigo Favosa.—This variety begins with very small pustules of a peculiar straw-yellow color, which exhibit from the first the special character of not being raised at all above the level of the skin. Directly after their formation, the yellowish matter which they contain begins to concrete, and there can be perceived from this early period a central depression in the crusts, which becomes more marked as these augment in size, so that at the end of five or six days it is perfectly evident. Each pustule, and of course each crust is, as a general rule, traversed by a hair. The favous crust is a very remarkable feature of the disease, and is in itself a pathognomonic symptom. As it increases in size, which it does gradually until it reaches in some instances a diameter of half an inch, the central depression above spoken of becomes more and more distinct, and the crust assumes, from this circumstance, the shape of a cup with an inverted edge. Their structure is made up of a series of concentric layers, or layers or rings, compactly arranged one upon the other. This cuplike form with the concentric arrangement of layers, the peculiar straw-yellow color, and the fact that each crust is usually pierced by a hair, are the distinguishing characters of the disease.

The pustules are usually isolated at first, though they may be arranged in groups of irregular size. When numerous, the crusts, by their gradual enlargement, touch at their edges, and blend into larger or smaller patches of irregular shape, but still presenting many little depressions corresponding to the first-formed pustules. In rare cases, the disease is so extensive as to form a kind of mask covering the whole scalp.

When the disease is not interfered with by treatment, the crusts remain adherent for a long time,—for months or even years; they become also paler in color than they were at first, and so dry and pulverulent, as to break very readily when rubbed or touched. They become, moreover, thicker and more massive, and lose their first regular cuplike form, from the disappearance of their depressions, and from the irregular and uneven shape given to their edges and surfaces, by the breaking which they

undergo. When the case runs on in this way, the head exhales a most unpleasant odor, which has been compared to that of mice or the urine of a cat; McCall Anderson has, however, noticed a very similar odor in cases of eczema impetiginoides of the scalp. In some instances, where the disease is grossly neglected amongst the very poor, pediculi form in abundance amidst the crusts, and add to the disgusting appearance of the disorder.

When the crusts have been removed by any means, the surface of the scalp is seen to be red, moist, and to present slight erosions or even ulcerations. The crusts are reproduced only by the eruption of new pustules.

An invariable and unfortunate sequel to the favous disease is a more or less extensive loss of the hair. The hairs become loose from a very early period of the disease, and can be pulled out with great ease. As the case goes on they fall out, and the scalp is left smooth, shining, uneven, and deprived of hair. On these spots the hair seldom grows again, and if it does, it comes out thin, woolly, and with every appearance of weakness and unhealthfulness.

Though the usual and favorite seat of favus is the scalp, it is met with occasionally on the forehead, temples, chin, and eyebrows, and, in still rarer instances, on the shoulders, elbows, forearms, on the upper and outer parts of the legs and thighs, on the scrotum, and even on the nails. The nails are also liable to be invaded, probably in consequence of the parasite gaining entrance during the act of scratching. The affected nails become thickened, yellowish and opaque, and brittle. Even in such cases, however, it has frequently existed first on the scalp, and extended thence to the other parts, though it may sometimes begin upon the trunk or limbs in consequence of a direct application to them of the contagious element.

Favus Confertus, or Porrigo Scutulata.—In this variety of favus the pustules are arranged so as to form circles or rings upon the forehead or scalp, instead of being dispersed irregularly over the scalp, as in the preceding variety. The disease begins with red, circular patches, attended with a good deal of itching, upon which, after a short time, appear small yellow pustules, that seem to be sunken in the skin. The pustules are more numerous on the circumference than at the centre of the red patch or disk; or the latter increases in size by the extension of the disease to the follicles just beyond its outer edge. The pustules are exactly like those of favus dispersus, except that their yellow color is of a lighter tint. They desiccate very rapidly, and form crusts which are very thin at first, never very thick, and of an irregular shape.

When the disks are very numerous, either originally, or by propagation of the disease from part to part, they meet at their borders, blend together, and give to the scalp the appearance of an extensive and irregular crust, presenting at its circumference curved lines, marking the segments of circles of which the whole is composed. The crust has sometimes covered the whole scalp, excepting merely a small border at its circumference, where may still exist some scanty remains of the hair.

When the crusts are removed, the surface beneath is found to be red and tumid, according to Wilson, and to present numerous yellow points.

Cazenave and Schedel state that when the crusts fall, they leave exposed a large, uneven, furfuraceous patch, upon which new favus pustules do not appear often for a long time. The hair is in great measure destroyed over the diseased surfaces, though not so completely, it is said, as in the other variety.

Favus is not, in either variety, attended with constitutional symptoms. The only marked local symptom complained of is the itching, which is always greatly aggravated by want of cleanliness.

Nature of Favus.—We have already, in our general remarks introductory to this class of skin diseases, given the arguments which prove their parasitic nature.

Mr. E. Wilson, alone among dermatologists of note, persists in regarding favus and the others, as due to mere alterations in the nutrition of the skin dependent upon constitutional nutritive debility; and he refers the characteristic fungous elements revealed by microscopic examination, merely to a peculiar granular degeneration of the epithelial elements.

We refer the reader, for a more full discussion of this question, to the works already quoted, merely adding here that, in our opinion, the results of microscopic examination, the results of inoculation of the parasite in man, as well as in the lower animals and plants, the undoubtedly contagious nature of the disease, and finally the astonishing and never-failing success of the local treatment when properly carried out, conclusively show its parasitic nature. The reader is also referred to the remarks introductory to this chapter for a full description of the parasite, the achorion Schœnleinii, which is the essential cause of favus; as well as for the differences which distinguish it from the parasites which are found in the various forms of tinea.

Diagnosis.—The diagnosis of favus rarely presents any difficulties. The peculiar pustules which exist at first—small, yellow, on a level with or below the surface of the scalp, and the crusts which so soon follow these, saffron-yellow in color, dry, and cup-shaped, will mark a case of favus dispersus from every other disease. In favus confertus the same characters exist, but the crusts and pustules are arranged on circular erythematous disks, instead of being isolated or dispersed as in favus dispersus.

From impetigo of the scalp, which is the only disease with which it is at all probable that it would be confounded, it may readily be distinguished by an examination of the primary characters of the two disorders. This primary character can always be found by searching at the outer edges of the diseased surface. In favus the pustule is small, depressed, and contains very little fluid, while in impetigo it is large, globular and projecting. The crusts are very different: in the former dry, as though dusted with sulphur, cup-shaped, depressed, and usually traversed by a hair; in the latter, rugous, irregular in shape, not cupped, resting above the skin, and generally somewhat moist and soft. The peculiar odor which is present in cases of favus may be of assistance, although a very similar odor has been observed in cases of different characters. The microscopic examination of the hair or crusts in favus also shows the presence of the achorion

Schœnleinii, which is never met with in impetigo. Lastly, the alopecia which so constantly results from favus, does not occur in impetigo.

Prognosis.—Favus is a serious disease because of its usually long duration, the difficulty often experienced in effecting its cure, and because of the loss of hair which it occasions.

Treatment.—The treatment of favus should be both general and local, for though some writers, and particularly Cazenave and Schedel, state that it must be altogether external, and that in spite of numerous trials they do not feel authorized to propose any internal means (*Malad. de la Peau*, 4ème ed., p. 326); others, as Wilson, Bennett, and Neligan, recommend constitutional remedies as of very great importance in assisting the cure.

The *general* treatment must be such as may seem called for by the state of health of the individual patient. When, as so often happens, the disease occurs in a scrofulous person, cod-liver oil, iodide of potassium, nourishing food, air, and exercise, are of the utmost importance. When the health of the patient is feeble and broken from the want of wholesome and abundant food, from insufficient clothing, or from residence in a vitiated, close, and confined air, the removal of these conditions, which undoubtedly act as predisposing causes in the production of the disease, cannot but aid in its cure. Dr. Neligan (*Dublin Quart. Journ. of Med. Sci.*, vol. vi, p. 56) recommends very highly the use of the iodide of arsenic as a constitutional remedy. It must be given in doses carefully graduated to the age of the patient (one-eighth of a grain being the proper dose for an adult), and should any symptoms of its irritative action ensue, its use must be immediately suspended for a few days, and a purgative be administered.

The *local* treatment of favus is undoubtedly that upon which we must chiefly rely, since the essential element in the treatment must always be the destruction of the parasite.

The mere application of remedies adapted for this purpose, called parasiticides, is, however, rarely of itself sufficient, since they cannot penetrate to the hair-follicles, and it is, therefore, directed by most authors of experience in the treatment of this disease, that the hairs must be removed from the affected parts before the application can be efficiently and successfully made. Before doing this the crusts must be removed. Some recommend for this purpose poultices, but these are condemned by Wilson, as clumsy, and by Lebert as causing the extension of the disease by the softened sporules which spread to the surrounding surfaces and propagate the disorder. This objection does not, however, appear valid, and their use is countenanced by many good authorities. Wilson recommends their removal by means of a local vapor-bath, applied through the medium of a caoutchouc cap, or, if this is not at hand, by laying a piece of folded lint, wetted in a solution of subcarbonate of soda or potash, upon the head, and covering it with an oiled silk or gum-elastic cap, which should include the entire scalp. M. Lebert insists upon the necessity of removing the favi (not the pustular crusts which accompany the specific vegetable growth), in their dry state, by means of small spatulas, needles,

or some kind of instrument. The epidermis is readily detached from around the favus, and this latter, which adheres but slightly to the skin, is then easily removed. M. Lebert states that this is so easily done, that he has been able to teach his ward-attendants to remove them without pain to the patients. Hebra uses applications of alcohol, which cause the crusts to shrink and thus lose their attachments, when they are readily removed.

After the crusts have been gotten rid of, the scalp should be well washed with soap and water in order to remove any favous sporules that may have escaped and become free, and the hair should then be cut short. Various applications are then recommended, before proceeding to epilation, as tending to allay the irritability of the scalp and to render the hair less friable; among these are oil of cade (Bazin), and almond-oil (Anderson), which may be applied for a few days before epilation is begun. There are various methods which have been adopted for the extraction, but the best is undoubtedly to employ a small pair of forceps with square ends, and fine but not sharp teeth, so as to enable the operator to catch the delicate and brittle hairs surely without breaking them. The hairs must be extracted singly, and so soon as a little space has been cleaned, the parasiticide remedy should be applied so as to secure its entrance to the follicle. A single epilation is frequently not sufficient, but it is easy to distinguish, by the appearance of the surface and the growing hairs, those parts where the disease has been eradicated. This process is at first somewhat tedious both to operator and patient, but by practice a degree of skill is acquired which enables the physician or trained nurse to remove the hair rapidly and with very little discomfort to the patient.

