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DIGESTIVE ORGANS

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DISEASES

OF THE

DIGESTIVE ORGANS

IN

INFANCY AND CHILDHOOD.

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DISEASES

OF THE

DIGESTIVE ORGANS

IN

INFANCY AND CHILDHOOD

WITH

CHAPTERS ON THE DIET AND GENERAL MANAGEMENT OF CHILDREN, AND MASSAGE IN PEDIATRICS.

ROYAL COLLEGE OF PHYSICIANS, EDINB. LIBRARY.

BY

LOUIS STARR, M.D.,

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THIRD EDITION—REWRITTEN AND ENLARGED.

Illustrated

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PREFACE TO THE THIRD EDITION.

During the ten years that have elapsed since the publication of the last edition of "The Diseases of the Digestive Organs in Infancy and Childhood," the whole subject of Pediatrics has been so greatly advanced, and our knowledge of the dietetics of both well and ill children and of therapeutic procedures has grown so much more extended and accurate, that a revision of the original work has become necessary to its continued usefulness. This revision the author has endeavored to make as thorough as possible, at the same time adding a number of new chapters and omitting much obsolete matter.

Of the additions the most important are the sections on Simple Atrophy, Infantile Scurvy, Rickets, Lithæmia, Infectious Follicular Tonsillitis, Naso-pharyngeal Adenoid Hypertrophy, Proctitis, and Appendicitis. Extensive changes also have been made in the section on Feeding.

Since, for the successful management of diseases of the digestive organs in the young, so much depends upon careful choice of food and sound hygienic measures, greater stress has been laid, in this as in the former editions, upon dietetics and general regimen than upon the mere administration of drugs, though the question of appropriate therapeutics has not been neglected.

The author is indebted to Dr. Thompson S. Westcott for efficient and interested aid in guiding these pages through the press and in preparing the index.

LOUIS STARR.

1818 Rittenhouse Square, S., Philadelphia.
September 1, 1901.

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DISEASES

OF

THE DIGESTIVE ORGANS

IN

INFANCY AND CHILDHOOD.

INTRODUCTION.

I. The General Management of Children.

It is the duty of the child's physician not only to remove disease, but also to manage convalescence and everyday life in such a way that the little subjects confided to his care may be led to complete recovery, and kept in as perfect health as possible. To accomplish these objects in any abnormal condition, but particularly in the special class of maladies to be presently considered, the ability to direct intelligently the daily regimen is much more important than a mere knowledge of drugs and of the principles of therapeutics.

The daily regimen embraces several factors : these are feeding, bathing, clothing, sleep, and exercise, and under such headings the subject will be briefly outlined, for little more is possible, in the present chapter.

1. Feeding.

Age bears so close a relation to the choice of food and the method of feeding, that it will greatly simplify the study of these questions to consider them from the standpoint of the two stages of a child's life, namely, infancy, or the period extending from birth to the age of two and a half years; and childhood, the time elapsing between completion of the first dentition and puberty.

An **infant** may be fed in either one of three ways—first, from the mother's breast; second, from the breast of a wet-nurse; and third, from a bottle, the latter being the method known as artificial or hand feeding.

First. *Feeding from the Maternal Breast.*—There can be no doubt that this, being the natural, is at the same time the proper method of nourishing the human infant; and fortunate is the babe that in our day of advanced civilization and city-living can draw from the breast of a robust mother an abundant supply of pure, health-giving, tissue-building food.

It follows, therefore, that every woman who is free from certain contraindicating diseases, to be mentioned later, should nourish her child solely from her breast up to the age of eight months, and partially to the end of the first year, or, failing in either limit, so long as possible.

The infant should be put to the breast as soon as the mother has recovered somewhat from the fatigue of labor—some four or eight hours after birth. Of course, no milk can be drawn at this early stage, but the babe gets a small quantity of thin, watery fluid, called colostrum, which affords sufficient nourishment and at the same time, from its laxative properties, clears away the greenish or black, viscid material that collects in the infant's intestinal canal during intra-uterine life. This procedure, too, is of great advantage to the mother, for it insures proper contraction of the womb, draws out the nipples, and encourages the formation of milk.

As the secretion of milk is never fully established until the third day after labor, it stands to reason that no food other than the colostrum is required before that time. Hence the practice of filling the infant's stomach with gruel, sugar and water, and other sweetened mixtures, is more than useless, for it diminishes the activity of sucking and the consequent stimulation of milk production. Put the child to the breast every two hours while the mother is awake, and there need be no fear of starvation.

After the third day, should the breasts not yield a supply of milk, a mixture of two fluidrachms of cream, three fluidrachms each of whey and water, and twenty grains of sugar of milk may be given every fourth hour, the babe being put to the breast in the meanwhile. So soon as the flow begins, however, the artificial feeding is to be discontinued.

Usually on the fourth day milk is secreted and regular lactation commences. Many untrained mothers make a failure of nursing because they know nothing of the manner of giving suck; of the length of time the child should be kept at the breast; of the proper time for, and interval between, feeding; and of the importance of regularity. Upon these points the physician should give minute instructions.

When taking the breast, the infant must be held partly on its side, on the right or left arm, according to the gland about to be drawn, while the mother must bend her body forward, so that the nipple may fall easily into the child's mouth, and steady the breast with the first and second finger of the disengaged hand, placed above and below the nipple. In case the milk runs too freely—a condition very apt to excite vomiting—the flow is easily regulated by gentle pressure with the supporting fingers. Each of the breasts should be drawn alternately, the contents of one usually being sufficient for a meal; and a healthy child may be allowed to nurse until satisfied, when he will stop of his

own accord, drop the nipple and fall asleep with milk still flowing over his lips.

During the first six weeks the breast is required every second hour, from 5 A. M. until 11 P. M. At night the infant should be put in a crib by the mother's bed, or in an adjoining room, under the care of a competent nurse, and there remain quietly until the morning feeding. This secures the mother six hours of uninterrupted repose, a matter of great importance to her general health and consequent capacity for prolonged lactation. As to the infant, he may rebel at first, and wake and cry, so that it is necessary to quiet him with a little milk and water administered from a bottle; but often after a few days, and certainly at the end of a week or two, the good habit of sleeping at night is formed, and there is no further trouble.

Regularity in meal hours is even of more importance in early than in adult life, on account of the natural feebleness of digestion. To secure this, it is only necessary to have a little perseverance, for infants are such creatures of habit that a short training brings them into the way of expecting food only at certain times, and, when healthy, they wake to suck the breast with almost the precision of the clock. While insisting upon this rule, one must recognize the fact that, although in the vast majority of instances a two-hours' interval is most suitable up to the second month, there is no absolute law as to the number of daily nursings. Some infants seem to need food less frequently, and it is best to respect their peculiarity and not force the breast upon them so long as they sleep well, do not fret when awake, and thrive generally. Others, again, may require it oftener; every hour and a half, perhaps, and once or twice at night. In these exceptional cases an appropriate schedule can only be made by close observation of individual characteristics.

A common and most ruinous mistake is to resort to constant feeding as a means of pacifying crying. Babies certainly do

cry from hunger, but just as frequently the crying results from colic, or from the discomfort and pain of indigestion. Every mother should be able to recognize the difference. The cry from hunger usually begins after a sound sleep. It is not peevish, and stops at the sight of the breast, when the infant rouses himself, presents an expression of pleasure, clinches his hands and flexes his limbs. The cry of colic is violent and paroxysmal; the face is livid and wears an expression of suffering; the abdomen is distended and hard; the hands and feet are cold; the legs are drawn up or kicked violently about; and an explosion of wind from the mouth or bowels ends the attack. A peevish cry, hot skin, and sour breath attend indigestion.

It stands without saying that the cry of hunger must be relieved by giving food; but this is the very worst thing to do under other circumstances, for it both breaks up good habits and produces serious mischief. The pain of colic and the discomfort of indigestion are chiefly due to the accumulation of flatus resulting from the fermentation of food. Mothers soon learn, and unfortunately infants too, that the breast milk temporarily relieves suffering. This it does in the same way as any other warm liquid; but, unlike a simple fluid, milk only adds more material to the already fermenting contents of the gastro-intestinal canal, and every nursing is soon followed by more pain, until, between crying and sucking and sucking and crying, the infant's life is passed in misery, if not cut short altogether. Instead of continuous feeding, the plan for relief is to decrease the quantity of food by increasing the intervals between nursing and by abridging the time of lying at the breast.

After the sixth week the interval between nursing may be slowly increased until, by the sixth month, it reaches three hours. During this period, also, the time of lying at the breast may be gradually lengthened, for the quantity of milk secreted

and the child's appetite and capacity for food are all augmented as the days pass by. At the end of the seventh month feeding every fourth hour suits some children well, but, as a rule, the three-hour interval must be adhered to from the sixth month to the end of lactation.

After the sixth or eighth month "mixed feeding"—breast- and bottle-feeding alternating—is advisable, if the babe ceases to gain strength and flesh while on the breast alone. Otherwise, the maxim of not interfering with any course that is doing well is as applicable here as elsewhere, and the breast may be relied upon entirely until the time comes for weaning. Should additional nutriment be required, the food must be selected with due reference to age, and prepared in the same manner as in regular hand-feeding.

The date of weaning cannot be fixed for all cases, since it must depend upon two conditions—the health of the mother and the development of the child. When the former continues to be robust and the child steadily grows and gains flesh, lactation can be prolonged until the tenth or twelfth month. If persevered in longer, the mother's strength begins to fail, her milk is lessened in quantity or becomes poor in quality, the child's nutrition suffers, and he grows pale, thin, and flabby, and may become rachitic.

Weaning may be accomplished gradually or suddenly. In gradual weaning about four weeks are required to prepare for the absolute withdrawal of the breast. For instance, if suck be given every three hours, from 5 A. M. until 11 P. M., or seven times a day, there should be, during the first week of preparation, one artificial feeding and six nursings daily; during the second, two and five; during the third, four and three; during the fourth, six and one. Then the breast must be entirely withheld. Carefully modified cows' milk, administered from a bottle, is the best substitute. At the age of ten months a mixture that ordinarily agrees well is:

Cream, ... f℥ss
Milk, ... f℥iv
Sugar of milk, ... ℥j
Water, ... f℥iss.

This is to be poured into a perfectly clean bottle, warmed in a water-bath, and taken through a clean, plain rubber tip. Should the quantity (six fluidounces) be insufficient to satisfy the child's appetite, the milk and water may be increased until the mixture measures seven or even eight fluidounces, according to the demand.

When such accidents as fever, disordered digestion, with vomiting and diarrhœa, or the actual cutting of one or more teeth occur during the period of preparation, the number of artificial feedings must be reduced, or the breast resumed until the disturbance be passed; then the course may be begun again and carried to its completion.

Usually there is little trouble in weaning infants in this way. Sometimes they become fretful under the change and may refuse food entirely for a day or more; but a little determination on the part of the mother and the cravings of hunger will soon overcome this difficulty.

Occasionally the child refuses to suck milk from a bottle or to drink it from a cup or spoon; in fact, seems to object to any form of liquid food except that drawn from the mother, while at the same time he is eager for bread or other solid food. Under these circumstances prepare for each meal a moderate portion of either rice pudding or junket. After these have been taken for a day or two, add to each meal a little milk, reducing the amount of pudding or junket, stir the whole together, and feed from a spoon; next day still further reduce the solid and increase the liquid, and so proceed until finally a taste for milk is cultivated.

Sudden weaning is more difficult to accomplish, and is not advisable unless, while the breast is being presented, there is

an absolute refusal to take artificial food from either a bottle or a spoon. This is most apt to occur when food has been given too frequently, and when the breast has been used as a means to quiet crying. Sudden weaning is also to be recommended when the mother's health becomes so affected as to render any further sucking a positive peril to the child's life; attacks of erysipelas or of smallpox are instances in point.

The physician is often forced to decide upon the advisability of premature weaning. His decision must be made cautiously and after thorough investigation of two propositions: namely, (*a*) the effect of further lactation upon the health of the mother, and (*b*) the requirements of the child.

(*a*) Lactation being a physiological process is not a drain upon the systemic strength so long as the functions of nutrition are actively performed, but under other circumstances it very frequently becomes so. Premature weaning is necessary when the mother is attacked by any acute disease threatening dangerous temporary prostration, such as typhoid or typhus fever. A change must also be made if pulmonary consumption be developed, or, being already present, rapidly advances under the drain of milk secretion. Ordinarily, however, the general condition that leads to withdrawal of the breast is one of simple loss of strength and flesh on the part of the mother.

Undoubtedly these indications often warrant the procedure; but every one who has seen much of children's practice must have met with many cases in which the advice to wean has been given carelessly and unnecessarily, and in which the child might have had its natural food had proper attention been given to the health of the mother. If a woman be worn out by household cares; if she wear herself out by a round of dinners, balls, or shopping, or if she expose herself to injurious atmospheric conditions and eats improper food, she

grows weak and thin whether she be nursing or not; and a woman heedless of her health will probably care little whether she suckles her child or gives it up to a wet-nurse or to the bottle.

In addition to making nursing the important duty of her life for the time being, a mother must be as free from household cares as possible. Mental and physical fatigue is to be avoided, sufficient exercise must be taken to maintain a healthy appetite and digestion, and abundant time devoted to rest and sleep. Beyond securing a plentiful supply of plain and easily digestible food, with a judicious portion of meat, vegetables, and fruit, it is unnecessary to give special attention to the diet.

Should the secretion of milk be scanty, it may often be increased by the free use of milk, animal broths, chocolate, gruel, and malt extracts. Such tonics as ferrated elixir of cinchona, bitter wine of iron, and the preparation known as "beef, wine and iron" are useful when there is anæmia, or when the general failure of strength cannot be overcome by food and attention to hygienic rules.

The ordinary local conditions indicating the necessity of premature weaning, on the mother's account, are fissures of the nipple and mammary abscess.

Fissure being usually an unilateral condition, it is only necessary to retire the affected side from duty and to nourish the child alternately from the unaffected gland and from the bottle until healing takes place, the disabled breast being pumped in the mean time to keep up secretory activity. Should both sides be affected, weaning may be imperative, on account of the extreme pain produced by sucking; though even under these circumstances an effort must be made to maintain the flow of milk by regular pumping. Sometimes women are able to struggle through the attack by taking advantage of the protection afforded by a nipple-shield.

Fissures of the nipple may be preceded by various diseases of the delicate skin of the part. They result, also, from want of cleanliness or from keeping the nipple too moist, as when constant sucking is allowed or when there is a continual flow of milk. They may be prevented by proper attention to the nipple before confinement. During the latter months of pregnancy the clothing covering the breasts must be loose. Each day, for three months before labor, the nipple should be washed thoroughly with hot water in the evening and anointed with cacao-butter in the morning. At the same time, should the nipples be small or retracted, the woman must be taught to use her thumb and finger to draw them out. This process is not only an advantage in giving proper size and shape, but brings the skin into good condition without hardening it. The application of alcoholic and astringent lotions is not to be recommended. They tend to harden the tissue, which should be soft and pliable rather than tanned, and render the nipples liable to crack.