So soon as a clean surface has been thus obtained, some application intended to destroy the vitality of the vegetable growth ought to be made use of. One of the best for this purpose is a solution of corrosive sublimate, the strength of which, according to Lebert, ought to be, when employed in lotion, from two to four grains to the ounce, and, when used as a fomentation, weaker. This is also McCall Anderson's favorite application. Dr. Bennett (*Ranking's Half-Yearly Abstract*, No. xii, 1850, Am. ed., p. 73), employs, to fulfil this indication, cod-liver oil. The head is kept constantly smeared with the oil, and covered with an oiled silk cap. This application is, however, merely palliative, and, so soon as it is intermitted, the disease reappears.

There are various other remedies that have been applied to the diseased scalp empirically, either to "modify the state of the skin," to "excite the disordered follicles to healthy action," or, lastly, to "destroy the vitality of the fungus, and, by altering the nature of the soil on which it flourished, to prevent its reproduction." Without attempting to define the mode in which any of these various substances may produce their effect, we deem it best to mention as succinctly as possible those which have the strongest testimony in their favor.

Mr. E. Wilson, who it will be remembered does not believe in its parasitic nature, is less favorable to strong applications than he was formerly. Those he now prefers are the ceratum tiglii, containing from ten to thirty

drops of the oil to the ounce; the unguentum hydrargyri nitratis, diluted one-half; the unguentum hydrargyri nitrico-oxidi, diluted in similar proportion; the compound sulphur ointment, and some others.

Dr. Bennett's application of cod-liver oil has been referred to above. This, in connection with the constitutional treatment for scrofula, is said to have cured, on an average, in six weeks.

MM. Cazenave and Schedel recommend alkaline and sulphurous applications, and acidulated lotions. They speak very favorably of, and give much the highest place, amongst the substances to be used in friction, to the iodide of sulphur. This remedy was originally made use of by Biett, and employed by him with much success. Its efficacy is attested also by Lebert. It is used in the form of an ointment, consisting of from a scruple to half a drachm of the drug to an ounce of lard, which is to be applied morning and evening to the diseased surfaces by gentle friction.

Applications of hyposulphite of soda, in proportion of ʒj to fʒj of water, or of sulphurous acid lotions, are highly recommended. Among the parasiticides most valued in France, are oil of cade and turpeth mineral, which latter may be employed in the proportion of ʒj to fʒj of glycerin of starch, which is perhaps the best excipient for the various parasiticides.

Ointments and lotions containing carbolic acid have been much employed of late, but apparently not with entire success.

Dr. Fuller recommends the ablution of the head twice a day by means of soft soap, and the inunction of an application composed of equal parts of unguentum hydrargyri ammonio-chloridi, and unguentum picis liquidæ. He states that a cure may usually be effected by this plan in from two to four weeks.

When the disease affects other parts of the body, the treatment must be similar to that above recommended; epilation is, however, unnecessary, and a cure is usually more promptly obtained. When the nails are invaded, they should be cut and scraped, and the parasiticide application should be rubbed into and beneath the free border of the nail.

Under any plan of treatment, a complete cure is rarely obtained in less than from four to eighteen weeks; the disease is extremely obstinate and there is a strong tendency to the redevelopment of the parasite after the cessation of the local treatment, until it be completely eradicated. By persevering in the plan above recommended, however, this can invariably be effected, and a perfect cure obtained, with the exception of patches of baldness, which but too frequently follow, from the destruction of the hair-follicles.

ARTICLE II.

TINEA.

We have already, in our general remarks introductory to this chapter, stated our belief that the various forms of tinea or ringworm are contagious diseases, and due to the presence of a peculiar fungus, the tricophyton.

The ordinary varieties of tinea which are described, are tinea tonsurans, or ringworm of the scalp; tinea circinata, or ringworm of the general surface; and tinea sycosis, or ringworm of the beard. With the latter form, of course, we are not at present concerned, nor are its relations to the two other varieties indisputable, since opinions are still divided as to its contagious and parasitic nature.

There is, however, abundant reason for believing the essential identity of tinea tonsurans and tinea circinata. In addition to the results of microscopic examination, which reveals the presence of the same fungus in both, there is the strongest clinical testimony to the same effect. Thus it constantly happens that patches of the two varieties will be observed upon the same patient, and there are innumerable instances on record to prove that they give rise to each other.

These diseases were formerly described by some authors under the generic name of porrigo; by others under that of herpes. Wilson, in his last edition, employs the term trichinosis to designate the group.

Causes.—The peculiar parasite, the tricophyton, is the essential cause of the disease; and the mode of its propagation is chiefly by contagion. Mr. Wilson believes the cause of the disease to be imperfect nutrition; but it is quite certain that the only way in which a scrofulous or debilitated constitution can influence the production of the disease, is by favoring the more ready growth of the parasite. In like manner, dirtiness of every kind may be said to be a predisposing cause.

The influence of these is, however, trifling, and we have frequently met with the disease among families living in easy or very affluent circumstances, the children of which were perfectly well lodged, well clothed, and well fed, and to whom every attention required by the nicest cleanliness was given. The means by which the affection is communicated are such as brushes, combs, caps, etc., or by the direct contact of the diseased surfaces.

One of us has but lately had an opportunity of studying, on a large scale, these affections and the mode of their transmission, at a large Children's Home in this city. There were a considerable number of children, about twenty in all, affected with the disease in a severe form; by strict isolation, by the utmost care in preventing any use of their combs, brushes, caps, or clothing, by the other children, by covering the entire scalp with an oiled-silk cap, whenever they mingled with their comrades, the disease was prevented from spreading. It was, however, frequently

observed, that in the children who suffered with tinea tonsurans of the scalp, patches of tinea circinata would appear either on the neck or face, or on some part which could be brought in contact with the affected surface; and its highly contagious nature was unhesitatingly believed by all the attendants, who had indeed themselves furnished the strongest evidence possible of it, by each and all contracting the disease repeatedly from handling the children in dressing them, or in making applications to the affected parts.

Age exercises a marked influence upon the production of these diseases, tinea tonsurans being confined to childhood and early youth, most commonly occurring between the ages of three and twelve years; though tinea circinata may be met with at any age.

Tinea Tonsurans.—Symptoms.—The disease most frequently begins with little erythematous patches, which soon become covered with furfuraceous scales, and which increase circumferentially while they heal in the centre, leaving the skin more or less furfuraceous. Occasionally there may be a crop of minute vesicles on the patch, which are soon followed by desquamation. When fully established, the disease appears in the form of furfuraceous patches of oval or circular shape, which are at first not more than $\frac{1}{8}$th or $\frac{1}{4}$th of an inch in size, but which increase gradually until they attain a diameter of one or two inches, and seldom more. The diseased surface is slightly thickened, elevated, of a grayish, bluish, or slate color, and covered with fine dry scales, which are very easily rubbed off, and are quickly renewed after being removed by any cause.

The hairs are altered from the very first. In the early stage, the apertures of the follicles of the diseased hairs are generally more or less prominent or papillated, and the hairs are unnaturally brittle, dull, and dry, and are bent on themselves and twisted, so as not to lie smooth, and the roots are somewhat matted together by the furfuraceous scales. A little later, they break off at a short distance from the diseased surface, leaving the circular patches partially deprived of hair. The broken hairs are uneven in length, and otherwise altered in appearance, being bent and twisted, and having become lighter in color than the original hairs, so as to assume somewhat the look of bundles of tow. The enlarged follicles also dot the surface, giving it the appearance of cutis anserina, or the skin of a plucked fowl. The epidermis and the stumps of the broken hairs now become covered with a characteristic grayish-white powder, consisting of the sporules of the tricophyton, the peculiar parasite; and, on examining the hairs, the same fungus will be found penetrating into the bulbs and shafts between the separated fibres, and causing here and there, by its accumulation, swellings or bulgings of the shaft.

The disease is unattended by any local sensations, excepting a moderate degree of itching.

If the disease persist and the degree of inflammation increases, there may be a good deal of infiltration of the scalp, and the surface becomes tumid, and dotted with enlarged orifices of hair-follicles, or there may be an eruption of vesicles or pustules, which dry and form scaly, yellowish crusts.

Diagnosis.—This disease is easily distinguished from other eruptions of the scalp. The appearances it presents when fully developed, are utterly unlike those of favus or eczema impetiginodes capitis. In favus, the peculiar cup-shaped crusts and the presence of the spores of the achorion, are sufficient to prevent mistakes; while in eczema, the eruption is sero-pustular, with the formation of yellowish or brownish yellow crusts; the patches are not circular, the hairs are healthy, the itching is extreme, and finally the disease is not contagious; in all of which particulars it differs entirely from the eruption of ringworm.

Pityriasis capitis does not occur in circular patches, but affects the whole scalp; it is not parasitic nor contagious, and does not lead to so much alteration of the hairs.

Occasionally tinea tonsurans, either from the irritation of scratching, or some other cause, may be associated with eczema impetiginodes, which to a great extent obscures the former disease, though a careful search will usually detect some of the characteristic broken stumps of hairs, loaded with the parasitic growth.

Prognosis.—Ringworm of the scalp is entirely devoid of danger, but is an exceedingly troublesome disease, as it is apt to spread to other children, and is often very difficult of cure. Its duration is very indefinite, and it not rarely leads to patches of permanent baldness.

Tinea circinata, as we have already said, frequently occurs in connection with tinea tonsurans, appearing on the neck or face; though it occurs also as an independent disease on any part of the body, and in patients of every age.

It begins as a little rose-colored, slightly elevated spot, which soon becomes the seat of slight furfuraceous desquamation; and extends circumferentially, healing in the centre, until it forms a large slightly elevated erythematous ring, inclosing a portion of sound skin.

In other cases, minute vesicles form on the reddened inflamed ring. They follow the usual course of development, being at first transparent, then turbid, and finally drying into small thin scales.

The size of the patch varies greatly, being in some instances small, not larger than a shilling, and in others presenting a diameter of two or three inches. When small, the redness covers the whole of the patch, but is much fainter in the centre than at the circumference; when large, the centre regains the natural color of the skin. Usually the ring is exactly circular, but at times it assumes an oval shape.

If any hairs have been growing on the affected spot, they become brittle and changed, as before described. There are usually several such circles present, and in some cases they are formed in great numbers. The only symptoms accompanying the eruption are slight pricking, smarting, and itching in the part.

Occasionally the parasitic growth invades the nails, which then become opaque, whitish, thickened and brittle.

Diagnosis.—There are but few diseases with which there is any danger of confounding tinea circinata. It is distinguished from erythema circinatum by the greater elevation of the marginal ring, by the presence of the

parasite, and by its contagious nature; and the two last peculiarities serve to distinguish it from psoriasis circinata.

According to McCall Anderson, and some other dermatologists, herpes iris is merely a form of this affection.

Treatment.—The cases of tinea tonsurans that have come under our charge, have proved in many instances very rebellious to treatment.