When a fissure exists, it is best to see first whether or not nursing can be continued by means of a nipple-shield. Should the child refuse this, a good plan is to fill the shield with warm milk and invert it over the nipple. The infant then draws the fluid at once and without difficulty, and will often continue sucking until the breast milk follows. After nursing and removing the shield, the nipple must be dried thoroughly with absorbent cotton, and the following lotion applied with a camel's-hair brush :

℞. Acid. borici, ... gr. xx
Mucilag. acaciæ, ... f℥j. M.

(*b*) On the part of the infant, there are several indications for anticipating the time of withdrawing the mother's breast. It must be done if the occurrence of pregnancy or the recurrence of menstruation render the milk unwholesome ; if the

mother contract a dangerous contagious disease, as smallpox, scarlet fever, or erysipelas; if the mammary glands become inflamed; if the breast does not afford sufficient nourishment and artificial food be refused; and, finally, if dentition be markedly delayed and the premonitory symptoms of rickets appear.

As to the amount of nourishment, it must be remembered that the breast milk may be of good quality, but so diminished in quantity that it is insufficient; or, while abundant in quantity, so poor in quality that it does not meet the demands of nutrition. Even without a minute examination of the milk, it is possible to form a good idea of which condition is present from the behavior of the infant in the act of sucking. If the milk be good in quality but deficient in quantity, the babe, when put to the breast, seizes the nipple as if famished, and draws upon it vigorously for a time, and then drops it with a scream of rage. On the contrary, should there be an abundant supply of poor milk, the nipple is grasped languidly, the child lies a long time at the breast and falls asleep there.

Consideration of the final indication opens the question of the propriety of regulating weaning by the progress of dentition. This is certainly a good guide, but not in the way implied in the old precept, that the child must not be taken from the breast until evolution of the stomach and eye teeth. Insufficient food is one of the chief causes of rickets, and rickets more than any other disease delays dentition; consequently, should the teeth not pierce the gum in time, the inference is for other food rather than a continuance of the faulty maternal supply.

Upon deciding to anticipate the time of weaning, the next point to consider is whether the infant shall be brought up by hand or by a wet-nurse.

Second. *Feeding by a Wet-nurse.*—The advantage of feeding from the breast of a wet-nurse is that the mother's milk

is substituted by the milk of another woman; in other words, that natural feeding is continued—a matter of moment in all cases, and of inestimable importance with delicate children. The disadvantage consists in the difficulty of finding, in a woman belonging to the class from which wet-nurses come, all the moral and physical characters essential to a good substitute, and in the fact that a stranger is introduced into the household, often to deceive and annoy the family, and on the slightest provocation to leave her charge to fate or to the tender mercies of another of her kind. For these reasons it is preferable, in the majority of instances, to trust to careful bottle-feeding. Nevertheless, as some children must have human milk if their lives are to be saved, the rules for selecting a wet-nurse must be understood.

The woman chosen must be strong and robust, but rather spare than fat. Her bill of health must be perfectly free from hereditary tendency to mental or physical disease and from taint of syphilis or tuberculosis. She must be cheerful, good-natured, active, careful, and temperate in habits. Her age should be between twenty and thirty years; she should understand the care of an infant and the manner of giving suck; her child ought to be nearly the same age as the infant to be adopted, and she must be able to afford an abundant supply of good milk.

The last quality can be estimated by inspecting the breasts, by examining some of the milk drawn by a pump, and by ascertaining the condition of the woman's own child. The breasts of a good nurse are not necessarily large, but are firm to the touch and pyriform in shape, with well-developed, prominent nipples, and with the skin distinctly marbled with large blue veins. The milk, which ought to flow readily on pressure or on suction, should be opaque and bluish-white in color, have a specific gravity of 1.031, an alkaline reaction, and show, when placed under the microscope, a number of

minute, equal-sized fat globules. Its quantity may be ascertained by weighing the child before and after sucking, the normal gain being from three to six ounces. There is, however, no better or more readily applied test of the quality of a nurse than the size, weight, and general development of her own child; and if it be weak and ill-nourished, no amount of fitness in other respects can warrant her engagement.

Even when a woman is found fulfilling in her single person all the required conditions—a rare thing, indeed—it does not necessarily follow that her milk will suit the babe to be suckled. Then changes and new trials must be made until the desired end be attained.

The diet of a wet-nurse and the manner of weaning must be governed by the rules already given for maternal guidance.

Personally, I have had such good results from carefully regulated bottle-feeding, that I have almost given up the employment of wet-nurses, preferring to regulate the artificial food myself rather than allow an ignorant woman to supplement surreptitiously her deficient supply of breast milk by an unskilfully proportioned food—an event of not uncommon occurrence.

Third. *Artificial Feeding.*—In my experience, there are few American women, especially in the well-to-do classes, who do not look upon the duty of nursing their babies as a pleasant one; but there are many who are completely unable to do so, and a vast number in whom the secretion of milk fails after a few weeks or months of lactation. They must, therefore, through no fault of their own, resort to a wet-nurse or to artificial feeding. Usually, they select the latter method, with results that vary in direct proportion to the care and intelligence displayed in carrying it out.

There is no artificial food equal to the infant's natural food—good breast milk. The fluid, however, secreted from the glands of a feeble or unhealthy mother, though often sufficient in

quantity to fill the suckling's stomach and satisfy the cravings of hunger, does not contain enough pabulum to meet the demands of nutrition. In such unfortunate cases, good cows' milk, properly modified, is a better food than the bad breast milk. More care and trouble, though, are involved in bottle than in breast feeding. If the child has been nourished in the natural way—*i. e.*, breast-fed—even for a few weeks, the task is far easier to accomplish. In these cases the stomach and intestinal canal, inactive in fœtal life, are trained to their new duties under normal conditions, and so prepared for the digestion of properly selected artificial food. So, too, when the powers of digestion are inherently active. On the contrary, if the infant must be bottle-fed from the first, or if digestion be naturally feeble, great difficulty may be expected, and most skilful handling is necessary.

To insure success in hand-feeding, it must be remembered that an infant is not nourished simply by the food he swallows, but by that portion of it he digests and assimilates. The best diet, therefore, is one so adapted to age and digestive power that everything eaten will be digested and absorbed. But as children differ as much in constitution as in feature, it is impossible to formulate exactly a food that will be applicable to every case, or one that needs no change from month to month of progressing growth. As age and strength increase, there is a corresponding development of the gastro-intestinal functions and a demand for more and stronger food. On the other hand, should the system be accidentally reduced by disease, the digestion, sympathizing in the general debility, temporarily loses its normal activity and assumes that of an earlier age. In such a case more nourishment is certainly needed to build up the failing strength, but it is to be supplied by giving such food as can be completely assimilated, and not by forcing down strong food merely because it is *strong;* for the latter, when not vomited, passes through the bowels

undigested, and the little creature starves to death in the midst of plenty, or dies from the ill effects of the constant presence of fermenting food in the alimentary canal. On these accounts many changes in diet, as to quality and quantity, must be anticipated and made.

Important matters, therefore, to be studied in detail are: (*a*) the selection of a proper substitute for the breast milk; (*b*) the quantity to be given; (*c*) the method of modification; (*d*) the mode of administration; and (*e*) the means of preservation.

(*a*) Healthy breast milk may be taken as the type of infants' food, and the nearer an artificial substance can be made to approach it in chemical composition and physical properties, the more perfect it is.

Normal breast milk has a specific gravity of 1.031. It is a persistently alkaline fluid, having a somewhat animal, usually disagreeable, and very rarely sweetish taste. It is bluish-white in color and thin and watery in consistence.

According to Leeds' analysis, its average composition is:

Fat,	4.13 per cent.
Milk sugar (lactose),	7.00 " "
Albuminoids,	2.00 " "
Salts,	0.20 " "
Water,	86.67 " "

Some authorities give a lower albuminoid average, namely, 1.50 per cent.; but as will be detailed later, the proportion of this ingredient varies greatly, and it is safe to assert that a range from 1.00 to 2.25 per cent. is perfectly normal.

Human milk contains, then, fats, nitrogenous material, carbohydrates, salts, and water—all the elements essential to repair tissue waste, to supply new material for growth, and to maintain body heat, or, in other words, to constitute a perfect aliment; and these, too, are so proportioned in the combination as to most easily and completely meet the demands.

It must not be supposed, however, that the elements are uniformly present in the same proportion. On the contrary, the fluid varies both at different periods of lactation and in different individuals.

This fact is the most striking feature of the above observer's work, which shows that the most changeable constituent is the albuminoids, varying from a maximum of 4.86 per cent. to a minimum of 0.85; the next are the fats and salts, the maximum being about three times the minimum; and the least, the sugar. The latter, in fact, varies but little from a standard of about 7 per cent. The function of the albuminoids is nutritive; that of milk sugar calorifacient. Hence the point seems to be that nature, while allowing a wide range of oscillation in the rapidity of tissue building, carefully provides an available fuel for the constant maintenance of animal heat; the supply of caloric due to cerebral impulses and self-originated locomotion being extremely small in early infancy.

In seeking a substitute for human milk, one naturally turns to the domestic animals for the source of supply. Between the milk of the ass, cow, goat, and ewe there is little choice, so far as composition is concerned, though, perhaps, asses' milk resembles that of women a little more closely than the others; nevertheless, cows' milk is usually selected, because, being plentiful, it is easily obtained and cheap.

Cows' milk * (market milk) has a specific gravity of 1.029, is richer looking—that is, whiter and more opaque—than human milk, and is slightly acid in reaction unless perfectly fresh from pasture-fed animals, when it may be neutral or alkaline, and contains:

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* The characters of cows' milk may be determined with sufficient accuracy in the following way:

Provide a urinometer, such as shown in figure 1. To obtain the specific gravity,

Fat,	3.75 per cent.
Milk sugar (lactose),	4.42 "
Albuminoids,	3.76 "
Salts,	0.68 "
Water,	87.39 "

Comparing this analysis with that previously given for human milk, it is readily seen that the two fluids differ in specific gravity and reaction, and that cows' milk contains more nitrogenous material, but less fat and much less sugar than woman's milk. These differences and the general characteristics of the two fluids are very striking when tabulated,* as follows:

	Sound Dairy Milk.	Woman's Milk.
Reaction,	Feebly acid.	Persistently alkaline.
Specific gravity,	1.0297	1.0313
Bacteria,	Always present.	Absent.
Fats,	3.0 to 6.0; average, 3.75	2.0 to 7.0; average, 4.13
Lactose,	3.5 to 5.5; " 4.42	5.4 to 7.9; " 7.00
Albuminoids,	3.0 to 6.0; " 3.76	0.85 to 4.86; " 2.00
Ash (salts),	0.6 to 0.9; " 0.68	0.13 to 0.37; " 0.20

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fill the beaker to such a point with milk that it will float the specific gravity glass, and read the degree of density from the scale at a level with the surface of the milk. The chemical reaction is found by inserting a piece of blue litmus paper, which should turn slightly red a few moments after being wet. In applying this test small pieces of litmus paper should be examined under and in the milk, as exposure to air may redden paper dipped in milk though the fluid itself may not be acid. To ascertain the proportion of cream, cut a narrow strip of paper four inches long, and divide the upper half-inch, by cross-markings, into twel e equal parts; paste this on the beaker with the marked portion uppermost, and the lower edge coming accurately to the bottom of the beaker; then pour in enough milk to come just to the top of the paper, and place the whole aside for twenty-four hours. During this time the cream rises and appears as a yellow layer at the top; this layer should have the depth of ten or twelve spaces.

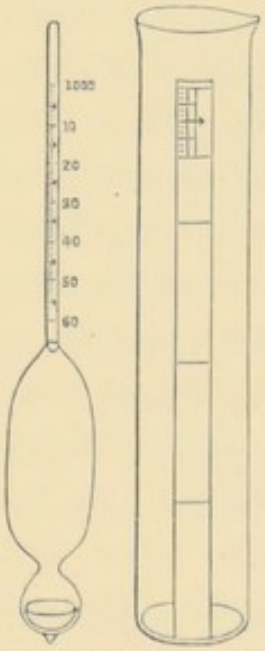


Fig. 1.—Lactometer.

* Leeds, "American Text-book of Diseases of Children."

While the sugar of human and cow's milk is chemically identical, and the fats are quite similar, there are important differences in the quality as well as the quantity of the nitrogenous material. This in both fluids is complex, being made up of casein, lactalbumin, and peptones. The peptones are present in very small quantities only, and to what extent they exist naturally, and to what, in cow's milk, they are formed by bacterial action, is not known.

Casein is an acid substance, and is present in combination with an alkali, chiefly as potassium caseinate. The casein of cow's milk is readily precipitated by dilute acid, and is thrown down in large firm masses; that of human milk requires more acid and is precipitated in fine, soft particles, which are dissolved by an excess of acid. After the separation of the casein, the lactalbumin is left in solution in the whey. Lactalbumin closely resembles serum albumin, is unaffected by acid, but is precipitated by boiling.

The relative proportions of casein and lactalbumin have been determined with sufficient accuracy to point out the most important of all the differences between the two secretions, which is, that the fraction of the total albuminoids in cow's milk which is coagulable by acids (casein) is far greater (perhaps four times) than the non-coagulable part (lactalbumin). In woman's milk, on the contrary, the reverse is true, and the non-coagulable part much exceeds (perhaps by more than twice) the coagulable portion. Taking weight for weight of each secretion, the coagulum of human milk is only one-fifth of that of cow's milk.

This difference is readily tested by adding rennet to the two fluids. In the case of cow's milk the casein is coagulated into large, firm masses, while with human milk a light, loose curd is formed. In the stomach the acid gastric juice has the same effect, producing, in the first instance, a coagulum most difficult to digest; in the other, one of vastly less bulk

and readily attacked and broken down by the gastro-intestinal solvents.

These chemical and physical properties of cows' milk can be altered by various methods of preparation; and unless this be done, there are few instances in which it will not prove a poor substitute for the natural food.

Condensed milk is frequently recommended by physicians, and largely used by the laity on their own responsibility. It keeps better than cows' milk and is supposed to be more readily digested by young infants. The latter supposition is a mistaken one, and arises from the overlooked fact that condensed milk is always given dissolved in a large proportion of water, while cows' milk is too frequently used insufficiently diluted or otherwise improperly prepared. The author is convinced of the accuracy of this statement from a number of years' close study of the subject.

Condensed milk contains a large proportion of sugar, forms fat quickly, and thus makes large babies; sugar also counteracts the tendency to constipation—often a troublesome complaint in hand-feeding. These advantages are unquestioned, and, together with the ease of preparation and the fact that, when in good condition, it is a sterile fluid, are those which place it so high in the esteem of monthly nurses. It is equally true, however, that prepared as a food it does not contain enough nutrient material, either in the form of fat or of albuminoids, to supply the wants of a growing infant.

Again, more than half of the saccharine ingredient of this preparation is cane sugar, added for the purpose of preservation, and this material is very liable, when in excess, to ferment in the alimentary canal, giving rise to irritant products that impede digestion.

Infants fed upon condensed milk, though fat, are pale, lethargic, and flabby; although large, they are far from strong; have little power to resist diseases; often cut their teeth late,

and are very liable to drift into rickets. It must be remembered, also, that condensed milk, when long kept or when packed in imperfect cans, not infrequently undergoes decomposition, and thus becomes utterly unfit for use.

For a temporary change of diet, and as a substitute during traveling or under circumstances in which sound cows' milk cannot be obtained, it may be resorted to with advantage. Again, for feeding very young infants when a sterile food of low albuminoid percentage is indicated, it may sometimes prove useful, but the necessity of adding fat, in the form of cream, must always be insisted upon.

The farinaceous substances so often selected, especially by the poor, to replace breast milk, not only are bad foods, but have both directly and indirectly a deleterious effect upon the processes of nutrition. They are bad for two reasons: First, they differ materially in chemical composition from human milk. For example, in arrow-root, which is the favorite, the proportion of the tissue-building to the heat-producing element is as one to twenty, while in human milk it is about one to five. Secondly, the heat-producing principle, starch, must be converted into sugar before it can be absorbed. This change is accomplished in the body by the saliva and pancreatic juice—secretions that are not fully established until the fourth month.

While the starch lies undigested in the gastro-intestinal canal it is subject to fermentation, resulting in the formation of irritant products that rapidly induce catarrh of the mucous membrane—a condition directly interfering with the digestion and absorption of food. Again, perfect nutrition demands rapid waste and removal of effete tissues as well as repair of the same. This is effected by oxidation. Now, sugars are known to have a much greater affinity for oxygen than albuminates, and when the diet consists of farinaceous material, the small amount of sugar formed and absorbed appropriates

oxygen that otherwise would go toward the removal of waste, and so retards the necessary changes. The persistent and exclusive use of this class of food always leads to a condition of malnutrition, which may result in simple atrophy, scurvy, or rickets, while the irritant products of fermentation often produce sufficient gastro-intestinal disturbance to cause death.

Farinaceous food, as such, is therefore never permissible before the later months of infancy, and then only as an adjunct to properly modified milk mixtures. Earlier, it may be employed, for its mechanical action, with milk mixtures, and in properly selected cases proves very useful in this way. The purpose of this method of employment will be considered later.

The nutrient value of the cereals and their products as they exist in so-called "infants' foods" has been imperfectly determined. They are undoubtedly useful as mechanical attenuants, but it is very certain that none of them, unless prepared with milk, can permanently meet the demands of nutrition. At the same time, it is quite probable that the albuminoids with the soluble carbohydrates (maltose) obtained by Liebig's process have a food value of their own, making them more serviceable than the starches.

(*b*) The quantity of food to be allowed each day varies with the appetite and age. Some infants habitually eat little, others much; as both thrive, the question of the correct amount in a given case must be answered by observation. So long as the child develops with normal rapidity and keeps well, he may be allowed to eat as much or as little as he wants; for if food of proper strength be given at proper intervals, the instinctive cravings of hunger, since they represent the wants of the system, rarely lead to excess in either direction. Nevertheless it is well to have some guide.

During the first four weeks infants generally require from twelve to seventeen fluidounces of food; in the second and third months, about thirty fluidounces; and from this time to the twelfth month, from two to two and a half or even three pints. After the twelfth month the quantity depends upon whether additions be made to the diet, or milk food be used exclusively. When the daily amount reaches three pints, the limit of the capacity of the stomach is usually attained, and the greater demand for nutriment, as growth advances month by month, must be met by adding to the strength of the food rather than by increasing its bulk. These two factors, strength and quantity, are intimately associated throughout the whole period of infancy, and in the earlier months a mere increase in the latter is not always sufficient to maintain the balance of nutrition.

As a rule, infants are overfed, and this opens the very interesting question of the normal capacity of the stomach at different ages. Rotch states that, by actual measurement, the stomach of an infant five days old holds 25 c.c., or six and a quarter fluidrachms, a quantity very far short of that usually forced upon the babe during the first week. Frowlowsky's investigations show that there is a very rapid increase in the capacity of the stomach during the first two months of life, while in the third, fourth, and fifth months the increase is slight.

Guided by these data, the quantity of food should be rapidly augmented during the first six or eight weeks of life and then held at the same quantity up to the fifth or sixth month. Another considerable increase is also demanded between the sixth and the tenth months.

The author has been unable to verify the above measurements, and has, on the contrary, found no uniformity in the size of the stomach for given ages; still clinical experience is a sufficient guide, and upon this the following table is based:

TABLE OF INTERVALS OF FEEDING AND AVERAGE AMOUNTS OF FOOD.

Age.	Intervals of Feeding.	Average Amount at Each Feeding.	Average Amount in 24 Hours.
During first week, . . .	2 hours.	1 ounce.	12 ounces.
From second to sixth week, ...	2 hours.	1½ to 2 ounces.	12 to 17 ounces.
From sixth week to third month, ...	2 hours.	3 to 4 ounces.	24 to 30 ounces.
From third to sixth month, ...	2½ hours.	4 to 6 ounces.	32 to 36 ounces.
At ten months, ...	3 hours.	8 ounces.	40 ounces.

(*c*) The object to be accomplished in the preparation or modification of cows' milk is to make it resemble human milk as much as possible in chemical composition and physical properties. To do this, it is necessary to reduce the proportion of albuminoids, to increase the proportion of fat and sugar, and to overcome the tendency of the casein to coagulate into large, firm masses after entering the stomach and coming in contact with the acid gastric juice.

Dilution with water is all that need be done to reduce the amount of albuminoids to the proper level; but as this diminishes the already insufficient fat and sugar, it is essential to add these materials to the mixture of milk and water. Fat is best added in the form of gravity cream; and of the sugars, either pure white loaf sugar or sugar of milk may be used. The latter is greatly preferable, because it is the natural sugar, is directly assimilable, in the process of digestion is converted into lactic acid, and, unlike cane sugar, is not readily decomposed into alcohol and carbonic acid.

Firm clotting may be prevented by the addition of an alkali or one of the *attenuants*.

Lime water is the alkali usually selected. It neutralizes

the slightly acid reaction which always characterizes market milk, and, to the extent of the quantity added, forms a soluble calcium caseinate, which is not decomposed by the acid gastric juice with the precipitation of firm curds. In consequence, the total bulk of casein coagulum is diminished, and the ease of digestion increased. As lime water contains only half a grain of lime to the fluidounce, measurable results cannot be attained unless at least a third part of the milk mixture be lime water. The quantity often used—one or two teaspoonfuls to the bottle of food—has no effect beyond neutralizing the usual acidity of the milk itself. When lime water is constantly employed, it becomes quite an item of expense if procured from the drug shop ; this outlay is unnecessary, for it can be made quite as well in the nursery. Take a piece of unslaked lime as large as a walnut, drop it into two quarts of filtered water contained in an earthen vessel, stir thoroughly, allow to settle, and use only from the top, replacing the water and stirring as consumed.

Instead of lime water, from five to fifteen drops of the saccharated solution of lime may be added to each bottle.

This solution is made in the following way :

Take of—

Slaked lime,	1 ounce
Refined sugar, in powder,	2 ounces
Distilled water,	1 pint.

Mix the lime and sugar by trituration in a mortar. Transfer the mixture to a bottle containing the water and, having closed this with a cork, shake it occasionally for a few hours. Finally, separate the clear solution with a siphon and keep it in a stoppered bottle.

Attenuants are substances employed to act in the main mechanically by getting, as it were, between the particles of casein during coagulation, preventing their running together and forming a large, compact mass. This class embraces gummy materials like dextrin, gelatin, the various infants'

foods prepared by Liebig's process (in which the starch of wheat and barley is converted into maltose and dextrin), and *finely divided* starch as it exists in barley or oatmeal water; and it is for this purpose only that starch is permissible as an element of diet in infancy. Barley water and gelatin are the attenuants usually employed.

To prepare barley water, put two teaspoonfuls of washed pearl barley, with a pint of cold filtered water, into a saucepan, boil slowly down to two-thirds, and strain. To be efficient, it must be used as a diluent instead of, and in the same proportion as, water.

Gelatin is prepared in the following way: Put a piece of plate gelatin, an inch square, into a half-tumblerful of cold water, and let it stand for three hours; then turn the whole into a teacup; place this in a saucepan half full of water and boil until the gelatin is dissolved. When cold, this forms a jelly; from one to two teaspoonfuls may be added to each bottle of milk food.

When an "infants' food" is used to act mechanically, care should be taken to select a reliable one—that is, one in which the starch has been converted into maltose and dextrin by the process of manufacture. The articles known as "Mellin's Food" and "Horlick's Food" can be relied upon. One teaspoonful of either, dissolved in a tablespoonful of hot water and added to each portion of food, makes a very easily digested mixture.

It must not be inferred from what has been stated in regard to the use of lime water and attenuants, that these are essentials in the artificial feeding of infants. On the contrary, the majority of healthy babies require only sound cows' milk, properly modified by the addition of cream, milk sugar, and water. To the practical understanding of the proper methods of modification a schedule of the diet of a hand-fed infant from birth upward, with a sketch of the variations that have to be made most frequently, will serve as a useful guide.

Diet during the first week :

Cream, ... f℥ ij
Whey, ... f℥ iij
Water (hot), ... f℥ iij
Milk sugar, ... gr. xx.

For each portion ; to be given every two hours from 5 A.M. to 11 P.M., and in some cases once or twice at night ; amounting to twelve fluidounces of food per diem.

Diet from the second to the sixth week :

Milk, ... f℥ ss
Cream, ... f℥ ij
Milk sugar, ... gr. xx
Water, ... f℥ j.

For each portion ; to be given every two hours from 5 A.M. to 11 P.M. ; amounting to seventeen fluidounces of food per diem.

Diet from the sixth week to the end of the second month :

Milk, ... f℥ j, f℥ ij
Cream, ... f℥ ss
Milk sugar, ... ℥ ss
Water, ... f℥ j, f℥ ij.

For each portion ; to be given every two hours ; amounting to thirty fluidounces per diem.

Diet from the beginning of the third month to the sixth month :

Milk, ... f℥ ij
Cream, ... f℥ ss
Milk sugar, ... ℥ j
Water, ... f℥ iss.

For each portion ; to be given every two and a half hours, or thirty-two fluidounces per diem.

Diet during the sixth and seventh months :

Milk, ... f℥ iijss
Cream, ... f℥ ss
Milk sugar, ... ℥ j
Water, ... f℥ ij.

For each portion ; to be given every three hours from 6 or 7 A.M. to 9 or 10 P.M. ; thirty-six fluidounces daily.

Often a pinch—gr. 2 to 5—of table salt is of service, and may be added, after the second week, to each portion of food.

A table of the dietary, so far as it has been carried, may be useful for convenience of reference:

TABLE OF INGREDIENTS, HOURS AND INTERVALS OF FEEDING, AND TOTAL QUANTITY OF FOOD FOR A HEALTHY ARTIFICIALLY FED INFANT FROM BIRTH TO THE END OF THE SEVENTH MONTH.

Age.	Cream.	Whey.	Milk.	Milk Sugar.	Salt.	Water.	Hours for Feeding.	Intervals of Feeding.	Total Quantity.
During first week.	f ℥ ij.	f ℥ iij.		gr. xx.		f ℥ iij	5 A.M. to 11 P.M.; sometimes 1 A.M. and 3 A.M.	2 hours.	f ℨ xij.
From second to sixth week.	f ℥ ij		f ℨ ss.	gr. xx.	a pinch	f ℨ j.	5 A.M. to 11 P.M.	2 hours.	f ℨ xvij.
From sixth week to end of second month.	f ℨ ss		f ℥ x.	℥ ss.	a pinch.	f ℥ x.	5 A.M. to 11 P.M.	2 hours.	f ℨ xxx.
From third to sixth month	f ℨ ss.		f ℨ ij.	℥ j.	a pinch	f ℨ iss	5 A.M. to 10.30 P.M.	2½ hours.	f ℨ xxxij.
During sixth and seventh months.	f ℨ ss		f ℨ iiiss.	℥ j.	a pinch.	f ℨ ij.	7 A.M. to 10 P.M.	3 hours.	f ℨ xxxvj.

Throughout the eighth and ninth months five meals a day will be sufficient, each meal composed of:

Milk, ... f ℨ vj
Cream, ... f ℨ ss
Milk sugar, ... ℥ j
Water, ... f ℨ iss.

This allows forty fluidounces of food per diem.

At this age it is sometimes advisable to supplement the milk mixture with one of the reliable "infants' foods" (Liebig's foods); thus, two teaspoonfuls of Mellin's food may be added to the second, third, and fourth meals, the milk sugar being then omitted. Instead of a Liebig's food, one of the wheat or barley flours prepared by baking or by diastase digestion may be used. Baking at a temperature of 300° to 400° converts the starch into dextrin; treatment with diastase produces maltose and dextrin. The best examples of the baked flours are Blair's Wheat Food, Imperial Granum, and Robinson's Barley. In selecting a Liebig's food or a baked flour as an adjuvant, one must be influenced by the condition of the infant to be fed. A baked flour is indicated when there is a tendency to too frequent and liquid fæcal evacuations, as it has a somewhat astringent action, and is to be avoided in cases of sluggish bowels and constipation. Under the latter conditions a Liebig's food—Mellin's, for instance—should be used, as a laxative action is desirable.

Diet from the tenth to the fourteenth month, five meals daily:

Milk,	f℥ vijss
Cream,	f℥ ss
Milk sugar,	℥ j
Water,	f℥ iss.

Here also a supplemental food—Mellin's or barley jelly*—often may be employed with advantage.

Occasionally, about the end of the first year, a more varied and substantial diet may be required; for example:

First meal, 7 A. M.—Milk mixture as above.

Second meal, 10.30 A. M.—A breakfast-cupful (eight fluid-ounces) of milk, warmed.

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* *Barley Jelly.*—Put 2 teaspoonfuls of washed pearl barley into a quart saucepan with a pint and one-half of water; boil slowly down to a pint; strain, and allow liquid to set into a jelly.

Third meal, 2 P. M.—The yolk of an egg lightly boiled, with stale bread-crumbs.

Fourth meal, 6 P. M.—Same as first.

Fifth meal, 10 P. M.—Same as second.

On alternate days the third meal may consist of a teacupful (six fluidounces) of beef-,* mutton-,† or chicken-broth,‡ containing a few stale bread-crumbs.