Strict attention should always be paid to cleanliness and hygienic rules; and, if the disease be associated with any impairment of the constitution, cod-liver oil, iron, in the form of the syrup of the iodide in syrup of sarsaparilla, arsenic, and bitter tonics, should be administered.

The local treatment is, however, the most essential. Where the disease occurs on a part covered with hair, epilation is advised by some authorities, and it would in all probability facilitate and hasten the cure.

Among the local applications which have proved most useful to us have been sulphùro-alkaline lotions, composed of ʒj of subcarbonate of potash and ʒij of sulphur, to a pint of water, applied by washing with a sponge several times a day; strong solutions of sulphite of soda; and an ointment consisting of ʒj of muriate of ammonia, mixed in an ounce of sulphur ointment, applied first at night by inunction, and after a time on rags.

Alkaline remedies have also been much used by other observers, who recommend washing the scalp every morning with a lotion composed of gr. xxx or xl of carbonate of potassa or borax to a pint of water, and applying in the evening an ointment containing ℈j of tannic acid to ℥j of lard.

Much more stimulating applications are, however, highly recommended, and often prove very serviceable. Thus Mr. Wilson advises a single application of the acetum cantharidis, or the stronger acetic acid; and Devergie recommends a solution of nitrate of silver, ʒj to f℥j of water.

Various mercurial applications are also advised, as solutions of corrosive sublimate, the citrine ointment, or the following, recommended by Jenner:

℞.—Hydrargyri Ammonio-Chloridi, . . . gr. xx.
Ung. Sulphuris, ... ʒiv.

Tarry applications may also be employed in obstinate cases, in the form of lotions, ointments, or soaps, containing tar, or oil of cade.

Nayler speaks highly of a plan used by Mr. Coster, who saturates the part with the following mixture:

℞.—Iodini, ... ʒij.
Ol. Picis, ... f℥j.

This solution is to be rubbed in firmly with a piece of sponge on the end of a piece of wood or whalebone. It is allowed to dry on the part, and left until the cuticle and the black crust separate at the end of a week or ten days.

In cases where many patches are present over the body, it is advisable to employ mercurial or sulphur vapor baths.

It must not, however, be forgotten that these varieties of tinea are among

the most obstinate disorders to which children are subject. The most faithful trial may be made with the remedies recommended above, for a long time, without success, and it is often necessary to persevere in their use for months; conjoining the treatment with a change of diet, and, when possible, with a change of residence, before the affection will be entirely and permanently cured.

CASES.—The following cases may be taken as types of the aggravated form of tinea, after it has persisted a long time and become complicated with secondary eruptions of eczema or pityriasis. It will be noticed that in the following records, all of the patients are stated to have been markedly scrofulous; but this circumstance must not have too much importance attached to it, since in the Home where these cases occurred, almost every one of the children presented unquestionable marks of the strumous diathesis. There can be no doubt, however, that this condition of constitution strongly favored the development of the disease, rendered it more severe and obstinate, and also favored the occurrence of the secondary inflammatory eruptions.

George T., æt. five, scrofulous, admitted to the Home in 1864, with bleeding piles. Tinea tonsurans appeared two months after admission, and persisted with various fluctuations for eighteen months, when it became complicated with eczema impetiginodes. Applications of tar and corrosive sublimate have been chiefly relied on.

Nov. 30th, 1866. Scalp covered with grayish-yellow crusts, one-fourth inch thick, in places running together or forming isolated lumps. A few spots of tinea circinata on face and neck. The scalp is reddish, and there is very little discharge from it. The hairs are sparse and broken. The cervical glands are much enlarged on both sides. On removing the crusts and examining the base, numerous exudation corpuscles and some spores of tricophyton were found; the epithelium not very granular.

Poulticed to remove the crusts. Ordered iodide of iron and potassium internally.

December 4th. Scalp quite clean from crusts, but remains reddish, with here and there bald patches. Numerous spores of tricophyton found in the hairs and among the epidermic cells.

Solution of sodæ sulphis (℥j to Oss. water), applied morning and evening, and kept on during the whole time by means of folds of linen saturated in the solution, and covered with an oil-silk cap.

December 16th. Much improved. Scalp cleaner, and less red. Some flat, thin, whitish scales over surface. Hairs more free from tricophyton, but numerous spores can still be seen by scraping moist surface beneath the thin crusts.

Treatment continued, with ultimate success.

William L., æt 5; hereditary tendency to tuberculosis; scrofulous; cervical glands enlarged on both sides; admitted in 1865, and has had tinea ever since, many forms of treatment having been tried, but none with more than temporary success.

November 30th, 1866. The scalp is reddened and wax-like from infiltration, with patches of baldness. In places where the eruption is oldest it is covered with whitish scales; elsewhere, there are scattered or confluent grayish-yellow or yellow crusts. Discharge of pale, thin, fetid pus.

On examining the surface beneath the crusts, numerous pus-cells and spores of tricophyton, often aggregated together, are found. The hairs have lost their normal appearance entirely, are bent, and where they emerge from the scalp, the

shaft is swollen, with bulging outline. The shafts are covered with spores of tricophyton, and their longitudinal fibres separated by collections of the fungus. Some of the bulbs remain healthy, others are broken and apparently converted into masses of fungous spores.

Ordered poultices to remove crusts; iodide of iron and potassium internally.

December 4th. Scalp clean, with exception of minute white scales; shows bald glazed patches, with light, short, thin hairs. Ordered same application of sulphite of soda as used in previous case.

December 15th. Immensely improved; the large bald patches still covered with minute shining white scales, but few tricophyta to be seen.

Charles L., æt. 4, admitted in May, 1866; hereditary tendency to tuberculosis; cervical glands slightly enlarged. Tinea soon appeared on the face and scalp, and in early part of November, thin flat grayish-yellow crusts formed over vertex, the rest of the scalp being covered with minute whitish scales.

November 30th, 1866. Ordered poultices to remove crusts; iodide of iron and potassium internally.

December 4th. Scalp comparatively clean. Patches of baldness, especially over parietal protuberances, with straggling, short, light-colored hairs. Abundant spores of tricophyton found. The hair-shafts much involved, collections of the parasite existing between the longitudinal fibres. The bulbs are also diseased, and seem to have become affected just below the exit of the hair; the bulb first becoming swollen at this point and then its sheath having become destroyed, so that the fungus forms a bed surrounding the shaft.

Ordered same application of solution of sulphite of soda.

December 16th. Very much improved; scalp smooth and clean, excepting above the ears, where there is on each side a collection of thin yellowish crusts. The hairs passing through these had numerous pus-cells adherent to their shafts, but the hair-bulbs seemed healthy, and no spores of tricophyton could be found on any of them.

ARTICLE III.

ALOPECIA AREATA.

This affection, which is also known by the names of area and tinea decalvans, is characterized by the loss of hair in circumscribed patches of round or oval shape. It is by no means a rare disease, and is much more common in children than in adults; thus of 42 cases cited by Hutchinson, 28 were under fifteen, 14 above that age.

Cause.—There is still much doubt as to the essential cause and nature of alopecia areata, although it appears to us that the view which attributes it to a perversion or suspension of innervation is the correct one.

Gruby is said to have discovered in 1843 a fungus in it, which has been called the microsporon Audouini, and some dermatologists of high authority accept the view of its parasitic nature. It cannot, however, be said to be demonstrated, since the parasite is very rarely found; so that Anderson, who has made numerous microscopic examinations, has never succeeded in detecting it.

Wilson, Duhring, and many others, consider it as due to suspended innervation, as a kind of paresis.

The disease appears to be, at least in some instances, propagated by contagion; though it certainly possesses this property to a much less degree than either of the forms of ringworm.

Symptoms.—The disease is limited to the scalp in children; though in adults it may attack any hairy part. In some cases, the first intimation of the existence of the disease is the sudden discovery of a bald spot, but in others, though less frequently, there is slight itching, with redness and branny desquamation of the affected spots.

The bulbs of the hairs then atrophy, and become tapering instead of being rounded and club-shaped; the hairs themselves become dry, lustreless, and brittle, with a fibrous fracture, and rapidly fall out, leaving bald patches.

These patches vary in size from one-half inch to an inch or even more in diameter, and there may be but a single one present, or they may be numerous, in which case they often coalesce, forming large patches of irregular shape; when the patches are single they usually assume a round or oval form.

The denuded portion of scalp is peculiar in appearance, being very white and polished, and thinner than the surrounding healthy scalp; the sensibility of the affected surface is also frequently impaired.

Diagnosis.—There can be no difficulty in recognizing the fully developed disease, excepting in the comparatively rare cases when it is combined with other skin diseases, as eczema or pityriasis.

Prognosis.—The only danger attendant upon alopecia areata is that of deformity, which is, in some cases, very great, depending of course upon the extent of the disease and the stage at which it is brought under treatment.

If the patches are small, the scalp not materially atrophied, and the orifices of the hair-follicles still visible on the bald patches, there is good reason to hope that steady persistence in treatment will effect a cure. In the majority of instances, it may be said that recovery occurs after a length of time varying from several weeks to several months.

Treatment.—Those who regard this as a parasitic affection, advise the ablation of the hairs immediately surrounding the patch, and the application of some of the stimulating parasiticides recommended in the article on tinea.

The majority of authors, however, content themselves with the application merely of such stimulating lotions and ointments as will increase the nutrition of the affected spots, and favor the renewed growth of hair.

Among the ointments which are most highly recommended are those containing the red iodide, the nitrate, the ammonio-chloride of mercury; some form of sulphur; or tar, iodine, or cantharides.

Hillier recommends, as the treatment he has found most useful, the application at long intervals of acetum cantharidis to the bald patches; painting them every other day with tincture of iodine, washing the head twice a week with soap and cold water, and applying a wash (consisting of one

pint of rum, one ounce of tinct. cantharidis, one-half ounce of spirit. ammoniæ aromat., and ten ounces of water) to the parts of the head which are not bald, twice a week.

The effect of this local treatment will be much increased by the internal administration of arsenic and iron.

Alcohol, carbolic acid, ammonia, and capsicum have also all been highly recommended as local applications in the treatment of this affection; they should of course be employed in a sufficiently dilute form.

SECTION II.

ARTICLE I.

SCLEREMA.

Definition; Synonyms; Cause; Frequency.—This peculiar affection, characterized by induration of the skin and subcutaneous tissue, with or without œdema, has been described by numerous writers, almost each one of whom has given a distinct name and theory for the disease. Among these names the most appropriate are sclerema, scleriasis, scleroderma, induration of the cellular tissue, or chorionitis.

It is an affection not altogether peculiar to infants, though it is rare to find it well developed after the first few months of life. There are, however, a sufficient number of cases in adults on record to establish the fact of its occasional occurrence at all ages. It must be a very rare disease in this country, even among infants, and especially in private practice, as we have met with but three well-marked cases in adults, and but one instance occurring in childhood, which was the case in which imperfect induration of the skin was developed in connection with atelectasis pulmonum, to which allusion is made in our article upon the latter affection.