Diet from the fourteenth to eighteenth month, five meals a day:

First meal, 7 A. M.—A slice of stale bread, broken and soaked in a breakfast-cup (f℥viij) of new milk. Or two tablespoonfuls of well-cooked and strained porridge (oatmeal or cracked wheat), with two tablespoonfuls of cream and a little salt (no sugar); a breakfast-cupful (f℥viij) of new milk.

Second meal, 10 A. M.—A teacupful (f℥vj) of milk, with a soda-biscuit or a thin slice of lightly buttered bread.

Third meal, 2 P. M.—A teacupful (f℥vj) of beef-, chicken-, or mutton-broth, with a slice of bread; one good tablespoonful of rice-and-milk pudding.

Fourth meal, 6 P. M.—Same as first.

Fifth meal, 10 P. M.—A breakfast-cupful (f℥viij) of milk, with or without one tablespoonful of a good Liebig's food.

To alternate with this:

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* *Beef-broth.*—Mince one pound of lean beef, put it, with its juice, into an earthen vessel containing a pint of water at 85° F., and let it stand for one hour; strain through stout muslin, squeezing all juice from the meat; place this liquid on the fire, and, while stirring briskly, slowly heat just to the boiling-point; then remove at once and season with salt.

† *Mutton-broth.*—Add one pound of loin of mutton to three pints of water; boil gently until very tender, adding a little salt; strain into a basin, and, when cold, skim off fat. Warm when serving.

‡ *Chicken-broth.*—A small chicken, or half of a large fowl, thoroughly cleaned and with all the skin and fat removed, is to be chopped, bone and all, into small pieces; put them, with salt, into a saucepan, and add a quart of boiling water; cover closely and simmer over a slow fire for two hours; after removing, allow to stand, still covered, for an hour; then strain through a sieve.

First meal, 7 A. M.—The yolk of an egg lightly boiled, with bread-crumbs and salt; a teacupful (f℥vj) of milk.

Second meal, 10 A. M.—A teacupful (f℥vj) of milk, with a thin slice of lightly buttered bread.

Third meal, 2 P. M.—A mashed baked potato moistened with four tablespoonfuls (f℥ij) of meat-broth; two good tablespoonfuls of junket with cream.

Fourth meal, 6 P. M.—A breakfast-cupful (f℥viij) of milk, with a slice of bread broken up and soaked in it.

Fifth meal, 10 P. M.—A teacupful (f℥vj) of milk.

The fifth meal is often unnecessary, and sleep should never be disturbed for it. Should the child awake at 5 or 6 A. M., he should break his fast upon a cup of warm milk, and not go hungry until the set breakfast hour.

Diet from eighteen months to two and a half years, five meals daily:

First meal, 7 A. M.—A breakfast-cupful (f℥viij) of new milk; the yolk of a lightly boiled egg with a little butter and salt; two thin slices of bread and butter.

Second meal, 11 A. M.—A teacupful (f℥vj) of milk, with a soda-biscuit.

Third meal, 2 P. M.—A breakfast-cupful (f℥viij) of beef-, mutton-, or chicken-broth; a thin slice of stale bread; a saucer of rice-and-milk pudding.

Fourth meal, 6.30 P. M.—A breakfast-cupful (f℥viij) of milk, with bread and butter.

To alternate with this:

First meal, 7 A. M.—Four good tablespoonfuls of well-cooked porridge (oatmeal or cracked wheat), with two tablespoonfuls of cream and a little salt (no sugar); a teacupful (f℥vj) of milk.

Second meal, 11 A. M.—A teacupful (f℥vj) of milk, with a slice of bread and butter.

Third meal, 2 P. M.—One tablespoonful of underdone

mutton pounded to a paste; bread and butter, or mashed potatoes, moistened with good, plain dish-gravy; a saucer of junket.

Fourth meal, 6.30 P. M.—A breakfast-cupful (f℥viij) of milk; a slice of soft milk-toast, or a slice or two of bread and butter.

Diet from two and a half to three and a half years, four meals daily:

First meal, 7.30 A. M.—One or two tumblerfuls (f℥viij) of milk; a saucer of thoroughly cooked oatmeal or wheaten grits, and one or two slices of bread (one day old) and butter.

Second meal, 11 A. M. (if hungry).—A tumblerful (f℥viij) of milk, or a teacupful (f℥vj) of meat-broth, with a biscuit.

Third meal, 2 P. M.—A slice of underdone roast beef or mutton, or a bit of roast chicken or turkey, minced as fine as possible; a baked potato thoroughly mashed with a fork and moistened with gravy; a slice or two of bread and butter; a saucer of junket or rice-and-milk pudding.

Instead of the potato, well-boiled rice or plainly dressed macaroni may be allowed for variety, or one well-cooked green vegetable—*i. e.* spinach, celery, young onions, cauliflower, and young peas mashed with a fork.

Fourth meal, 7 P. M.—A tumblerful (f℥viij) of milk; one or two slices of bread and butter or of well-moistened milk-toast; a baked apple, or stewed prunes or apples.

An important point, often neglected, is the matter of drink. Even the youngest infant requires water several times daily, and the demand increases with age. The water must be as pure as possible and should not be too cold. In the heat of summer, however, water moderately cooled by ice may be allowed without harm.

The foregoing schedule must, of course, be regarded only *as an average*. Many children can bear nothing but milk food up to the age of two or even three years, and, provided enough be taken, no fear for their nutrition need be entertained.

If a child be thriving on milk, he is never to be forced to take additional food merely because a certain age has been reached; let the healthy appetite be the guide.

Much more difficulty is experienced in feeding infants during the first twelve months than during the second; it will be well, therefore, to consider what would best be done in case the food described should disagree.

If, after feeding, vomiting occur, with the expulsion of large, firm clots of casein, the effect of adding lime water or barley water must be tried.

For instance, at the age of six weeks, make each bottle of:

Milk, ... f℥j, f℥ij
Cream, ... f℥ss
Milk sugar, ... ℥ss
Lime water, ... f℥j, f℥ij.

Or of:

Milk, ... f℥j, f℥ij
Cream, ... f℥ss
Milk sugar, ... ℥ss
Barley water, ... f℥j, f℥ij.

Sometimes, particularly if there be diarrhœa, boiling makes the milk more tolerable, and in this condition it may be used instead of fresh milk in either of the above mixtures. Condensed milk, too, can be employed temporarily, making each portion of:

Condensed milk, ... ℥j
Cream, ... f℥ss
Hot water, ... f℥iiss.

"Strippings" is another good substitute for cows' milk. It is obtained by re-milking the cow after the ordinary daily supply has been drawn, and contains much cream and but little curd. Assimilable proportions of this are:

Strippings, ... f℥j
Water, ... f℥ij.

And if the small amount of casein in such a mixture be still undigested:

Strippings, ... f℥iss
Barley water, ... f℥iss.

Another good food is that recommended by Dr. A. V. Meigs. It consists of a combination of two parts of the cream, containing from fourteen to sixteen per cent. of fat; one part average milk; two parts lime water, and three parts sugar water, the latter consisting of seventeen and three-fourths drachms of milk sugar to one pint of water. This makes an alkaline mixture with the percentage of its ingredients closely corresponding to human milk.

When, in spite of careful preparation, all of these foods give rise to indigestion with fever, and the expulsion, by vomiting and diarrhœa, of hard curds from the stomach and intestines, the expedient of predigesting the milk must be resorted to.

Predigestion or peptonization is best accomplished by the action of pancreatin. That manufactured under the name of extractum pancreatis, by Fairchild Brothers & Foster, of New York, has proved most efficient in my hands.

It is sometimes necessary to carry the artificial process almost or quite to complete digestion of the casein; more frequently, partial predigestion is sufficient.

For the first, put into a clean quart bottle five grains of extractum pancreatis and fifteen grains of sodium bicarbonate (the contents of a "peptonizing tube"), with four fluidounces of cool, filtered water; shake thoroughly together, and add a pint of fresh, cool milk. Place the bottle in water, not so hot but that the whole hand can be held in it for a minute without discomfort, and keep the bottle there for exactly thirty minutes. At the end of that time put the bottle on ice to check further digestion and to keep the milk from spoiling.

The fluid obtained, while somewhat less white in color than milk, does not differ from it in taste; if, however, an acid be added, the casein, instead of being coagulated into large, firm curds, takes the form of minute, soft flakes, or readily broken-down feathery masses of small size. When the process is carried just to the point described, the casein is only partly converted into peptone; but every succeeding moment of continued warmth lessens the amount of casein until peptonization is complete. Then the liquid is grayish-yellow in color, has a distinctly bitter taste, and shows no coagulation whatever on the addition of an acid. This artificial digestion, therefore, may be carried just as far as circumstances indicate, although it is ordinarily best to stop it short of complete conversion, as children object to the markedly bitter taste, and often, on account of it, absolutely refuse the food. Partial peptonization, too, is usually sufficient to adapt the milk to ready assimilation. To seize the proper moment for arresting the process, the person conducting it must be told to taste the milk from time to time, and as soon as the least bitterness is appreciable, to remove the bottle from the hot water and place it upon ice for cooling and use. Such milk may be sweetened with sugar of milk, and given pure or diluted with water. For an infant of six weeks each meal may consist of:

Peptonized milk,	f℥ij
Milk sugar,	℥ss
Water,	f℥j.

To this, cream may be added when desirable, and by diminishing the quantity of water and increasing that of milk the strength of the food may be made greater at any time.

Although every precaution be taken, the last of a quantity of predigested food is very apt to grow bitter; and if the attendants will take the trouble, it is much better to peptonize every meal separately. This is readily done by obtaining a

number of powders of pancreatin and bicarbonate of sodium, so proportioned that each packet shall contain the proper amount for one bottle of food.

For example :

℞. Extract. pancreatis, ... gr. ix
Sodii bicarb., ... gr. xxiv.
M. et ft. chart. No. xii.

SIG.—Put one powder into a nursing bottle with two fluidounces of filtered water and two fluidounces of fresh sweet milk ; shake together and keep warm in a water-bath for about half an hour before feeding ; sweeten with half a teaspoonful of milk sugar.

Partial predigestion is the most useful and most uniformly applicable of all the methods of modifying cows' milk for infants having feeble digestive powers. For this purpose I have employed for the past ten years the material known as Fairchild's "peptogenic milk powder." This powder contains a digestive ferment, pancreatin ; an alkali, bicarbonate of sodium ; and a due proportion of milk sugar. It is in no sense an "infants' food," and as a considerable heat (115° F.) is required to insure its action, the food prepared by it is not only partially predigested, but also, to a certain extent, Pasteurized—an end greatly to be desired under certain conditions, as will be detailed later.

The mode of employment is as follows :

Take of—

Milk, ... f℥ij
Water, ... f℥ij
Cream, ... ℥ss
Peptogenic milk powder, ... ℈j (a level teaspoonful).

This mixture is heated over a brisk flame to a point that can be comfortably sipped by the preparer (about 115° F.), kept at this heat, with constant stirring, for six minutes, and then quickly cooled to the proper temperature (98° F.) for administration. In preparing each bottle separately—by far

the better plan—the mixture should not be heated to the boiling-point, as this checks the action of the pancreatin, and all digestive action after ingestion is lost. On the other hand, when the whole supply for a day is prepared at once, the required bulk of powder for the quantity of milk mixture is added, and the whole is heated slowly to boiling, ten minutes being occupied, and then quickly cooled. Here the object is to stop the digestion, so that the portion to be used later in the day may not be fully peptonized and bitter. This method has the advantage of effecting more perfect Pasteurization. When properly prepared, the resultant, so-called "humanized milk" presents the albuminoids in a minutely coagulable and digestible form; has an alkaline reaction; contains the proper proportion of salts, milk sugar, and fat; is not bitter in taste; has the appearance of human milk, and by Leeds' analysis shows:

Water,	86.2 per cent.
Fat,	4.5 "
Milk sugar,	7. "
Albuminoids,	2. "
Ash (salts),	0.3 "

This corresponds very closely with Leeds' average analysis of human milk.

The great advantages of partial peptonization are that the necessity for lime water, barley water, and thickening substances to keep apart the curd is done away with, and that, when the digestive disturbance requiring a careful preparation of food is removed, an ordinary milk diet can be gradually resumed by regularly diminishing the time artificial digestion is allowed to progress. This changes the casein in a less and less degree, until, finally, it is taken in its natural form.

As milk exists in the healthy cow's udder it is aseptic, but during milking and subsequent handling and transportation it often becomes contaminated by various foreign materials, both

organic and inorganic, which either are apt to set up some injurious change in the fluid before ingestion, or give rise to various disturbances after entering the alimentary canal. Again, if the cows themselves be unhealthy, their milk may carry disease germs. The germs most frequently present are the saprophytic bacteria, potent in the production of diarrhœal disorders; the bacillus tuberculosis; and the germs of cholera, diphtheria, scarlet and typhoid fevers: all of which are readily taken up by and flourish in milk at ordinary temperatures. To deprive these accidentally introduced organic impurities of their activity the milk must be subjected to "sterilization." It must be insisted here that this process is a *preventive*, and in no sense a therapeutic measure; that it is not to be recommended when one can be sure of the purity of the milk supplied and of the conditions for its preservation; and that milk so treated must be modified according to the age and demands of the individual case in the usual way. Sterilization may be conducted either at a *high* or a *low* temperature.

Sterilization at a High Temperature (212° F.).—Several admirable implements have been devised for conducting the process; one of the most simple, made after a design of my own, is shown in figure 2.

This apparatus is made of tin, and consists of an oblong case provided with a well-fitting cover, and having a movable perforated false bottom (D), which stands a short distance above the true one and has attached a framework capable of holding ten six-ounce nursing bottles. On the outside of the case is a row of supports (B) for holding bottles inverted while drying, and at the proper distance below these a gradually inclining gutter (C) for carrying off the drip. A movable water bath (A) is hung to the side; in this each bottle of food may be heated at the time of administration.

The bottles are made of flint glass and are graduated; the graduated markings being especially convenient for measure-

ment and rendering the use of a separate measuring glass unnecessary, a matter of no little moment, as every implement that comes in contact with the milk in sterilization must be kept chemically clean. Ten bottles are used, so that the whole supply of milk intended for a day's consumption can be prepared at once. Each bottle is provided with a perforated rubber cork, which in turn is closed by a well-fitting glass stopper.

Sterilization should be performed in the morning as soon as

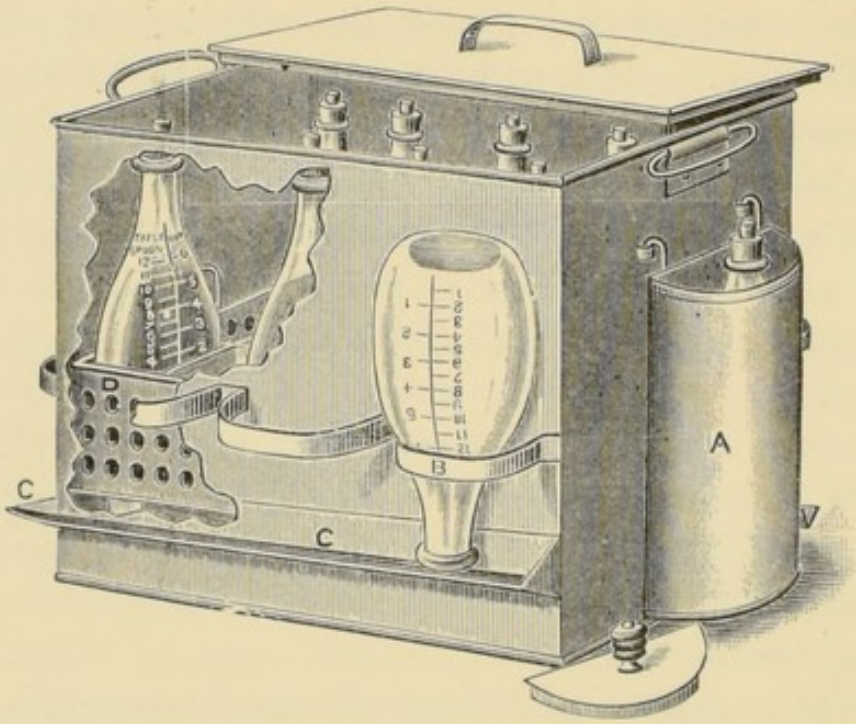


FIG. 2.—AUTHOR'S STERILIZER.

possible after the milk has been served. The process is as follows: First, see that the ten bottles are perfectly clean and dry; pour into each six fluidounces (12 tablespoonfuls) of milk; insert the perforated rubber corks—without the glass stoppers, however; remove the false bottom and place the bottles in the frame; pour into the case enough water to fill it to the height of about two inches; replace the false bottom carrying the bottles; adjust lid, and put the whole on the

kitchen range. Allow the water to boil, and, by occasionally removing the lid, ascertain that the expansion that immediately precedes boiling has taken place in the milk; then press the glass stoppers into the perforated corks, and thus hermetically close each bottle. After this, keep the apparatus on the fire, and the water boiling for twenty minutes. Finally, remove the false bottom with the bottles; pour out the water, replace, and carry the whole, covered with the lid, to the nursery.

When the hour of feeding arrives, put one of the bottles into the attached water-bath and heat it to the proper point for administration. The milk must, of course, be diluted with filtered water, and receive the additions ordinarily made to adapt it to children of different ages. The tip used—and a tube must not be employed even here—should be thoroughly cleaned, and immersed for a few moments in boiling water before it is attached to the bottle.

So soon as a bottle is emptied—and if the whole of its contents be not taken, the remainder must be thrown away—it is washed in the ordinary manner with a solution of bicarbonate or salicylate of sodium (one teaspoonful of either to a pint of water) and placed in the rack (B) to drain and dry.

Milk sterilized by the above process will remain sound for several days—according to some authorities, as many as eighteen—when the heating is continued for thirty minutes, and still longer if protracted for an hour and a half. It is especially useful in traveling, when fresh milk cannot be obtained; for use in cities during the heat of summer, when milk is most apt to undergo injurious changes; for a temporary change of food for delicate children, or for those suffering from diseases of the stomach or intestinal canal. But the experiments of Leeds show that sterilization at the boiling-point of water causes the following modifications: Casein is rendered less coagulable by rennet, and is acted on slowly

and imperfectly by pepsin and pancreatin; proteid matters attach themselves to fat globules, and probably bring about a less perfect assimilation of fat; while milk sugar, by prolonged heating, is completely destroyed. Koplik states that "from the temperature of 75° C. upwards, there is a separation of the serum-albumin of the milk; the casein loses its coagulability to rennet, and at 85° C. amounts of rennet which for the raw condition of the milk are found sufficient to act, cease to be effective." On account of these alterations produced by prolonged subjection to a high temperature, milk so sterilized is difficult to digest, and many infants do not thrive upon it, become constipated, are badly nourished and anæmic, and sometimes develop scurvy.

The problem, therefore, that presents itself in the sterilization of milk for infants' food is to devise a method which shall efficiently destroy the contained germs, and yet in the least possible degree interfere with its ready digestion and its nutritive qualities. This is best accomplished by:

Sterilization at a Low Temperature, or Pasteurization.—Hueppe considers that from a physiological standpoint milk is best sterilized under a temperature of 75° C. (167° F.), while other experimenters have shown that temperatures lower than 100° C. (212° F.), if continued for a short time, will destroy a very large proportion of the germs, and will destroy with certainty many pathogenic germs which find their way into milk either from the cow or as external contaminations. The elaborate experiments of Yersin, Granchier, Lidoux-Libard, and Bitter show that the bacillus tuberculosis in milk will be destroyed in ten minutes by an exposure to 75° C. (167° F.), in fifteen minutes to 70° C. (158° F.), and in thirty minutes to 68° C. (154.5° F.). Concerning other bacteria, Van Geuns found that a few seconds' exposure to 60° C. (140° F.) would kill the cholera spirilla, the Finkler-Prior bacillus, the typhoid bacillus, and the pneumococcus.

It may, therefore, be concluded that a temperature of not less than 158° F. will render milk sufficiently germ-free for infant food. It is also certain that a temperature of less than 176° F. produces no alterations in the composition of milk that affect its digestibility.

Methods of Pasteurizing milk in bulk have been brought forward both in Germany and in this country, and now the procedure has been brought down to an easily managed system for household use. This depends upon the fact that the temperature of the milk to be treated may be raised to

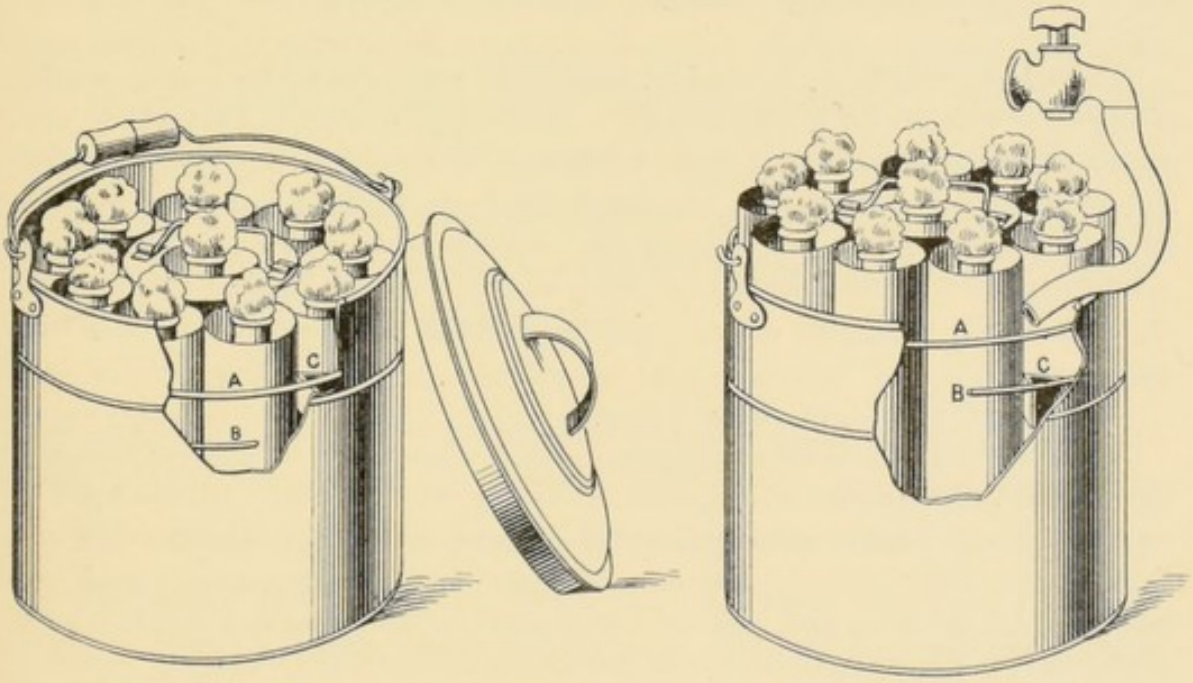


FIG. 3.—FREEMAN'S PASTEURIZER.

about the desired point (167° F.) by immersing a certain definite quantity of milk in a properly proportioned bulk of boiling water, the source of heat having been removed. The apparatus consists of two parts—a graduated pail for the water and a receptacle for the bottles of milk. This receptacle consists of a series of seven or ten hollow zinc cylinders fastened together, which fits into the pail containing the boiling water. Each of these cylinders is large enough to hold one of the bottles of milk, the series of seven cylinders

accommodating seven eight-ounce bottles, and the series of ten cylinders being intended for ten six-ounce bottles. When the bottles, stopped with cotton corks, are in place, water is poured around them to secure perfect conduction of the heat. After the water in the pail is thoroughly boiling, it is removed from the stove and placed on a non-conducting surface. The cylinders are now introduced, and the pail covered and left standing for thirty minutes, after which the milk is rapidly cooled by placing the bottles in a refrigerator or immersing them in cold water. A convenient apparatus for nursery use is Dr. Freeman's Pasteurizer, shown in figure 3.

The apparatus consists of a pail for water and a receptacle for the bottles of milk. The *pail* is a simple affair with a cover. Extending around it is a groove for indicating the level to which it is to be filled with water; inside are three supports (C) for holding the receptacle. The *receptacle* for the bottles consists of a number of hollow cylinders fastened together and surrounded by a wire (A), which rests on the support (C) when the milk is being heated. Below the wire (A) are three short wires (B); these rest on the supports (C) when the receptacle is raised for cooling.

The steps of the process are as follows:

Fill the pail to the level of the groove with water, cover it, and put it on the stove to boil, the receptacle for the bottles having been left out. Fill the body of each bottle with milk or some modification of milk in proper proportion for feeding; stopper with a wad of cotton-batting and put in a refrigerator. If all the bottles which the receptacle holds are not needed, fill the remaining cylinders with cold water. When the water in the pail on the stove boils thoroughly, take the bottles of milk from the refrigerator and put them in the spaces in the receptacle. Pour cold water into each of these spaces so as to surround the body of the bottle. Take the pail of boiling water from the stove and put it on a table or mat; not on metal or stone. Be sure that the pail is still filled exactly to the level of the groove and that the water is boiling vigorously. Put the receptacle containing the bottles of milk into the pail of boiling water, so that the wire (A) will rest on the support (C), cover the pail quickly and let it stand forty-five minutes. During this period the pail must not be on the stove and the cover must not be removed. Now uncover the pail and lift the receptacle and turn it so that the wire (B) will rest on the support (C), thus elevating the top of the receptacle above that of the pail. Put the whole in a basin under a faucet to which a rubber pipe may be attached connecting it with the pail. The water will overflow from the pail into the basin. Or the pail may be placed under a pump, fresh cold water being pumped into it every few minutes. When, however, it is not possible to cool the

milk in this way, place the receptacle containing the bottles in iced water, or stand the bottles on wood in a refrigerator. To warm the milk for use, put the bottle containing it in a vessel of cold water on the stove, and leave it until it is warm. Use a fresh bottle for each feeding. Wash the bottles thoroughly after using, and once a day put all the empty bottles in a kettle of cold water on the stove and let this water boil for an hour. The bottles should then be taken out and placed bottom up until used.

A sufficiently perfect apparatus may be readily improvised. All that is required is a bottle rack similar to that of the Arnold sterilizer, and a tin pail large enough to receive the rack and bottles and provided with a well-fitting cover. In conducting the process fill the bottles, previously perfectly cleaned, with milk and stop them with cotton ; place them in the rack, and this in turn in the pail ; pour into the pail enough *boiling* water to come up to the level of the milk in the bottles, adjust the cover, and let the whole stand on a wooden table until the water becomes cool—twenty to thirty minutes ; lastly, place the bottles in a refrigerator.

Pasteurized milk so prepared and placed in a refrigerator will keep perfectly sound and sweet for twenty-four hours at least. Its advantage as a food lies in its sterility, and, like ordinary milk, it must be modified by the addition of water, cream, and milk sugar to meet the special demands of each case. The various milk mixtures are often sterilized, the method being the same as for pure milk.

Within the past ten years Dr. Rotch, of Boston, has introduced a method of preparing cows' milk for the artificial feeding of infants which has for its object a recombination of the fat, proteids, and lactose of the milk, and the production of a mixture having a composition identical with human milk, or one of any desired percentage of these three essential ingredients. The resultant food is called "modified milk" ; but since cows' milk has been modified in the nursery for years past by the addition of water, sugar, cream, and various other less suitable materials, it will be termed here laboratory

milk or percentage milk. For its production laboratories have been established in several leading cities of this country where a physician, upon sending a prescription indicating the percentages required, may have the mixture compounded, and whence the food is sent daily to the consumers. Percentage milk is composed of centrifugal cream of 16 per cent. fat-strength (usually), separated milk from which practically all fat has been removed by the centrifugation of the cream, 20 per cent. sugar of milk solution, sterilized lime water, and distilled water. After combination in the total quantity necessary for a day's feeding, the mixture is divided into as many portions as there are to be feedings and these are poured into sterilized nursing bottles, which are stopped with cotton. If so desired, the mixture is sterilized either at a high or low temperature. The day's supply is now ready to be delivered to the consumer in convenient baskets.

Properly prepared laboratory milk food has certain readily recognized advantages. The original milk is obtained from carefully selected and kept stock; it is milked from the cow by clean, often gloved, hands, and due care is taken in the cooling and subsequent treatment to prevent the introduction of gross or microscopic foreign matter. Again, to insure still further an aseptic food, each day's supply is Pasteurized or sterilized before it is sent to the infant; and, if it must be shipped a long distance, it is packed in ice, and thus kept at a temperature unfavorable to fermentation or other injurious change. The same care for absolute cleanliness is also observed with the apparatus used in preparing the food and with the bottles in which it is served. The food comes to the infant ready to be administered, except that it must be warmed, and the labor of home preparation is avoided. The infant receives from day to day a food which is uniform in quantity (each feeding being sent in a separate bottle); has an identical percentage of fat, sugar, and proteids, and a fixed alkalinity.

Laboratory milk being prescribed, it is possible for the physician to supply an artificial food identical in chemical composition with normal human milk, and at the same time to vary at will and accurately the percentages of fat, sugar, and proteids to meet the demands of each infant's digestive powers and developmental requirements.

In prescribing, a special blank is used and filled out as desired by the physician; for example, a prescription for a child of two months should read:

	Per Cent.	Remarks.
℞. Fat, ...	3 50	Number of feedings *8.*
Milk sugar, . .	6 50	Amount at each feeding *3½ fluidounces.*
Albuminoids, .	1 25	Infant's age *2 months.*
Mineral matter,	—	Infant's weight *10 pounds.*
Total solids, . .	—	Alkalinity *5 %*
Water, ...	—	Heat at *155° F.*
	100 00	

Ordered for Baby B.