In the large foundling hospitals in Europe, however, where so many causes exist to depress the vitality of the infants, it is of very frequent occurrence. Under such circumstances, moreover, it generally develops itself within the first twelve or fourteen days after birth.

The most varied causes were formerly assigned for this disease, before the researches of Bailly and Legendre appeared to point out sclerema as one of the results of imperfect expansion of the lungs. As we have already remarked, it is seldom observed among the children of the upper classes of society, so that all those conditions which depress the strength of the child, as insufficient or unhealthy nourishment, imperfect clothing, cold, especially when associated with moisture, may be considered as the predisposing causes of sclerema. The influence of dampness and cold in developing this affection is shown by the fact, deduced from numerous statistics, that twice as many children are attacked during the cold and wet months of

the year as at other times, although there are cases recorded as occurring in the hottest months.

Authors still differ in regard to the relation between atelectasis and sclerema. West[1] accepts the results of the researches of Bailly and Legendre, and considers it a result of the imperfect expansion of the lungs. Bouchut,[2] on the other hand, regards the changes found in the lungs as the result rather than the cause of the induration of the skin.

Letourneau[3] agrees with West in regarding sclerema as a condition depending primarily on congenital weakness, imperfect expansion of the lungs and defective hæmatosis. According to his view it is a slow asphyxia, the body becoming gradually cooled down and the child remaining in a state of organic torpor until death occurs.

Symptoms.—The disease presents some variety of symptoms according as it occurs in early infancy or in more advanced life.

In infants the induration of the skin appears within two weeks after birth, either with or without a preceding febrile condition for a day or two. It invades successively the feet, hands, limbs, the back, the face, and finally involves the entire surface of the body. At this early age, the skin retains its reddish tint in the affected parts; whilst later in life, the surface assumes a dull, slightly yellowish aspect. The skin becomes hard, is with difficulty pinched up, and instead of thinning, remains thick and waxlike. The parts appear somewhat swollen, though never to any great extent, and pressure with the finger scarcely leaves an impression on their surface. Occasionally the induration is associated with an effusion of serum beneath the skin, and when this exists, the surface is much more readily indented.

It is this occurrence of œdema which has led some observers to consider sclerema as a form of anasarca; it is probable, however, that its presence is merely a result of the obstructed cutaneous circulation, and that it does not, in reality, constitute an essential element of the disease. The skin is also quite frequently jaundiced. The children usually preserve the power of moving the affected parts, and there is no loss of cutaneous sensibility. The temperature of the body, and especially of the indurated portions, rapidly decreases, so that from 100° it may fall to 90°, 80°, and even, in some exceptional cases recorded by Roger, to 73° and 70°.

The little patients appear to suffer much pain during this disease. They utter a sharp, abrupt, isolated, but very frequently repeated cry, quite characteristic of the affection, and occasionally they present nervous symptoms, such as twitching of the hands or more general convulsive movements.

The strength fails rapidly, and they soon become too weak to suck. The pulse is feeble, though not much accelerated, unless some complication has ensued. The appetite fails, and the bowels are constipated, unless there is entero-colitis, which occurs in a few cases. This condition is naturally

[1] Diseases of Children (3d Amer. ed.), p. 238.

[2] Diseases of Infancy (Bird's trans.).

[3] Letourneau, Sclerema and Œdema. Paris, 1858 (Canstat. Jahrb., iv, 456).

attended with great emaciation, as we find in Elsässer's[1] cases, where the average loss of weight was three-fourths of a pound, the extremes being six ounces and two pounds.

The respirations are imperfect, and, after a short time, cough makes its appearance and continues throughout the case, indicating the occurrence of either pneumonia or collapse of the lungs, which are by far the most frequent complications, even if the state of atelectasis be not regarded as an efficient cause of sclerema. The disease, however, is not always so general and severe as above described; occasionally it occurs in limited portions of the body, and without any very alarming symptoms.

In later life the disease is more frequently thus limited to small portions of the body; the symptoms follow a more chronic course, and are somewhat amenable to treatment. Rilliet and Barthez[2] describe an acute and chronic form, and mention the following symptoms as distinguishing the disease in the adult: the severe epigastric pain associated with violent palpitations, the less acute progress of the case, and the more frequent implication of the serous membranes.

In one well-marked case, occurring at the age of thirty-five years, which one of us had the opportunity of observing during its entire course, these symptoms were very prominent.

Prognosis.—In infants, when the induration is at all general, the disease almost invariably terminates fatally in from two to six days. Under favorable circumstances, however, and when the induration is limited, resolution may occur, and the case terminate favorably; though it requires from fifteen days to a month to effect the cure.

The fatal result is either caused by the gradual exhaustion of the vital powers, or by the supervention of one of the complications already mentioned, by far the most usual of which are lesions of the lungs.

In later life, when the disease tends to recovery, a long time may be consumed before the induration completely disappears. Rilliet and Barthez report a case, occurring in a girl aged eleven years, which lasted two years, although it was at no time very general or accompanied by very severe symptoms.

Of 53 cases reported by Elsässer, all but 4 proved fatal, either from the sclerema itself, or from some incidental disease.

Diagnosis.—The absence of any lesion of the internal organs, together with the perfectly characteristic appearances of the induration, render an error of diagnosis almost impossible.

Anatomical Appearances.—The induration of the surface persists after death, and on incising the part, a turbid fluid, resembling that of anasarca, often flows out. The subcutaneous tissue is also indurated, and the fat is found in the form of solid granules. This layer, which varies from one-half a line to three lines in thickness, is sometimes followed by a gelatinous one.

The fluid which is contained in the meshes of the tissues has been subjected to analysis by several observers, but with conflicting results: Chev-

[1] Sclerema, Arch. Gén., N. S., t. i, 1853, p. 531. [2] Op. cit., t. ii, p. 106.

reul and Breschet reporting that it contained a plastic matter, spontaneously coagulable on contact with the air, which they were inclined to regard as characteristic of the disease; whilst Billard, on repeating this observation with fluid derived from an ordinary case of anasarca, found it to possess the same property. This subject, therefore, of much importance in regard to the pathology of sclerema, requires to be more fully investigated.

Different observers are not agreed as to the condition of the corium and subcutaneous tissue. In sclerema adultorum the essential element in the changes of the skin appears to consist in a morbid increase of the connective tissue, associated with a marked development of lymphoid cells, by multiplication of the cells in the perivascular sheaths of the minute bloodvessels of the derm and subcutaneous tissue. This condition was pointed out by Rasmussen (translated in *Edin. Med. Journ.*, vol. xiii, part i, pp. 200 and 318), and accords with our own investigations. In sclerema in children, Jenks[1] and Löschner[2] have observed marked increase in the connective tissue of the corium; but this condition has not been found by other observers.

The indurated tissue is traversed by numerous vessels, permeable, and for the most part gorged with dark blood. Bouchut believes that the cutaneous capillaries are in great measure obliterated in the indurated parts, and that the œdema which occasionally coexists with sclerema is due to this obliteration; founding his opinion upon an unsuccessful attempt to inject the skin of a limb affected with sclerema, although the injecting fluid freely entered all the deeper tissues. The observations of Elsässer, however, render this view doubtful, since in 49 cases, he failed to find this condition.

Apart from these morbid changes in the skin and subcutaneous tissue, there is no lesion characteristic of sclerema. In a large number of cases, however, the lungs present some abnormal condition. According to Bouchut, they are often gorged with blood, and here and there contain patches of lobar pneumonia: conditions which he regards rather as the result than the cause of sclerema.

Elsässer found lobular pneumonia present in a tenth of his cases; and in a third of them, portions of the lungs were impermeable to air. We have already stated that West, following the researches of Bailly and Legendre on atelectasis, believes that sclerema is one of the results of this persistence of the fœtal condition of the lung, not differing in its essential nature from œdema following pulmonary obstruction. The occurrence of undoubted cases of sclerema in the adult, and the frequent absence of atelectasis in well-marked cases of sclerema in infants, appear, however, to render this view untenable.

The entire venous system and the cavities of the heart are distended with dark fluid blood; but the heart presents no constant condition to which could be attributed the production of the disease. The jaundice

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[1] Amer. Journ. of Obstetrics, May, 1871, p. 129.

[2] Prager, Vierteljahrschrift, 1868.

which has been mentioned as occasionally existing, is not found to be associated with any abnormal condition of the liver, excepting congestion. Entero-colitis is a rather frequent complication of sclerema, and has been regarded as influencing its development; but this view has long since been abandoned. Elsässer found intestinal lesions and hyperæmia of the abdominal viscera quite commonly; and in eight of his cases, peritonitis was present.

TREATMENT.—The preventive treatment of sclerema consists in attention to all the hygienic conditions of the young infant.

The curative treatment implies the removal of all the causes, and the application of remedies calculated to restore the force of the circulation, and the function of the skin. *Warmth* stands foremost as a curative measure, and recourse may be had to warm baths or hot vapor-baths, and to frictions with hot oil; hot sand or bran-bags may be applied to the surface, and the temperature of the room should be carefully regulated.

The child should be nourished with breast-milk; and stimulants, such as wine-whey, should be freely given. Cordial and aromatic draughts are also recommended, which may be formed of any of the diffusible stimulants.

As there is reason to believe that some relation exists between sclerema and atelectasis pulmonum, we should, in addition, resort to all those means especially adapted to remove this condition, for a full account of which the reader may refer to the article on collapse of the lungs.

The same plan of treatment is advisable in cases in adult life.

By these means we may hope to arrest, and even cure this strange affection, when it has not involved any considerable portion of the surface.

CLASS VIII.

WORMS IN THE ALIMENTARY CANAL.

GENERAL REMARKS.

THERE are five different species of worms found in the alimentary canal. These are the Ascaris lumbricoides, or round-worm; Ascaris vermicularis, thread-worm, seat-worm, or, as it is popularly called, ascarides; Tricocephalus dispar, or long thread-worm; Tænia solium, and Tænia mediocanellata, the most common varieties of tape-worm; and the Bothriocephalus latus, tænia lata, or broad tape-worm.

We shall give a short description of each of the intestinal entozoa, in order that they may be readily distinguished, but will treat of the causes, symptoms, and treatment only of the first two, inasmuch as the tænias very rarely exist during infancy or childhood, and the tricocephalus is much less frequent than the round and seat-worms, and gives rise to symptoms of the same kind as the former.

DESCRIPTION.—The *Ascaris lumbricoides*, or, as it is commonly called, lumbricoides, lumbricus, or round-worm, is shaped not unlike the common earth-worm, having a cylindrical body, which is attenuated towards either extremity, but particularly the anterior. It varies in length generally between six and twelve inches, and is usually about two or three lines in thickness. The young worm, about an inch and a half long, is rarely met with. The head of the animal is at the smallest extremity, and may be distinguished by a circular depression, around which may be seen three tubercles. When recently voided, the worms are somewhat transparent, so that the viscera may sometimes be seen through the parietes. The integument is marked by circular fibres, and by four lines extending at equal distances from the head to the tail, the former of which indicate the course of the muscles, while the latter indicate that of the vessels and nerves.