Address

Date,	*Signature,*
Month and day 1901.	—— —— M.D.

Experience with this method has been sufficiently extended to warrant the following tabulation of average percentages and quantities for healthy infants at different ages:

THEORETICAL BASIS FOR FEEDING A HEALTHY INFANT.
(WALKER-GORDON LABORATORY.)

WEEKS OF LIFE.	AMOUNT FED IN OZS.	PERCENTAGES.			WEEKS OF LIFE.	AMOUNT FED IN OZS.	PERCENTAGES.		
		Fat.	Sugar.	Proteids.			Fat.	Sugar.	Proteids.
1st, . . .	1¼	2.00	4.50	0.75	27th, . .	5½	4.00	6.50	1.75
2d, . . .	1¾	2.50	5.50	1.00	28th, . .	5½	4.00	7.00	1.75
3d, . . .	2	3.00	6.00	1.00	29th, . .	5¾	4.00	7.00	1.75
4th, . . .	2¼	3.00	6.00	1.00	30th, . .	5¾	4.00	7.00	1.75
5th, . . .	2¾	3.25	6.50	1.00	31st, . .	6	4.00	7.00	1.75
6th, . .	3	3.25	6.50	1.25	32d, . . .	6	4.00	7.00	1.75
7th, . . .	3	3.50	6.50	1.25	33d, . . .	6¼	4.00	6.50	1.75
8th, . . .	3¼	3.50	6.50	1.25	34th, . .	6¼	4.00	6.50	2.00
9th, . .	3½	3.50	6.50	1.25	35th, . .	6¼	4.00	6.50	2.00
10th, . .	3½	3.50	6.50	1.25	36th, . .	6¼	4.00	6.50	2.00
11th, . .	3½	3.50	6.50	1.25	37th, . .	6½	4.00	6.50	2.00
12th, . .	3¾	3.50	6.50	1.25	38th, . .	6½	4.00	6.50	2.00
13th, . .	3¾	3.50	6.50	1.25	39th, . .	6½	4.00	6.50	2.00
14th, . .	4	3.50	6.50	1.25	40th, . .	6¾	4.00	6.50	2.00
15th, . .	4¼	3.75	6.50	1.25	41st, . .	6¾	4.00	6.50	2.00
16th, . .	4¼	3.75	6.50	1.25	42d, . . .	7	4.00	6.50	2.00
17th, . .	4½	3.75	6.50	1.50	43d, . . .	7	4.00	6.50	2.25
18th, .	4½	3.75	6.50	1.50	44th, . .	7	4.00	6.00	2.50
19th, . .	4¾	3.75	6.50	1.50	45th, . .	7	4.00	6.00	2.50
20th, . .	4¾	3.75	6.50	1.50	46th, . .	7¼	4.00	6.00	2.50
21st, . .	4¾	3.75	6.50	1.50	47th, . .	7¼	4.00	6.00	2.50
22d, . . .	5	3.75	6.50	1.50	48th, . .	7¼	4.00	6.00	2.50
23d, . . .	5	3.75	6.50	1.50	49th, . .	7¼	4.00	6.00	2.75
24th, . .	5¼	3.75	6.50	1.75	50th, . .	7¼	4.00	6.00	2.75
25th, . .	5¼	3.75	6.50	1.75	51st, . .	7¼	4.00	6.00	2.75
26th, . .	5½	3.75	6.50	1.75	52d, . . .	7¼	4.00	5.50	3.00

The figures tabulated above should be taken as averages only; they are too high for infants that are not in perfect health both as to digestive power and development. However, each case must be considered on its own merits, percentages prescribed accordingly, and when a suitable formula has been attained, the food may be increased in strength as rapidly as digestion permits.

Dr. L. Emmett Holt gives the following rules for alterations in the percentages: "If not gaining in weight, without special signs of indigestion, increase the proportion of all the ingredients; if habitual colic, diminish the proteids; for frequent vomiting soon after feeding, reduce the quantity; for the regurgitation of sour masses of food, reduce the fat, and sometimes also the proteids; for obstinate constipation, increase both fat and proteids."

With all these advantages, laboratory milk is theoretically the most perfect substitute for normal human milk that science has yet devised. But, unfortunately, clinical experience does not bear out this theory.

Since the establishment of a milk laboratory in Philadelphia I have thoroughly tested this method of artificial feeding, with very unsatisfactory results. Of a large number of infants so fed there were a few that thrived under the exclusive use of percentage milk from shortly after birth up to the time of beginning a mixed diet, a larger class in which the method was partially satisfactory, and a much larger one in which it was quite unsatisfactory.

In the partially satisfactory class laboratory milk was used for a considerable period—six months to a year—without producing active illness, but gradually inducing health conditions necessitating a change of food.

The symptoms indicating an unhealthy condition were very uniform: *viz.*, pallid, dry skin; dry, lusterless hair; flabby, soft muscles; indifferent appetite; inactive—not decidedly constipated—bowels, with clay-colored evacuations; light-colored urine; listlessness and disinclination to play; peevishness and restless sleep—in a word, the features of malnutrition. With the muscle flabbiness there was not always emaciation, but the two conditions were often associated, and the little sufferer was both weak and puny.

The instances of the totally unsatisfactory group were by far the most numerous, and in it, in my experience, may be placed the vast majority of infants fed upon laboratory milk after the first eight weeks of life. It embraces those cases in which laboratory milk feeding must, of necessity, be discontinued on account of the onset of some acute disorder of undoubted dietetic origin. The disorders observed in my cases were in some instances infantile scurvy, but most frequently acute gastro-intestinal catarrh, indicated by pyrexia, vomiting,

and diarrhœa with the expulsion of curds and greenish mucus or large quantities of greenish serum.

The question now naturally arises, Why should a food capable of being prescribed to approach so nearly breast milk in chemical composition, so uniform in its make-up, so sterile, and so easily and accurately varied to meet digestive emergencies, fail when put to a clinical test?

My answer is that in its composition all the fat is removed by a separator, and the food as prepared for the infant is a recombination of this fat and an alkaline solution of the proteids and sugar. In a word, the natural emulsion is destroyed. This, I think, in some way lessens the digestibility of the proteids and leads either to conditions of malnutrition or to an irritative diarrhœa with the expulsion of the undigested proteids in the form of compact curds—and this, too, despite changes in the proportion of the proteids; for the partially starved children are attacked with vomiting or diarrhœa with fever if the percentage of proteids be increased (say to 2.00 per cent. at ten months), and those having irritative diarrhœa are not benefited until the percentage is cut down to a starvation point (0.75 per cent. in a child of three months still showed numerous curds in the evacuations). What a contrast to normal breast milk, an emulsion having 1.5 to 2 per cent. of proteids!

I have never seen an infant from two to ten months of age able to satisfactorily digest a laboratory mixture of stronger proteid percentage than 1.50, and have often seen cases of two months and more unable to digest a percentage of 0.50.

On the other hand, how does it stand with the cream, milk, sugar of milk, and water mixture made at home by capable heads and careful hands? These mixtures are still modified milk mixtures; but their basis is unseparated milk, a natural emulsion containing fat, proteids, sugar, and salts. Under this physical condition the proteids are much more easily

digested, so that a badly nourished child of ten months, for whom the proteid percentage of laboratory milk cannot be forced higher than 1.50, will easily digest and grow strong upon a domestic mixture of:

Cream (16 per cent.), . . .	f℥ss		Fat, ... 3.75 per cent.
Milk, ...	f℥vss	=	Sugar, ... 4.84 "
Milk sugar, ...	℥j		Proteids, ... 2.97 "
Water, ...	f℥ij.		

And an infant of two months having an irritative diarrhœa on a starvation diet of 0.50 per cent. proteids, will begin to improve and soon grow strong and well on:

Cream (16 per cent.), . . .	f℥ss		Fat, ... 4.00 per cent.
Milk, ...	f℥x	=	Sugar, ... 6.15 "
Milk sugar, ...	℥j		Proteids, ... 2.09 "
Water, ...	f℥iss		

In domestic modification, of course, the same care must be taken to secure clean, pure milk and cream from healthy, well-kept cows. This is quite possible now in Philadelphia, and in other cities of the country, and is becoming easier each year, as more attention is being given to infant feeding and greater demand is being made for a pure milk supply. Pasteurization is as readily done in the nursery as in the laboratory. Accurate measurement of quantities and cleanliness of vessels and feeding bottles is equally possible and, in my experience, quite as certain at home as in the shop.

The milk and cream from a dairy may vary slightly in chemical composition from day to day, but this variation seems to me to be a minor detail, perhaps of hygienic advantage, and certainly of questionable importance when compared with the separator's destruction of the physical properties of the basal milk. One certainly should not sacrifice everything to chemical accuracy.

These statements must not be understood as condemning

laboratory milk absolutely. If its introduction has done nothing else, it has greatly advanced substitute infant feeding, by fixing the attention of the profession upon the importance of cleanliness and accuracy in the quantity and chemical composition of cows' milk foods, and by placing the whole question upon a higher scientific plane than it had ever reached before. Further, laboratory milk is of great use in feeding infants who must be artificially nourished from birth, and may often (about 20 per cent. of cases) be advantageously employed up to the end of the second month, and is better at any age than the haphazard mixtures employed by careless and untrained mothers or nurses. At the same time, like every other single plan of preparing artificial food for infants (sterilization for instance), its applicability is limited, and much more so, in my experience, than the process of home modification, in which unseparated milk is employed.

The ordinary home modification of whole milk by the addition of cream, milk sugar, and water, while most successful clinically, is, as already stated, comparatively inaccurate. It is quite possible, though, to apply the principles of the milk laboratory in the nursery if the attendant be intelligent and appreciative of the importance of absolute cleanliness in manipulation. Dr. Thompson S. Westcott has devised a series of formulæ for home modification which yield very accurate results; they are best detailed in their author's own words:

"A careful study of the principles of percentage feeding has shown that milk mixtures can be prepared with the same accuracy as is secured in laboratory modification by using whole milk in combination with creams of 16 per cent., 20 per cent., and, very exceptionally, 32 per cent. fat-strength. Sugar is supplied in definite percentage also in the form of varying quantities of dry sugar of milk, which is to be dissolved in the required amount of diluent before combination

of the three ingredients. The following symbols are readily understood:

F = desired percentage of fat.
P = " " " proteids.
S = " " " sugar.

C = quantity of cream in ounces.
M = " " milk " "
Q = " " total mixture in ounces.
W = " " water in ounces.
L = " " sugar of milk in ounces.

"The four necessary formulæ are as follows:*

$$C = \frac{(F - P) \times Q}{12.4 \text{ or } 16.8 \text{ or } 29.2}$$

$$M = \frac{Q \times F}{4} - 4 \text{ or } 5 \text{ or } 8 \times C.$$

$$L = \frac{Q \times S - (4C + 4.4\,M)}{100}$$

$$W = Q - (M + C)$$

"In practice the desired percentage formula is first decided upon and the total quantity of the mixture for the day, or for the bottle, is determined. The corresponding quantities of cream, milk, sugar, and water are then found by substituting these values in the formulæ and working out the indicated mathematical processes.

"For example, required the quantities of 16 per cent. cream, whole milk, milk sugar, and water or other diluent to give 40 ounces of mixture containing fat, 3.50 per cent., proteids, 1.50 per cent., and sugar, 6 per cent.

"By substituting these values for the corresponding symbols in the formulæ we obtain:

$$C = \frac{(3.50 - 1.50) \times 40}{12.4} = \frac{2 \times 40}{12.4} = \frac{80}{12.4} = 6.4 \text{ oz.}$$

$$M = \frac{40 \times 3.50}{4} - 4 \times 6.4 = 35 - 25.6 = 9.4 \text{ oz.}$$

$$L = \frac{40 \times 6 - (4 \times 6.4 + 4.4 \times 9.4)}{100} = 1\tfrac{3}{4} \text{ oz.}$$

$$W = 40 - (9.4 + 6.4) = 24.2 \text{ oz.}$$

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* Westcott: "The Scientific Modification of Milk." *International Clinics*, October, 1900. When 16 per cent. cream is used, 12.4 and 4 are to be used in the cream and milk formulæ, respectively. So, also, 16.8 and 5, or 29.2 and 8, are to be used when 20 per cent. cream or 32 per cent. cream, respectively, is required.

"In certain combinations of percentages it will be found that the value of M works out as a minus quantity. This indicates that the cream chosen is of too low a percentage, and a higher cream (20 per cent. or 32 per cent.) must be used, with which the formulæ give satisfactory values. Ordinarily 16 per cent. cream may be used for any proteid percentage above 1.00, and even for 0.75 with fat percentages up to 3.33. The 32 per cent. cream is required only for mixtures containing less than 0.50 per cent. proteids with fat percentages above 3.125. It will also be observed that if the fat percentage is lower than the proteid percentage the cream formula works out a negative value, which indicates that a skimmed milk must be used to supply the proteid percentage in excess of the fat percentage. Under such circumstances other formulæ appropriate to the conditions must be employed.* In practice, however, it is very unusual to make the fat percentage lower than that of the proteids, so that this contingency will rarely present itself.

"A distinct advantage of this method is that if the quantity of cream be kept constant and the milk gradually increased, the total quantity of mixture being kept constant, both the proteid and fat percentages are gradually increased by an equal increment. When the fat value surpasses 4.00, beyond which it is rarely desirable to go, a drachm of cream may be dropped for each half ounce of milk added, the total quantity being kept constant by adding water. By this means the strength of food may be gradually increased without necessitating frequent recalculation of the formula."

Sometimes milk, in every form and however carefully prepared, ferments soon after being swallowed, and excites vomiting, or causes great flatulence and discomfort, while it affords little nourishment. With these cases the best plan is to withhold milk entirely for a time and try some other form of food. The following are good substitutes for an infant from three to six months old:

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* Loc. cit.

1. Whey,* . . . . . f℥ij
   Barley water, ... f℥ij
   Milk sugar, ... ℥j (1 teaspoonful).
For one portion, to be given every two hours.

2. Barley-jelly, ... f℥j (1 teaspoonful)
   Water, ... f℥iv.
   Mix and add half the white of a fresh egg.
For one portion, to be given every two hours.

3. Veal broth† (½ lb. of meat to a pint of water),
   Barley water, ... of each, f℥ij.
For one portion, to be given every two hours.

4. Raw-beef juice,‡ . . . . . f℥j–ij.
Every two hours.

While on No. 4 the patient must take from 12 to 24 fluid-ounces of pure water, barley water, or white-of-egg water each twenty-four hours; these must be given in small doses at short intervals.

Such foods are only to be used temporarily until the tendency to fermentation within the alimentary canal ceases; then milk may be gradually and cautiously resumed.