The color of the worm is whitish, yellowish, or more or less deep rosy in tint, according to the nature of the aliment they contain; they are, as already stated, somewhat transparent when first voided. The alimentary canal, which may be distinguished by its brownish color, terminates by a transverse opening or anus, situated on the inferior surface of the animal, just in front of its posterior extremity.

The two sexes are in different individuals. The male may be known by its tail, which is shortly curved, while that of the female is straighter and thicker. The genitals of the male consist of a double penis, which may sometimes be seen to protrude just in front of the caudal extremity; those

of the female may be distinguished by the vulva, seated at a constricted point of the body, about a third of the distance from the head to the tail. The male is smaller and much less abundant than the female.

The *Ascaris* or *Oxyuris vermicularis*, thread-worm, seat-worm, or maw-worm, is the smallest of the intestinal worms, and is generally distinguished in popular language by the title of ascarides. The sexes are in separate individuals.

The male is generally about two lines in length; its body is elastic, of a whitish color, very slender, and looks not unlike a piece of cotton thread, whence one of its names was derived. The female is larger than the male, reaching a length of four or five lines. The anterior part of the body is of the same shape in both sexes. It is obtuse, and surrounded by a transparent membrane, through which may be seen a straight tube, forming a kind of bladder, which is the œsophagus, and which terminates in a globular stomach. The head is provided with three tubercles, as in the lumbricoides. The intestinal tube in the male continues the whole length of the body, which becomes somewhat thicker towards the end, and is arranged into a spiral shape at the tail. The body of the female is shaped like that of the male as far back as the stomach, and increases in size in the first third of its length, after which it diminishes, and becomes so small at the end as to be seen with difficulty by the naked eye.

The *Tricocephalus dispar*, or long thread-worm, is generally about an inch and a half or two inches long, and consists, as it were, of two portions, of which the anterior, constituting about two-thirds of the length, is exceedingly slender, scarcely thicker than a horse-hair, while the posterior third swells out suddenly so as to become much thicker and larger. The sexes are in different individuals. The worm is provided with an alimentary canal, which, commencing at an orbicular mouth placed in the small extremity, runs through the animal to the anus, placed at the caudal extremity. The male is smaller than the female, and is, usually, found convoluted. This worm is met with chiefly in the cœcum and colon, particularly the former. It usually exists in very small numbers, and sometimes but a single one is found. The symptoms which it occasions are the same as those produced by the lumbricoides.

The *Tænia solium*, common or long tape-worm, as well as the Tænia lata, are of rare occurrence in children. Of 206 cases observed by M. Wavruch, only 22 occurred in subjects under fifteen years of age, and of them the youngest was three years and a half old (*Bib. du Méd. Prat.*, t. v, p. 626). These worms have, however, been met with at an earlier age, but as they are rare, we deem it unnecessary to do more than describe their appearance, in order that the reader may be able to distinguish between them and the varieties which generally exist in children, the Ascaris lumbricoides and vermicularis. For a full account of the symptoms produced by the two varieties of the tænia, and their treatment, the reader is referred to any of the standard works on the practice of medicine.

The *Tænia solium* is usually of a whitish color, flat in form, and varying in length from five to ten feet, its ordinary length, to twenty feet, or even more. It is uneven in shape, being thick and broader behind, and meas-

uring three or four lines at its widest part, while it tapers gradually towards the anterior extremity, where it becomes slender and thread-like. The head is globose and very minute, being about $\frac{1}{30}$th inch in diameter. It has a projecting papilla in the centre, furnished with a double circle of hooklets. There are also four projecting suctorial disks placed at equal distances around the head. The neck is delicate and thread-like, but on microscopic examination presents transverse wrinkling at a short distance from the head, and soon merges into the distinctly jointed body. This is composed of numerous segments, which at first are small, and broader than they are long, but lower down increase more rapidly in length than in breadth. The largest joints measure about one-fourth of an inch wide by half an inch long. Each joint contains both male and female sexual apparatus, opening by a common aperture on the side.

The *Tænia mediocanellata* was formerly confounded with the tænia solium. It attains however a greater length, its joints are longer and broader, and its head is about three times as thick. The four suckers are present, but there is no central projecting papilla, nor any hooklets.

The *Bothriocephalus latus*, *Tænia lata*, or *broad tape-worm*, is long and flat like the preceding variety, but it is generally thinner and broader, measuring from four to ten lines in breadth. It attains even a greater length than the common tape-worm. It is usually of a dirty-white color, and rather less opaque than the tænia solium. It is distinguished also from the other tæniæ, by the shape of the segments, which are broader than they are long; by the form of the head, which is small, elongated, without spines, and divided into two lobes by a longitudinal fossa on each side; and by having, instead of the four mouths of the tenia solium, a single minute pore in the centre, between the fossæ, or else two pores, one at the extremity of each lobe.

The *frequency* of intestinal worms, and their *importance* as a cause of disease, have certainly been, and are still by many physicians, and especially by the public, very greatly exaggerated. There can be no doubt that they do, when they exist in large quantities, and particularly in certain countries, give rise to great disturbances of the digestive organs, and even occasion death; but such instances are, it seems to us, extremely rare, in this city, at least. We are quite sure that we have never as yet met with a case, in our own experience, in which life was at all seriously endangered by their existence,—though we have seen numerous instances in which slight disorders of the digestive apparatus, and various nervous symptoms, generally of very moderate severity, have disappeared after the administration of anthelmintics, sometimes followed, and in an equal number of cases probably, not followed, by the expulsion of worms.

To show the truth of the above remarks, as to the importance of worms as a cause of disease, we make the following quotations: Dr. Rush (*Med. Inquiries and Observations*, vol. i, p. 205) remarks: "When we consider how universally worms are found in all young animals, and how frequently they exist in the human body, without producing disease of any kind, it is natural to conclude that they serve some useful and necessary purposes in the animal economy." M. Guersant says (*Dict. de Méd.*, t. xxx, 669):

"It has always been the custom to assign to entozoa much too important an influence upon the diseases of childhood. In proportion as this part of pathology is perfected, it becomes evident that the greater number of children dying after having discharged worms, or even while having them still, are affected with acute or chronic diseases, which leave after death incontestable traces of their effects, and which are of themselves necessarily fatal." M. Barrier (*Mal. de l'Enf.*, t. ii, p. 100) quotes M. Trousseau as making the following remarks: "For sixteen years we have not met with a single child who has presented any verminous symptoms; never or almost never does a child born and reared in Paris discharge worms, while just the contrary is true as to the provinces. . . . . Young children, to be sure, are sometimes met with in our hospitals, who discharge worms, but they are those who have been born in the country, and have lived in the capital only for a short time." Dr. Condie (*Dis. of Child.*, 2d ed., p. 226), remarks: "Worms are a very common occurrence in the intestines of children, and may unquestionably, under certain circumstances, become a cause of severe irritation; but much less frequently than is generally supposed."

We believe we may conclude, therefore, that though these parasites are of very common occurrence, and productive of grave disorders in some countries, they are rarely met with in quantities sufficient to do serious injury to the health, in other places, as for instance Paris, and probably in this country, or at least in the northern parts of it.

That intestinal worms do, however, not unfrequently in some countries, and occasionally in all, produce dangerous and even fatal disturbances of the health, cannot be doubted after careful perusal of the evidence brought forward by different authorities. M. Guersant, amongst others, remarks (*loc. cit.*, p. 670): "It is nevertheless incontestable, that the development of these animals in the gastro-intestinal and abdominal cavities does sometimes give rise to very varied morbid phenomena, which are in some instances grave enough to cause death." Nevertheless, we are disposed to believe, as stated above, that fatal or even dangerous results from the existence of these parasites are of rare occurrence in this city, and probably throughout our Northern States. Dr. Dewees, however, mentions several cases in which they produced alarming symptoms, and one in particular (*Dis. of Child.*, p. 492), in which the subject, a child twenty months old, was extremely emaciated, and whose abdomen was "enormously distended, and semi-transparent," who recovered rapidly after ninety-six lumbricoides, from six to ten inches long each, had been expelled under the use of pink-root in infusion.

ARTICLE I.

ASCARIS LUMBRICOIDES.

THE *description* of this worm has already been given at page 965.

CAUSES.—Under this head we shall not pretend to consider the question of the origin of worms, but only the causes which predispose to their production, or favor their growth.

Age has no doubt a considerable influence upon the predisposition to lumbricoides. According to M. Guersant (*loc. cit.*, p. 685), infants at the breast under six months of age are very rarely affected with them. Instances occasionally occur, but are altogether exceptions to the general rule. Above six months of age, they begin to be met with, but still very rarely, so that scarcely one or two will be found in several hundred children of a very early age; while from three to ten years of age they will be observed in about a twentieth, or in some seasons perhaps in a larger proportion. M. Valleix states that he has never met with them in newborn children. Dr. Dewees says (*loc. cit.*, p. 481), that he has never seen worms in children under ten months old; and in only two instances at that age. We do not recollect ourselves ever to have seen them in subjects younger than eighteen months, and very rarely in those under three or four years.

There can be little doubt that the disposition to worms is *hereditary* in some families. It is generally believed that the species under consideration is more common in *girls* than *boys;* that it is most common in children of *lymphatic* and *scrofulous* constitutions; and that a too exclusively vegetable or milk *diet*, and an abuse of *fruits*, strongly predispose to their production. The *habitation* of a cold and damp, or warm and damp climate, and the *seasons* of summer and autumn, are supposed by many also to favor their production and growth. It is a general belief, and we should suppose from personal experience, a well-founded one, that a feeble and disordered state of the digestive function from any cause, often acts as a predisposing cause of worms, and particularly of lumbricoides.

SEATS.—The small intestine is, in a very large majority of the cases, the seat of the ascaris lumbricoides. They are met with, however, in other parts of the digestive tube, particularly the stomach and large intestine, and more rarely in the œsophagus or pharynx. In some instances they are found to have migrated to other organs, as to the liver, gall-bladder, and in still rarer cases they have passed into the peritoneal cavity, bladder, larynx, trachea, bronchia, and even into the nasal passages and frontal sinuses. They have also been met with occasionally in the walls of the abdomen, forming verminous abscesses, whence they have escaped on the opening of the abscess.

The *number* of ascarides is exceedingly variable; there may be only two or three, ten or twenty, or several hundred. When very numerous, they are apt to be rolled or twisted into knots or balls, which have been seen as

large as the fist, so as to block up completely the canal of the intestine. In a case cited by Rilliet and Barthez, from M. Daquin, the duodenum was so filled with worms as to be distended, and to have acquired a considerably larger size than natural, while at the same time it was hard and elastic. The jejunum, ileum, and cæcum were filled, so that it seemed as though the worms must have been pushed in by force. They were found also, but in smaller quantity, in the colon. Dr. Condie (*loc. cit.*, p. 230) states that he has known one hundred and twenty lumbricoides to be voided in a single day by a child five years old. It ought, however, to be remarked, that the instances in which such large numbers are met with are altogether exceptional, especially in our Northern States. We have never ourselves known more than six, eight, or ten to be expelled within a few days' time, and very generally there have not been more than three, four, or five.

Anatomical Lesions.—When the number of lumbricoides is small, the mucous membrane has been found in a state of perfect health, while, on the contrary, when they are numerous, and especially when collected together into knots, the membrane has presented a fine injection like that which exists in erythematous enteritis; in some very rare instances on record, in which the quantity of worms has been very great, the mucous membrane has been found deeply injected, thickened, granulated, and, in a small proportion of cases, softened, and even eroded. Not unfrequently the intestine presents all the characters of well-marked enteritis, or entero-colitis, though the number of worms may be very small. In such cases, it is reasonable to suppose that the inflammatory affection has been an accidental complication of the verminous disorder.

Much discussion has arisen in regard to the manner in which *perforation* of the intestine, as an accompaniment of worms, takes place. It is necessary to suppose, in subjects in whom worms are found in the peritoneal cavity, or in abscesses formed in the abdominal parietes, that perforation of the bowel has taken place, and yet in some instances no trace of the opening is left, no inflammation of the serous membrane is met with, nor has there been any escape of the contents of the digestive canal into the abdominal cavity. In others, however, and much the most numerous cases, it is evident from the anatomical appearances, that the perforation has taken place in consequence of previous ulceration of the coats of the bowel, and that the worms have escaped with the other contents of the intestine. It is in regard to the former class, therefore, that discussion has principally taken place; some asserting that the parasite itself makes the opening, by an active process, while others deny the possibility of this occurrence, and maintain a previous ulceration or softening in all cases. Amongst those who advocate the possibility of perforation independent of previous change in the intestinal coats by disease, are MM. Mondière and Charcelay, the former of whom has examined the subject with a great deal of care, quoted by Rilliet and Barthez; Rilliet and Barthez themselves; the authors of the *Biblioth. du Méd. Prat.*, and M. Guersant; while amongst those opposed to this opinion may be cited, MM. Cruveilhier, Barrier, Dr. Arthur Farre, who greatly doubts the possibility of the accident, and Dr. Condie. We confess ourselves inclined to believe, from facts stated by different authors,

and from the history of two cases which occurred to M. Guersant in 1841, at the Children's Hospital of Paris (*loc. cit.*, p. 680), that worms may in some instances cause a perforation independently of previous disease of the coats of the intestine. In one of these, two lumbrici were found engaged in an opening in the appendix vermiformis, half the bodies of the animals being in the appendix and half in the peritoneal sac; while in the other, an opening of the same kind as in the previous case was found in the appendix, and though the three worms which were found lying in the abdominal cavity might have escaped through an ulcerated perforation of the colon, it is not the less true that the opening in the appendix presented the same characters exactly as in the first case, in which the animals were, as the author remarks, "taken in the act." In both instances, the perforation of the appendix was at the extremity of that canal, and in the form of a narrow opening of a conical shape; the membranes were smooth, thinned, and the edges of the orifice sloped off from within outwards; no trace of anterior ulceration was perceptible. On the other hand, we have met with a fatal case of intestinal perforation, dependent on extensive ulceration of the bowel, in which a lumbricoid worm was found lying loosely half-way out through the opening. In this case it was evident that the presence of the worm was purely accidental.

In regard to the *verminous abscesses* already refered to, we shall make but few remarks, referring the reader to more extensive treatises for fuller information. These abscesses have been, in very rare instances, met with in the pharynx and nasal passages, but much more frequently they exist in the abdomen. The latter may be of two kinds, *stercoraceous* and *non-stercoraceous*. In the former, the abscess, which forms upon some portion of the walls of the abdomen, gives issue not only to the worm or worms, and pus, but also to fecal and even alimentary substances, and leaves behind a fistula connecting with the cavity of the intestine, which may cicatrize after a short time, or remain open during life. In the other form of abscess, the opening through the coats of the intestine has been closed immediately after the passage of the worm, so that the abscess gives issue only to the animal and pus, after which it heals up without giving rise to a fistula.

The verminous abscesses are said to be found generally about the inguinal and umbilical regions; to occur most frequently between the ages of seven and fourteen years, and not to be, as a general rule, very dangerous to life.

Symptoms Indicative of the Presence of Worms.—We believe it is almost universally acknowledged by later writers, that there is no single symptom, nor group of symptoms, other than the expulsion of the worms, and their detection, which indicate with certainty their existence in the digestive tube. This is the expressed opinion, amongst others, of MM. Guersant, Rilliet and Barthez, Barrier, Valleix, and Drs. Eberle and Condie, and it is also the opinion which we have ourselves been led to form from our experience amongst children.

Another point worthy of remark is, that even though one or several worms may have been expelled, it is not always fair to conclude that the

symptoms under which the child labors, are the result of the presence of others of these animals, as there may be no more in the bowels, or they may be so few in number as not to produce injurious effects; while, on the contrary, various disorders of the digestive tube, as chronic indigestion, simple diarrhœa, and inflammatory diseases of the gastro-intestinal mucous membrane, may and do exist simultaneously with, and yet independently of, the presence of these parasites.

The *symptoms* generally enumerated as indicative of the presence of worms are the following. The child presents various signs of disturbed health. The stomach is more or less deranged, as shown by furred tongue, eructations, variable appetite, which is sometimes diminished, and sometimes increased, thirst, acid or heavy breath, and nausea. The abdomen may be enlarged or retracted, generally the former, and is often more or less hard and painful to the touch; the condition of the bowels varies in different cases, as they are sometimes costive, and sometimes affected with diarrhœa. According to M. Guersant, the stools often contain glairy substances, and are sometimes streaked with blood and of a yellowish-green color; the patient often suffers from colics, which may be either dull or acute, though more generally the latter, and which are generally felt at the umbilical region. Children affected with lumbricoides are said to present a peculiar physiognomy; the face is usually paler than natural, and sometimes has a leaden tint; the eyes are surrounded by bluish rings, and have at the same time a dull and languid expression; the inferior eyelids are often swelled and puffy; the sclerotic coat of the eye assumes a bilious tint; the nostrils are said to be sometimes swelled, and the child complains much of irritation and itching of those parts, and is constantly picking at them with the fingers. In some instances epistaxis takes place. The child is generally pale and thin, indolent and languid, or irritable and unhappy. The sleep is almost always disturbed. This indeed is, it seems to us, one of the most important signs both of worms and of chronic functional disorders of the stomach and bowels. The nights are almost always restless, the patient either waking often to drink, or waking in fright and alarm from dreams, or else constantly tossing and turning in sleep, moaning, or grinding the teeth.

Other symptoms mentioned by different observers, and by some very much depended upon, are acceleration with irregularity of the pulse, and dilatation, especially unequal dilatation, of the pupils. We might cite also strabismus, and occasionally cough.

In children in whom the number of lumbricoides is very large, the constitution suffers to a dangerous degree. The symptoms above enumerated are very marked, and at the same time the child is very pale or sallow, emaciated, weak, and without appetite; the abdomen is hard and tumid; the nervous symptoms are severe, and some of the symptoms which we shall describe presently, under the head of disorders occasioned by worms, are also observed.

It should be remarked, however, again, that all or any of the symptoms just described may exist independently of the presence of worms, the only certain sign of which is their expulsion from the patient.

Morbid Effects occasioned by Worms.—MM. Rilliet and Barthez divide the accidents or effects produced by the existence of lumbricoides into two groups: those which result from the mechanical influence of the entozoa, as their accumulation or displacement; and those which appear to be the consequences of a purely sympathetic action on the different systems of the body, and particularly the nervous system.

Mechanical Effects.—Under this head are included perforation and hæmorrhage of the intestine, enteritis, abscesses, and the symptoms determined by the displacement or migration of the worms into the ductus communis choledochus, the liver, or the air-passages.

Of perforation and abscesses, we have already treated under the head of anatomical lesions. Hæmorrhage is a very rare event, but it occurred in one instance cited by MM. Rilliet and Barthez, and Guersant, from M. Charcelay, in consequence of the rupture of an arteriole in a small rounded ulceration in the duodenum, apparently occasioned by the presence of a large number of lumbrici. Enteritis, as an effect of the presence of worms, has also been referred to under the head of the anatomical lesions. In many instances it is, no doubt, a mere accidental complication, in no way connected with the presence of entozoa; probably this is true of a large majority of the cases. When, however, the number of the parasites is very great, and particularly when they are collected into large or firm knots and bundles, they may, no doubt, occasion, by their mechanical irritation, inflammation, thickening, softening, and even destruction of the mucous tissue, as in cases cited by M. Guersant, from MM. Bretonneau and Charcelay, and in one which occurred to himself. It should be remarked, however, that the cases on record in which ulcerations evidently depended upon the presence of worms, are, so to speak, infinitely few in comparison with those in which no such alteration existed, or in which it was evidently independent of any influence exerted by the worms.

Effects caused by the Displacement or Migration of Worms.—Lumbricoides have been found, as we have already seen, in the walls of the abdomen, giving rise to abscesses. They have been discovered, also, in the vermiform appendix, in the ductus communis choledochus, in the gall-bladder, in the hepatic ducts in the substance of the liver, forming abscesses, and in the pancreatic canal. The symptoms occasioned by the latter class of cases are very obscure. In one instance, M. Guersant supposed that an attack of convulsions depended upon the presence of worms in the common duct.

More numerous examples are on record, in which violent dyspnœa and cough, and fatal asphyxia, have occurred in consequence of the pressure of lumbricoides which had passed into the œsophagus, or from their introduction into the larynx, trachea, or bronchia. The symptoms occasioned by these accidents are a sudden attack of dyspnœa, anxiety, agitation, threatened suffocation, dry, spasmodic cough, acute painful cries, pain in the larynx or trachea, and, unless relief be obtained in a few hours, death. This kind of attack may depend on the rising of a worm or bundle of worms into the œsophagus, causing pressure on the larynx

and trachea, as in the case reported by M. Tonnelle, in which the symptoms disappeared after the expulsion of a large number of worms; or else it may be due to reflex spasm of the œsophagus or larynx dependent upon the irritation transmitted from the intestine which is excited by the presence of these parasites. One of us has met with an instance of this kind. It occurred in a boy fifteen years old, presenting every mark of strong and vigorous health, but who, for three or four weeks before we were consulted in regard to him, had been subject to sudden and apparently causeless attacks of suffocation, which seized him without the least warning. When the attack came on, he would for some instants cease to breathe, or breathe with much difficulty. He always seemed to suffer from the greatest anxiety; the countenance became altered and distressed; he was unable to speak, but made signs for water, and when able to swallow a mouthful, which was always exceedingly difficult, was at once relieved. His mother told us that he always appeared to be in the greatest distress, so that, on several occasions, she feared for his life. Striking him violently on the back, which she, when present, always did, sometimes relieved him, but generally the difficulty continued until he could swallow a little fluid of some kind. These attacks were unattended at the time by cough, nor was there the least sign of disorder of the respiratory system in the intervals between them. Suspecting that the difficulty must depend on the rising of a worm or worms into the œsophagus, or upon sympathetic irritation from the presence of these parasites in the stomach, and learning that he had been troubled with worms some years previously, we gave him wormseed oil, which caused the expulsion of a few large lumbricoides, after which he had no return of the symptoms.