When infants approaching the end of the first year become affected with indigestion, it is often sufficient to reduce the strength and quantity of the food to a point compatible with digestive powers. For instance, at eight months the food may be reduced to that proper for a healthy child of six

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* *Whey.*—Heat one pint of milk to a point that can be agreeably borne by the mouth; add, with gentle stirring, 2 teaspoonfuls (f℥ij) of Fairchild's essence of pepsin; let stand until firm coagulation takes place; beat with a fork until the curd is finely divided; strain.

† *Veal Broth.*—Mince ½ to 1 pound of lean veal; pour upon it a pint of cold water; let it stand for three hours, then slowly heat to boiling-point; after boiling briskly for two minutes, strain through a fine sieve and season with salt.

‡ *Raw-beef Juice.*—Take one pound of sirloin of beef, warm it in a broiler before a quick fire, cut into cubes of about one-quarter of an inch, place in a lemon-squeezer or a meat-press, and forcibly express the juice; remove the fat that rises to the surface after cooling. *Never actually cook the meat.*

months, or even less. Here, too, predigestion of the food is very serviceable.

If a few grains of extractum pancreatis be added to a goblet-ful of thick, well-boiled starch gruel, at a temperature of 100° F., the gelatinous mucilage quickly grows thinner, and soon is transformed into a fluid, the starch having been rendered soluble by the action of the pancreatin; by still longer contact, the hydrated starch is converted into dextrin and grape sugar. Advantage may be taken of this property to render the foods containing starch assimilable. Thus, to a mixture of barley jelly and milk, *e. g.*:

Barley jelly,	℥ij
Milk sugar,	℥j
Warm milk,	f℥viij;

add three grains of extractum pancreatis, and five grains of bicarbonate of sodium, and keep warm for half an hour before administering.

The same process may be employed with food containing oatmeal, arrowroot or wheaten flour, with a view of converting the starchy ingredients into digestible elements without materially altering the taste.

When the infant has arrived at an age to take meat broths, these, too, when digestion is enfeebled, may be readily peptonized.

(*d*) Success in hand-feeding depends upon proper administration as well as careful preparation of the food.

From birth up to such time as broth, bread, and eggs are added to the diet, all the food should be taken from a bottle. Even after this, as the bottle is a comfort and insures slow feeding, it may be allowed for milk preparations, until the child, of his own accord, tires of it. The only feeding apparatus to be admitted to the nursery is the simple bottle and tip. All complicated arrangements of rubber and glass tubing are not only an abomination, but a fruitful source of sick-

ness and death. Rather than use them, it is far better to feed the infant with a spoon. The graduated nursing bottle first suggested by myself is a useful implement. Its interior surface is so shaped as to present no angles for the collection of milk; it is easily cleaned, and the graduated scale is convenient for nursery use. It is made of transparent flint glass, so that the slightest foulness can be detected at a glance, and varies in capacity from six to twelve fluidounces. Two should be on hand at a time, to be used alternately. Immediately after a meal the bottle must be thoroughly washed out with scalding water, filled with a solution of bicarbonate or salicylate of sodium,—one teaspoonful of either to a pint of water,—and thus allowed to stand until next required; then, the soda solution being emptied, it must be thoroughly rinsed with cold water before receiving the food. The tips or nipples, of which there should also be two, must be composed of soft, flexible india-rubber, and a conical shape is to be preferred, as being more readily everted and cleaned; the opening at the point must be free, but not large enough to permit the milk to flow in a stream without suction. At the end of each feeding the nipple must be removed at once from the bottle, cleansed externally by rubbing with a stiff brush wet with cold water, everted and treated in the same way, and then placed in cold water and allowed to stand in a cool place until again wanted.

While taking these precautions for perfect cleanliness, the nurse must satisfy herself of their efficacy by smelling both the bottle and the tip just before they are used, to be sure of the absence of any sour odor.

Next to cleanliness of the feeding apparatus, it is important to insist upon the separate preparation of each meal immediately before it is to be given. The practice of making, in the morning, the whole day's supply of food, though it saves trouble, is a most dangerous one. Unless subjected to

Pasteurization or sterilization, changes almost invariably take place in the mixture, and by the close of the day it becomes unfit for consumption.

When the graduated bottle is not at hand, a common glass graduate, marked for fluidrachms and ounces, and holding a pint, should be provided for the nursery. Some moments before mealtime, so as to avoid hurry, measure the different fluid ingredients of the food in this, one after the other; add the requisite quantity of milk sugar, and mix the whole thoroughly by stirring with a spoon, and pour into the feeding bottle. When the graduated bottle is employed, thorough shaking is sufficient. The food must now be heated to a temperature of about 95° F. This can be done by steeping the bottle in hot water, or by placing it in a water-bath over an alcohol lamp or gas jet. Finally, apply the tip and the meal is ready.

When feeding, the child must occupy a half-reclining position in the nurse's lap. The bottle should be held by the nurse, at first horizontally, but gradually more and more tilted up as it is emptied, the object being to keep the neck always full and prevent the drawing in and swallowing of air. Ample time—say five, ten, or fifteen minutes, according to the quantity of food—should be allowed for the meal. It is best to withdraw the bottle occasionally for a brief rest, and after the meal is over, sucking from the empty bottle must not be allowed, even for a moment.

(*e*) For children residing in cities, an honest dairyman must be found, who will serve sound milk and cream from country cows once every day in winter, and twice during the day in the heat of summer. The farm should be so situated that the consumer may be served not later than twelve hours after milking. The milk of ordinary stock is more suitable than that from Alderney, Durham, Jersey, or fancy bred cows, as in these the proportion of fat percentage is either too low or

too high, varying from 2.88 to 5.21 per cent. The mixed milk of a good herd is to be preferred to that from a single animal. It is less likely to be affected by peculiarities of feeding, and less liable to variation from alterations in health or different stages of lactation.

The care of the herd and of the milk is of great consequence. The cows should be subjected to the tuberculin test, their condition of health should be guaranteed by careful and regular inspection by a competent veterinarian, and the milk of any animal failing to pass should not be mixed with that from healthy animals. The cows must not be fed upon swill or the refuse of breweries, glucose factories, or any other fermented food. They must not be allowed to drink stagnant water, and must not be heated or worried before being milked. The pasture must be free from noxious weeds, and the barn and yard and the animals themselves must be neat. The udder should be washed before the milking, and the hands and clothing of the milkers and dairy workers should be kept clean, and the same aseptic precautions must be observed with cans, pails, and every implement with which the milk comes in contact.

The milk must be at once thoroughly cooled. This is best accomplished by placing the can in a tank of cold spring water, or in ice-water, the water being the same depth as the milk in the can. It is well to keep the water in the tank flowing; indeed, this is necessary unless ice-water be used. The can should remain uncovered during the cooling and the milk should be gently stirred. The temperature should be reduced to 45° F. within an hour, and the can must remain in the cold water until the time for delivering.

In summer, when ready for delivery, the top should be placed in position and a cloth wet in cold water spread over the can, or refrigerator cans may be used. A better plan still is to serve the milk in glass jars having air-tight tops. At no

season should the milk be frozen, and at the same time no buyer should receive milk having a temperature over 65° F.

When the milk and cream are not served in sealed glass jars, it is well to provide two sets of small cans; one set to be thoroughly cleansed and aired while the other is taken away by the milkman to bring back the next supply. So soon as this arrives in the morning, or in the morning and evening in hot weather, the milk should be emptied into separate and absolutely clean earthenware or glass vessels with secure tops, and these put at once into a refrigerator reserved exclusively for them. This may stand in some convenient spot near the nursery, but not in it, and especially not in an adjoining bath room. With a good refrigerator there is no difficulty in keeping milk perfectly sweet for twenty-four hours in winter and for twelve hours in summer, except on intensely hot days; then it may be necessary to Pasteurize the whole of the supply when received, in order to prevent change.

As already indicated, milk is a fluid having active powers of absorption, and frequently acts as the medium for the transmission of the contagion of such diseases as scarlatina, diphtheria, and typhoid fever. Dr. V. C. Vaughan and other chemists have also discovered in milk a special poison which is termed *tyrotoxicon* (cheese poison).

The clinical element of interest in this discovery is the close analogy between the symptoms produced by the experimental use of tyrotoxicon and those observed in cholera infantum—an analogy suggestive of the probability of the latter disease being due to poisoned milk. This causal relation is borne out by certain well-known features of the disease. Thus, the affection occurs at a season when decomposition of milk takes place most rapidly; it occurs at places where absolutely fresh milk cannot be obtained; it prevails among classes of people whose surroundings are most favorable to

fermentative changes; it is most fatal at an age when there is the greatest dependence upon milk as a food, when the gastro-intestinal mucous membrane is most susceptible to irritants, and when irritation and fever are most easily produced.

Childhood.—Children who have cut their milk teeth may be fed for a twelvemonth—namely, up to the age of three and a half years—in the following way:

First meal, 7 A. M.—One or two tumblerfuls of milk, a saucer of thoroughly cooked oatmeal or wheaten grits with cream and salt, and a slice or two of bread and butter.

Second meal, 11 A. M. (if hungry).—A tumblerful of milk or a teacupful of broth with a biscuit.

Third meal, 2 P. M.—A slice of underdone roast beef or mutton or a bit of roast chicken or turkey, minced as fine as possible; a baked potato thoroughly mashed with a fork and moistened with gravy, or one well-cooked green vegetable, as spinach, young peas mashed with a fork, stewed celery; bread and butter; a saucer of junket or rice-and-milk pudding.

Fourth meal, 7 P. M.—A tumblerful of milk and one or two slices of well-moistened milk toast.

Orange juice, apple scraped with a spoon, ripe peaches, and cooked fruit not oversweetened may be allowed, especially if there be a tendency to constipation.

From three and a half years up the child must take his meals at the table with his parents, or with some reliable attendant who will see that he eats leisurely. The diet, while plain, must be varied. The following list will give an idea of the food to be selected:

BREAKFAST.

Every Day.	One Dish Only Each Day.	
Milk.	Fresh fish.	Eggs, plain omelette.
Porridge and cream.	Eggs, lightly boiled.	Chicken hash.
Bread and butter.	" poached.	Stewed kidney.
	" scrambled.	" liver.

Sound fruits may be allowed before and after the meal, according to taste, as oranges, grapes without pulp (seeds not to be swallowed), peaches, thoroughly ripe pears, cantaloupes, and strawberries.

DINNER.

Every Day.	Two Dishes Each Day.	
Clear soup.	Potatoes, baked.	Hominy.
Meat, roasted or broiled, and cut into small pieces.	" mashed.	Macaroni, plain.
	Spinach (purée).	Peas.
	Stewed celery.	String-beans, young.
Bread and butter.	Cauliflower.	Green corn, grated.
		All green vegetables.

Junket, rice-and-milk or other light pudding, and occasionally ice-cream, may be allowed for dessert.

SUPPER.

Every Day.

Milk.
Milk toast or bread and butter.
Stewed fruit, baked apple.

Fried food and highly seasoned or made-up dishes are to be excluded, and no condiment but salt is to be used.

Eating, however little, between meals, must be absolutely avoided. Keep a young child from knowing the taste of cakes or bonbons, or, having learned it, let him feel that they are as unattainable as the thousand other things beyond his reach, and he soon ceases to ask for them. Even a piece of bread between meals should be forbidden. His appetite then remains natural, and he will eat proper food at his regular meal hours.

Filtered or spring water should be the only drink; tea, coffee, wine, or beer being entirely forbidden.

As to the quantity, a healthy child may be permitted to satisfy his appetite at each meal, under the one condition that he eats slowly and masticates thoroughly.

In case of illness, the diet must be reduced in quantity and quality according to the rules that are applicable to adults.

2. Bathing.

During the first two and a half years of life a child ought to be bathed once every day. The bath should be given at a regular time, and it is best to select some hour in the early morning, midway between two meals—ten o'clock, for instance. The tub should be placed near the fire or in a warm room in winter, and away from currents of air in summer. It should contain enough water to cover the child up to the neck when in a reclining posture, and the temperature must be about 95° F. Upon undressing the child, the first step is to wet his head; then he is to be plunged into the water and thoroughly washed with a soft rag or sponge, and pure, unscented castile soap. After remaining in the water from three to five minutes the surface must be well dried, and rubbed with a flannel cloth or soft towel; then the body must be enveloped in a light blanket and the infant either returned to his crib to sleep, or kept in the lap for ten or fifteen minutes, until thoroughly warm and rested, and finally dressed. If there be repugnance to the bath, the tub may be covered over with a blanket, and the child being placed upon it, may be slowly lowered into the water without seeing anything to excite his fears.

In very hot weather, in addition to the morning full bath, the body may be sponged twice daily with water at a temperature of 90° F.; this, contrary to what might be expected, has a greater and more permanent cooling effect than bathing with cold water.

After the third year, three baths a week are quite sufficient. An evening hour is now to be preferred, but the water must still be heated to 90°.

About the tenth year cooler baths can be begun, from 72° to 75° being the proper temperature. The cold sponge or cold plunge is not admissible as a daily routine until youth is well advanced.

The hot bath—95° to 100°—is employed for various purposes, notably for a derivative action; to cause diaphoresis, to relieve nervous irritability, and to promote sleep. Whether a full bath or merely a foot-bath be required, five minutes is a sufficient time for immersion; then, with or without drying, according to the degree of sweating desirable, the whole body, or only the feet and legs in case of a foot-bath, must be enveloped in a blanket and the child put to bed. To render these baths more stimulating, from a teaspoonful to a tablespoonful of mustard flour may be added, and the child held in the water until the *arms* of the nurse begin to tingle.

It is important not to continue a hot bath too long, lest the primary stimulating effect be followed by depression. Cold baths, by shocking the system, first produce depression; but this is temporary, and is followed by reaction, during which the skin grows red, and the pulse becomes fuller and stronger. They have, therefore, a general stimulant and tonic action, promoting nutrition and giving tone to the body. On account of the shock, the extent of which depends directly upon the coldness of the water, these baths must be used with caution, and are not to be employed in very young or feeble subjects.

When giving a cold bath, the child must be stripped in a warm room, and thoroughly rubbed with the palm of the hand until the whole body, especially the spinal region, is reddened; he must then stand in a tub containing enough hot water to cover the feet and be rapidly sponged with the cold water. The temperature of the latter must never be below 60°, and the addition of half an ounce of sea-salt or a tablespoonful of concentrated sea water to the gallon renders it more stimulating and insures a complete reaction. After the sponging, the surface must be thoroughly and quickly dried with a soft towel and shampooed with the open hand until aglow.

The cooled bath may be employed with advantage in extreme conditions of hyperpyrexia. The child is first immersed

in water at 95°, and this is gradually lowered to 70° by the addition of cold water, the process occupying from fifteen to thirty minutes.

Various medicated baths are employed. Of these, the most useful are :

The Mustard Bath.