The attacks of dyspnœa may depend also, as already stated, on the introduction of worms into the air-passages. Under these circumstances death is very apt to be the result. In one instance, however, reported by M. Arronsshon, after the difficulty had lasted two hours, the patient, a little girl eight years old, after violent efforts at coughing, threw up a living lumbricus.

We have next to consider the *sympathetic effects*, and particularly the *nervous symptoms*, occasioned by worms. We may include amongst the nervous symptoms produced by worms the headache, languor, irritability, restless and disturbed sleep, and grinding of the teeth, so frequently observed. These, however, are of but slight importance in comparison with certain other disorders of the nervous system, which do undoubtedly occur sometimes, though we should suppose *very rarely*, in proportion to the whole number of subjects affected with the parasites. The disorders to which we allude are partial or general convulsions, chorea, hysteria, and catalepsy, which are the most frequent, though, as so often stated already, extremely rare in comparison with the number of cases in which the presence of the worms produces no such effects. Other disorders cited by the authors of the *Bib. du Méd. Prat.*, with cases to prove their reality, are insanity, paralysis, coma, palpitations, strabismus, cough, hyperæsthesia of the skin, amaurosis, and aphonia.

Diagnosis.—It has already been stated that there are no certain signs of the presence of worms in an individual except their expulsion. The symptoms which have seemed to us most strongly to indicate their presence are, a chronic disordered state of the digestive apparatus, producing irregular appetite, which is sometimes good and at others bad; slight emaciation; paleness or unhealthy tint of the complexion; languid expression of the face; some irritability of the temper, or a want of the gayety and activity of disposition natural to childhood; picking at the nose; often some tumidity of the abdomen, which may be at the same time either hard or merely tympanitic; and, what seems to us more important than any that we have named, very restless and broken sleep at night, with frequent grinding of the teeth.

M. Valleix remarks that, in a case presenting nervous symptoms simulating disease of the brain, we may suspect the existence of worms, if we learn upon inquiry that symptoms of marked intestinal disorder, the various signs cited above as indicative of the presence of worms, and different derangements of digestion, had preceded for some time the appearance of the nervous symptoms; chiefly for the reason that, in most diseases of the brain, the digestive tube is, at the invasion, in a state of integrity, with the exception of sympathetic vomiting. If we can learn, upon inquiry, that the child has discharged worms on some previous occasion, the probability of the dependence of the symptoms upon them becomes still stronger.

It is sometimes difficult to determine positively whether certain substances discharged at stool are fragments of worms, or whether they are portions of imperfectly digested aliment, or foreign bodies. The things which most resemble lumbricoides, are the remains of tendons, ligaments, vessels, fibres of plants, etc. To make the distinction with certainty, the doubtful substance ought to be placed in water, so that it may be thoroughly cleansed, after which it must be carefully examined as to its structure, arrangement, consistence, etc., with the eye, and with the microscope, if necessary. M. Guersant has suggested a very easy method of ascertaining whether the substance be animal or vegetable, which is to subject it to heat, after it has been carefully washed, when the odor will at once inform us of its real nature.

Prognosis.—It is no doubt a very rare event, at least in the northern parts of our country, for life to be endangered by the presence of worms. We have never, ourselves, met with an instance in which the general health was more than moderately disturbed by this cause. That verminous affections are sometimes, however, dangerous to life in this city, is shown by three cases related by Dr. Dewees, in which very severe and threatening symptoms were instantly relieved upon the expulsion of lumbrici after the exhibition of vermifuges.

Worms become dangerous to life when they migrate from their original seat to neighboring and important organs, particularly the air-passages and liver. The prognosis is unfavorable also when they accumulate in very large numbers, and give rise to the different nervous symptoms above described.

Treatment.—Before commencing our remarks upon the particular remedies employed for the destruction and expulsion of worms from the alimentary canal, we would call the attention of the reader to the fact that most of the recognized anthelmintics are more or less irritating to the gastro-intestinal mucous membrane, and some of them to the nervous system also, producing, in overdoses, severe and even dangerous nervous symptoms. It is evident, therefore, that remedies of this class ought not to be exhibited unless they are manifestly called for, and not at all when symptoms of severe gastro-intestinal irritation, and particularly of inflammation, are present, unless there be the very strongest reasons for supposing that those symptoms depend upon accumulations of worms. We are quite sure that we have, in a considerable number of instances, met with children whose digestive organs had been injured, and in whom slight functional derangement had been converted into severe indigestion, and even inflammatory disorder, by the too frequent or long-continued use, or the administration in excessive quantities, of different vermifuges, and of various quack nostrums, which are sold to an amazing extent in this city, and all over the country.

As the diagnosis of worms is always doubtful, it is best never to risk the administration of any of the irritating vermifuges, unless convinced, by the previous expulsion of worms, that they are almost certainly present; and, indeed, we ourselves rarely give any other remedy than small quantities of the *wormseed oil* in slight, and especially in doubtful cases, unless this has already been tried and failed. From our own experience, we believe that this remedy is all-sufficient in a large majority of the cases that occur in this city; as these are almost always of a mild character, and, as it not only produces the expulsion of the parasites when they exist, but also acts beneficially upon the forms of digestive irritation which simulate so closely the symptoms produced by worms. We are persuaded, indeed, that of all the cases that have come under our notice, in which it seemed probable that worms might be present, none were expelled in nearly half, and yet the signs of disturbed health have passed away under the use of the remedy. The oil of wormseed may be given in doses of four drops to children of two years of age, and of six or ten to those above that age, three times a day for three days, to be followed on the morning of the fourth day by a moderately active, but not irritating cathartic dose, the best of which is castor oil or syrup of rhubarb. The objection to the remedy is its nauseous taste and smell; these, however, may be partially disguised by making it into a mixture with yolk of egg, powdered gum, and syrup of ginger. Some children take it very well dropped upon a lump of white sugar, while others take it best mixed with common brown sugar. If one course of the oil, as it is called, fail to relieve the symptoms, another should be administered. It ought to be recollected that, when given in large doses, the wormseed oil is irritating to the digestive mucous membrane, and produces dangerous nervous symptoms. We know of one case, in which a girl six or seven years of age was made exceedingly ill and suffered for years afterwards, from the effects of a teaspoonful of the oil given by mis-

take. The following is a very good formula for the administration of this remedy:

℞.—Ol. Chenopodii, ... gtt. lx vel fʒj.
P. G. Acaciæ, ... ʒij.
Syrup. Simp., ... fʒj.
Aq. Cinnamom., ... fʒij.—M.

Give a dessertspoonful three times a day, for three days, and repeat after several days.

The wormseed may be given also in powder, in the dose of from twenty to forty grains.

The remedies most frequently employed in this country besides the wormseed, are pink-root or spigelia, oil of turpentine, calomel, and the bristles of cowhage.

We believe that the *pink-root* is more depended upon amongst us than any other single remedy. It is given either in substance or infusion. The dose of the powder is from ten to twenty grains for a child three or four years old, to be repeated every morning and evening for several days, and followed by an active cathartic. The powder is seldom used, however, as the drug is almost always given in infusion. The best and safest mode of administering it is in combination with cathartic substances. Thus, half an ounce each of pink-root and senna may be infused for a few hours in a pint of boiling water, and a tablespoonful given two or three times a day to children two or three years old, for three, four, or five days, when it should be suspended for a time, and resumed, if necessary. A preparation much used in this city under the title of worm-tea, and which we have ourselves given with very good success, consists of the spigelia mixed with senna, manna, and savine, in different proportions, made into an infusion and sweetened with brown sugar. Dr. G. B. Wood (*Pract. of Med.*, vol. i, p. 626) recommends the following formula:

℞.—Sennæ, Spigeliæ, ... āā ʒss.
Magnesiæ Sulphat., ... ʒij.
Mannæ, ... ʒj.
Fœniculi, ... ʒj.
Aquæ Fervent, ... Oj.

These are to be macerated for two hours in a covered vessel, and a tablespoonful given to a child two years old once or twice a day, or every other day, so as to procure two or three evacuations in the twenty-four hours. The remedy is continued for a few days, or for one or two weeks, if necessary, and if it do not debilitate the child.

The fluid extract of spigelia and senna has been introduced as a more convenient and acceptable mode of administering this vermifuge with a cathartic. The dose for a child is from thirty minims to a teaspoonful, according to the age.

The *spirit of turpentine* is highly recommended as an efficient remedy for worms by several authorities, and particularly by Dr. Joseph Klapp and Dr. Condie, of this city. Dr. Condie states that it is the article from

which he has derived the most decidedly beneficial effects, and remarks that it may be given when there exists considerable irritation of the alimentary canal, or even subacute inflammation, without any fear of its increasing either. He gives the rectified spirit in sweetened milk, in molasses, or in the following mixture:

℞.—Mucil. G. Acaciæ, ... ʒij.
Sacch. Alb., ... ʒx.
Spir. Æther. Nitr., ... ʒiij.
Ol. Terebinth., ... ʒiij.
Magnes. Calcinat., ... ℈j.
Aquæ Menthæ, ... ʒj.—M.
Of this mixture a dessertspoonful is given every three hours.

We have used the spirit of turpentine but seldom, on account of its extremely disagreeable taste, having always succeeded perfectly well with the wormseed oil, or with infusion of pink-root with cathartics.

Calomel also is highly thought of by many persons as a vermifuge, and, no doubt, when used in combination with or followed by cathartics, or given in full purgative doses, it is very effectual. We can only repeat what we have already said on several occasions, that it is a remedy which, from the powerful influence it exerts upon the constitution, ought not to be given except when really called for; and, as we can almost always succeed in curing verminous affections by milder drugs, we see no occasion for resorting to this, except in rare cases. When used it is given alone in considerable doses, and followed by some cathartic, or in combination with rhubarb and jalap, or jalap, or scammony.

The bristles or down of *cowhage* are also used by some practitioners, no doubt sometimes with success. We have never used them, and can give no opinion, therefore, from personal experience, as to their efficacy. They are administered by making them into an electuary with honey, syrup, or molasses, a teaspoonful of which is given every morning for three days, and then followed by an active cathartic.

The following *electuary*, recommended by Bremser, is very much employed in Europe, and is highly spoken of by Dr. Eberle:

℞.—Semin. Santonicæ (semen-contra of the French writers),
Semin. Tanaceti rude contus., ... ää ʒss.
Valerian. pulv., ... ʒij.
Jalapæ pulv., ... ʒjss.–ij.
Potass. Sulphat., ... ʒjss.–ij.
Oxymel. Scillæ, ... q. s.—ut ft. Electuarium.

A teaspoonful of this is given morning and evening for three or four days, when the dejections generally become more copious and liquid. If it do not produce this effect, Bremser advises that the dose be increased. Dr. Eberle gave it for six or seven days, and says it does far less good when it produces frequent and watery evacuations, than when it causes only three or four consistent stools a day. This preparation has a very dis-

agreeable taste, and children sometimes refuse to take it on that account. When this is the case it may be made into pills.

MM. Rilliet and Barthez recommend the following *syrup*, which was proposed and highly thought of by M. Cruveilhier:

℞.—Follicul. Sennæ, Rhei, Semin. Santonic, Artem. Abrotan., Helminthocort., Tanaceti, Artemis. Pontic, . . . āā ʒj.

To be infused in half a pint of cold water, strained, and made into a syrup with sugar, of which a tablespoonful is to be given every morning for three days.

Of late years, santonin, the active principle derived from the European wormseed, has been much employed, and with very good success. The remedy may be given in doses of from gr. ij to gr. v, combined or followed by a dose of castor oil or senna. It is also prepared in the form of sugar-coated dragées, which renders it quite acceptable to children.

The *empyreumatic oil* of Chabert is also highly spoken of by some European authorities. It is made by mixing one part of the empyreumatic oil or fetid spirit of hartshorn, with three parts of spirit of turpentine, and allowing them to digest for four days. The mixture is then put into a glass retort and distilled in a sand-bath until three-fourths of the whole have passed over into the receiver. The product should be kept in small and tightly-closed vials. The dose is about fifteen or twenty drops three or four times a day, for children between two and seven years old. This is recommended highly by Bremser and other authorities. The great objection to it is its exceedingly nauseous taste. Dr. Eberle speaks in very favorable terms of a strong decoction of *helminthocorton* or Corsican moss, which he has found "not only valuable as a vermifuge, but particularly so as a corrective of that deranged and debilitated condition of the alimentary canal favoring the production of worms." An ounce of helminthocorton, with a drachm of valerian, are to be boiled in a pint of water down to a gill, and a teaspoonful of the decoction given morning, noon, and evening. It is particularly beneficial in cases attended with the usual symptoms of worms, connected with want of appetite and mucous diarrhœa, and arising from debility of the digestive organs, and a vitiated condition of the intestinal secretions.

Kameela, the reddish-brown powder which clothes the capsules of the Rottlera tinctoria, has been of late highly recommended, not only in cases of tænia, but of ascaris lumbricoides. The dose for children is about gr. v, repeated till it has acted on the bowels.

In all cases of deranged health supposed, either from the nature of the symptoms, or proved by the previous expulsion of worms, to depend on the presence of these animals in the alimentary canal, it is exceedingly important to attend to the *hygienic treatment* of the child, and in some instances to administer *tonics* and *stimulants*. In not a few cases that have come under our own notice, in which many of the symptoms supposed to indicate the presence of worms have been extremely well marked, we have succeeded in removing them all without a resort to any vermifuge, by the treatment proper for the chronic indigestion or dyspepsia of children. The method

of treatment to be employed in such cases has already been laid down in the article on indigestion, to which the reader is referred for full information. It should consist chiefly in strict attention to exercise and diet, and in the use of tonics, as quinia and iron, and small quantities of fine port wine.

Whenever any complication exists in connection with worms, the treatment must be modified according to its nature. If it consist in inflammation of any part of the digestive tube, the inflammation ought to be attended to first, and the verminous disorder for the time neglected. If the inflammation be very slight, or if the symptoms indicate only severe irritation rather than positive inflammatory action, we may exhibit the milder and least injurious vermifuges, as very small doses of wormseed oil, which we have never known to do harm, the decoction of helminthocorton and valerian, recommended by Dr. Eberle, or, according to Dr. Condie, the spirit of turpentine. If the verminous affection coexist with any of the acute local inflammations of the thorax, the former ought to be, as a general rule, neglected, until the latter has been relieved by appropriate treatment. In doubtful cases, in which it is impossible to ascertain with certainty whether the symptoms depend on worms, or upon a simple dyspeptic condition of the digestive organs, it is most prudent to give only the simplest and least irritating vermifuges, to regulate the hygienic conditions of the patient, and afterwards to resort to tonics, if necessary.

Various writers, and particularly M. Guersant, advise that we should forbid, in verminous cases, the use of relaxing food, especially of milk preparations, fruits, and of fatty and farinaceous substances; and that, after the expulsion of the worms, we should direct a tonic and strengthening regimen. The diet should consist of boiled and roasted meats, of wine, and of bitters. The author just quoted, states that a change of food alone will often suffice to procure the expulsion of worms. He says (*Dict. de Méd.*, t. xxx, p. 689), "I have met with children who had been tormented with ascarides lumbricoides while residing in the country and living upon milk and fruits, and who, upon being brought to the city, and put upon the use of broths and soups, passed considerable quantities of worms, and after that got entirely rid of them."

Occasionally our opinion is asked with reference to worms of other varieties, which are reported to have been passed from the rectum of children. Thus, tapering elongated pieces of coagulated casein may be mistaken for worms.

So, too, we have seen a specimen, submitted to us by Dr. Bussey, of Buena Vista, Texas, and said to have been passed by a boy there, of male Gordicus aquaticus, or horse-hair worm. This is a nematoid worm, of chestnut-brown color, a foot in length, a little more than one-half line in breadth, with a bifid caudal extremity. It grows in stagnant water, and thus may readily have been swallowed and passed per anum.

ARTICLE II.

ASCARIS VERMICULARIS.

The *description* of this worm has already been given at page 966.

Seat.—The ascaris vermicularis is found almost exclusively in the large intestine, and in a large majority of the cases is confined to the rectum. It is said to have been found in the vagina in the female, having no doubt passed from the rectum into that canal.

The *causes* which determine the presence of this worm are not at all understood.

Symptoms.—The characteristic, and often the only symptom indicative of their presence, is violent itching about the anus, which is sometimes almost insupportable, and which is generally most troublesome and most apt to occur at night when the child is in bed. In consequence of this, the sleep is much disturbed, and the child grows peevish and irritable, and may suffer considerable impairment of general health. In some instances they give rise to acute and violent pain in the region of the anus, and sometimes to tenesmus and mucous or bloody stools. When the last-named severe symptoms exist, the worms may occasion dangerous nervous disorders, and even give rise to general convulsions. The worms not unfrequently escape from the rectum and are found upon the bed-clothes, or upon the clothes which the child has worn through the day. Sometimes they are discharged in considerable numbers, and are found, in that case, either mixed with the fæces, or with mucus, or collected into balls or knots.

The *diagnosis* of the seat-worm, like that of the lumbricoides, cannot be regarded as positive, unless some have been expelled, or unless they can be seen by examination of the rectum. This can generally be done when they are present in any number, by pressing the nates apart so as to open the anus and bring the folds of the mucous coat of the bowel into view. The only other symptom which indicates their presence with any certainty, is the existence of severe itching about the anus, not to be explained upon any more reasonable supposition.

Prognosis.—These worms do not, as a general rule, produce the same disturbances of the general health as lumbricoides, and in not a few instances are entirely innocuous, with the exception of the pain and inconvenience they occasion.

They are, however, exceedingly troublesome, because of the difficulty of removing them entirely by any treatment. No matter how many are discharged, some almost always remain concealed in the folds of the mucous membrane, and as they are propagated with great rapidity, the same train of symptoms is very apt to return soon after they may have been seemingly dislodged.

Treatment.—It has been found by long experience that the common vermifuges, given by the mouth, exert much less influence in causing the expulsion of these worms than of the lumbricoides. For this reason

enemata are generally resorted to in the treatment, instead of remedies given by the mouth. Dr. Dewees, however, recommends the elixir proprietatis (tinct. aloes et myrrhæ), in small and often-repeated doses, continued for some time, and followed by enemata of lime-water, camphor, or aloes. He gave twenty drops of the elixir three times a day, in a little sweetened milk, to children from two to four years old, and thirty drops to those between five and seven years.

The plan we have generally resorted to has been to give small doses of the wormseed oil, as directed in the article on lumbricoides, and to direct an injection of from four to six grains of powdered aloes, suspended in a gill of warm milk, for children four years old, to be repeated once in three, four or five days, according to the necessity of the case.

Lime-water by injection is recommended by several different authorities. It may be given of its ordinary strength, or mixed with an equal quantity of warm milk, or flaxseed mucilage. Other enemata recommended are spirit of turpentine in milk, a teaspoonful of the former to a gill of the latter; decoction of helminthocorton; an injection made by infusing two drachms of fresh garlic-cloves in three ounces and a half of boiling water, and adding to the infusion, after it has been poured off, a scruple of assa-fœtida rubbed up with the yolk of an egg; a solution of from six to twelve grains of sulphuret of potassium in half a pint of water; injections of sweet oil, or of lard beaten up with water until it becomes fluid, and even of cold water. The three last-mentioned substances have the advantage of calming the itching and irritation of the rectum almost immediately. Enemata of a solution of nitrate of silver, in the proportion of two to four grains to the ounce of water, have been recommended by Schultz (*Deutsche Klinik*, quoted in *Med. Times and Gaz.*, 1858), who asserts that two, or at most three, of these injections suffice to effect a cure. Again, it has been recommended to pass a bougie smeared with mercurial ointment into the rectum. We should much prefer a method of using this ointment which succeeded in the hands of M. Cruveilhier in a very severe case. This was to place a little of the ointment on the anus, by which course the patient was entirely relieved after a few days. In a very obstinate case in an adult, we succeeded in entirely destroying the worms by the daily use of suppositories, made unusually long, and impregnated with carbolic acid. M. Valleix states that he has obtained the same results by causing the anus to be anointed with the following preparation, a small quantity of which was introduced at the same time into the inferior extremity of the intestine:

℞.—Hydrarg. Chlor. Mitis, ... ℈iv.
Axung., ... ʒvj.—M.

Dr. Wood states that a dose of sulphur taken every morning before breakfast has been found very useful.

The *diet* and *general health* ought always to be strictly inquired after, and attended to by the physician. For information upon these points the reader is referred to the remarks upon hygienic treatment in the last article.

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