Take from two drachms to one ounce of powdered mustard; hot water, two to four gallons.

Derivative in form of foot-bath; stimulant as general bath.

Salt-water Bath.

Take two ounces of rock salt, or Ditman's sea-salt, or concentrated sea-water (best); water (hot or cold, according to season), four gallons.

General bath, to be used every morning in chronic tuberculosis, scrofula, rickets, and general debility. Bath to be followed by thorough rubbing of the surface, especially over the spine.

Bran Bath.

Take one pint of bran, tie up in a muslin bag, place in a quart of water, boil for an hour, squeeze bag thoroughly into the water; add to four gallons of warm water.

Useful in eczema and skin diseases.

Nitro-muriatic Acid Bath.

Take muriatic acid, one fluidrachm; nitric acid, two fluidrachms; warm water, four gallons.

Serviceable in hepatic sluggishness. Make bath in a wooden tub. May be employed as a foot or general bath.

Mercurial Bath.

℞. Hydrarg. chlorid. corros., ... gr. v
Alcohol., ... f℥ij
Aq. dest., ... f℥j. M.

S.—Add to four gallons of water. Employed in syphilitic skin diseases.

Soda Bath.

Take half an ounce of bicarbonate of sodium; warm water, four gallons.

Used in skin affections.

3. Clothing.

Infants and young children have little power of resisting cold, and on this account require warm clothing. Too much cannot be said in condemnation of the fashion of allowing children to go, even while in the house, with bare legs and knees.

Every child is supplied with a certain amount of nerve force to be daily expended in the maintenance of the different functions of the body—respiration, circulation, digestion, calorification, etc. If an excessive proportion of this force be consumed in keeping up the heat of the body, as is the case when so much is left bare, the other functions, especially the digestive, must suffer in consequence. During the oppressive heat of summer, the legs may be left uncovered; but throughout the rest of the year, the whole body must be encased in woolen underclothing. The thickness of this must vary, of course, with the season. Providing this be done, the outer clothing may be left to the taste of the mother; but all garments should fit loosely, that the functions of the different viscera may not be impeded by pressure.

The best pattern of a winter night-dress is a long, plain slip, with a drawing-string at the bottom to prevent exposure of the feet and limbs, should the child kick off the bed-covering. This should be made of flannel, or of the more easily washed Canton flannel. In summer, a loose muslin one may be put on, without the drawing-string. A flannel under-vest should always be worn at night, light gauze in summer and heavier wool in winter; care must be taken, however, to have one for night alone, discarding that worn in the daytime.

For infants under a year old, a broad flannel abdominal bandage, extending from the hips well up to the thorax, or, better still, a knitted worsted band shaped to fit the form, is very useful in keeping the abdominal organs warm, aiding digestion, and preventing pain.

All clothing should be changed sufficiently frequently to insure cleanliness.

Shoes must be large, well shaped, and made of soft leather, with pliable soles, so as to allow the feet to grow freely.

When dressing a child for exercise in the open air in cold weather, the outer clothing must not be put on until just before leaving the house, and removed immediately on return.

It is important to protect the head from cold in winter by a close-fitting, thick cap; and from the direct rays of the sun in summer by a broad-brimmed, light straw hat.

Rubber shoes are necessary in wet weather to keep the feet warm and dry while walking out of doors.

4. Sleep.

For some time after birth infants spend the intervals between being fed, washed, and dressed in sleep, and thus pass fully eighteen out of the twenty-four hours. As age advances, the amount of sleep required becomes less, until at two years thirteen hours, and at three years eleven hours, are enough. Any marked diminution in the length of sleep, or decided restlessness, indicates disease, and demands attention from the physician. This matter, though, is perhaps more a question of training than any other item of nursery regimen, and many a mother, by want of judicious firmness, has rendered the early years of her child's life not only a burden to himself, but an annoyance to the entire household.

One cannot too soon begin to form the good habit of regularity in sleeping hours, and, so far as circumstances will admit, the following rules may be enforced:

From birth to the end of the sixth or eighth month the infant must sleep from 11 P. M. to 5 A. M., and as many hours during the day as nature demands and the exigencies of feeding, washing, and dressing will permit.

From eight months to the end of two and a half years a

morning nap should be taken, from 12 M. to 1.30 or 2 P. M., the child being undressed and put to bed. The night's rest must begin at 7 P. M. If a late meal be required, the child can be taken up at about ten o'clock; but if past the age for this he may sleep undisturbed until he wakes of his own accord, some time between 6 and 8 A. M.

From two and a half to four years, an hour's sleep may or may not be taken in the morning, according to the disposition of the subject; but in every case the bed must be occupied from 7.30 P. M. to six or seven o'clock on the following morning.

After the fourth year few children will sleep in the daytime; they are ready for bed by 8 P. M., and should be allowed to sleep for ten hours or more.

A later retiring hour than 8.30 P. M. ought not to be encouraged until after the twelfth or fifteenth year.

When feasible, different rooms should be used for the day nursery and the sleeping apartment. The latter should be large, airy, well ventilated, so situated as to be exposed for a certain period each day to the direct rays of the sun, and provided with an open fire-place,—for wood, preferably,—which serves for both heating and ventilating. It should contain a bed for the nurse and a crib for the child, and be without curtains, heavy hangings, or superfluous furniture. A stationary washstand draining into a sewer is not to be permitted in the room, neither should it communicate with a bath-room. Soiled diapers or chamber utensils are to be removed at once, no matter what the time of night. The day nursery should have large windows, protected by blinds, and a southwestern exposure; all other requisites, with the exception of beds, are the same as in the sleeping room. It is very convenient to have the two chambers adjoining, but capable of entire separation by a door, so that one may be thoroughly aired without chilling the other. This arrangement, too, renders it practic-

able, by standing the door open and raising the windows in the day nursery, to keep the dormitory cool in hot weather without exposing the child to currents of air.

If an apartment has to be occupied during both the day and night, it must be vacated for half an hour or more in the evening and well aired before the child is put back to bed.

The temperature of the rooms must be as uniform as possible, the proper degree of heat being from 64° to 68° F.

The crib should have high sides, to prevent the child from falling out and injuring himself, and should be provided with springs and a soft hair mattress, protected by a gum cloth, placed under a double sheet. The bedclothes must be light in weight, while varying in warmth according to the weather; it is just as important to insist upon cleanliness here as in the clothing of the body.

5. Exercise.

A certain amount of muscular exercise is necessary for development and for the proper performance of the digestive functions. Infants, before they are able to stand, will use their muscles sufficiently if, when loosely clad, they are placed upon their backs on a bed and allowed to kick and turn about at pleasure. After the age of nine or ten months, a healthy child will begin to creep; at the end of a year, he will make efforts at standing, and from four to eight months later will be able to walk by himself; children, however, present great differences in this respect, and a delay of a few months must not be considered as abnormal. So soon as efforts at creeping are made, there need be no fear that insufficient exercise will be taken; the care should be rather to prevent overfatigue.

Fresh air and sunlight are as necessary as muscular exercise. The child must be taken out of doors every day, weather permitting, after arriving at the proper age; this is

four months for children born in the early fall and winter, and one month for those born in summer.

In cool weather babies who are unable to walk should be taken out in a coach, or in the nurse's arms, for an hour in the morning and half an hour in the afternoon, while the sun is shining. In summer they may pass the greater part of the waking hours in the open air, provided they be well protected from the direct rays of the sun.

Children old enough to walk may spend a longer time in the air in winter, and may be out all day in summer; but until the fourth year, it is better to let them play about at will than take a long set walk.

Until well advanced in childhood, the house is the safest place in damp and rainy weather, when there is a strong east or north wind blowing, and when the thermometer stands below 15°.

Management of Weak and Immature Infants.

When premature expulsion of the fœtus cannot be checked, children are born in a condition of feebleness requiring particular care. Such children are under weight; breathe and eat imperfectly; have ill-formed organs and badly performed functions; their skin is soft and delicate, bright red in color, and so transparent that the superficial blood-vessels can often be seen. Their cry is feeble, their muscles are inert and hardly seem to contract, and the movements of the limbs are rare and without vigor. Plunged in a sort of stupor, the infant has not even strength enough to suck, the muscles of the cheeks and of the tongue and palate being apparently too weak to perform this act, and deglutition itself is often slow—a grave symptom, since the regular accomplishment of this function alone renders life possible.

The employment of artificial heat and a well-regulated alimentation are the methods of combating this condition.

Warmth and even temperature of the surrounding air are most important. The old method of accomplishing this was to envelop the infant's body and limbs, under the ordinary clothing, with a layer of cotton wadding, and place a fold of the same around the head. Two or three bottles filled with hot water were placed under the blankets of the bed, and renewed from time to time as they became cold. An effort was made to maintain the temperature of the chamber at 77° F. All changes of clothing were made before a brisk fire, and two or

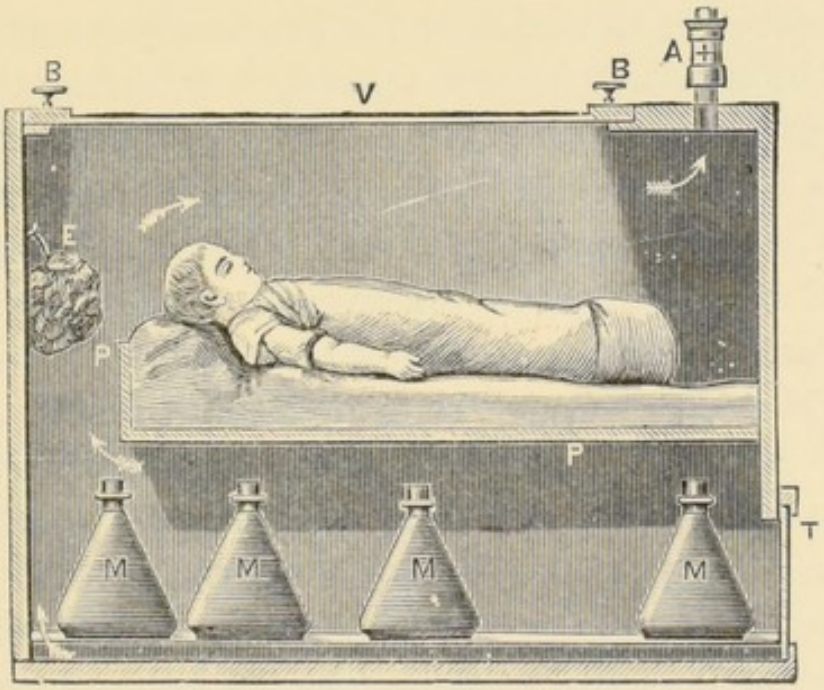


FIG. 4.—TARNIER'S "HATCHING-CRADLE."

three times every day massage or friction, either dry or with various stimulating embrocations, was practised to strengthen the circulation. As an improvement upon this crude and very unsuccessful method, M. Tarnier has devised an apparatus called a "hatching-cradle," or incubator.

It consists of a box made of wood, sixty-five centimetres long by fifty high and thirty-six wide, with sides twenty-five millimetres thick. The inside of the box is divided by a partial partition into two parts; this partition, which is horizontal,

is placed about fifteen centimetres from the bottom. The lower story is intended for hot-water bottles. Figure 4 shows the apparatus.

There are two doors; one is a sliding door on the lower side of the box, to push to either side, for the purpose of introducing the hot-water bottles; the other is at one of the ends (at T in the figure); it does not completely close the orifice, but allows a small amount of air to enter. The upper part, for the baby, contains the bedding, and is covered by a glass top at V; it should close tightly and be held by two screws at BB. At A is an outlet for the air, to which a small ventilator can be attached. In the opening between the two chambers a wet sponge is placed to keep the air slightly moist, and here also a thermometer is placed to mark the temperature. The heat is supplied by earthenware jugs at M; they contain a pint of water each; four or five are required to keep the temperature at the proper point—87° to 90° F. The chamber must be heated to this degree before the infant can be placed in it, and every one and a half or two hours one of the water bottles must be changed in order to maintain a constant temperature. The air passes in by the door, T, is heated by the bottles, and passing by the sponge, E, escapes at A; the movement of the small ventilator in the latter position is the index that the air is circulating. The infant must be dressed in swaddling clothes, as it has been observed that the temperature is always two or three degrees higher under the clothing than in the chamber itself. Every hour or two, according to the case, the little patient should be taken out to receive food and have its napkins changed. The shorter the time occupied in these processes, the better.

Auvard has suggested an improvement in Tarnier's incubator. In his apparatus a cylindrical reservoir of metal takes the place of the hot-water jars in the lower compartment of the couveuse. This reservoir is filled by means of a metallic

funnel at one end of the box and communicating with the cylinder through a metallic tube. The overflow of the cylinder is provided for by a curved metallic tube at the lower part of the cylinder, beneath the inlet through which the reservoir is filled. The air enters by a register on one side of the incubator instead of at the end, as in Tarnier's model. The other portions of the apparatus are the same as Tarnier's.

The metallic cylinder is capable of holding ten litres of liquid (a little over ten quarts). To start the apparatus, about five litres of boiling water should be poured in, after which three litres may be poured in every hour. When ten litres are contained in the cylinder, the overflow-pipe carries off the excess. Auvard suggests having two vessels, capable of holding three litres each, keeping one under the escape-pipe and the other over the fire, reheating the water in the vessel filled by the escape-pipe and having it in readiness for the next changes. The two vessels may thus be used alternately, and but little time consumed in the heating of the apparatus as compared with that required in the use of Tarnier's invention.

To empty the cylinder, a rubber tube is attached to the escape-pipe, by which it is made to act as a siphon—a small quantity of water poured into the cylinder through the funnel being sufficient to start the liquid.

The length of time the child remains in an incubator will vary from fifteen days to three weeks, a month, or even more. It should not be removed permanently until it has acquired sufficient vigor to live in the ordinary atmosphere of the apartment. To accustom the child to this atmosphere, it should, as it grows stronger, be removed from the incubator for an hour at a time during the warmest part of the day.

It is best to continue the use of the apparatus at night for some time after the child becomes accustomed by day to ordinary surroundings, for the danger of chilling from changes in the atmosphere is greater at night.

Auvard recommends the use of the incubator in all cases where the vitality of the child is enfeebled either by external causes, as cold, or internal causes, as premature birth, congenital feebleness, cyanosis, wasting, or other general maladies enfeebling to the newborn.

The excellent results obtained by the employment of incubators is shown by the following statistics, obtained from the Maternité, in Paris :

Weight of Child.	No. of Infants.	No. that Lived.	No. that Died.
1000–1500 grammes.	40	12	28, or 70 per cent.
1501–2000 "	131	96	35, or 26.7 "
2001–2500 "	112	101	11, or 9.8 "

Before the introduction of the incubator, infants died at the rate of 66 per cent.; since, the average proportion is 36.6 per cent. The apparatus has also been used with success in the treatment of sclerema, œdema, and cyanosis attacking the newly born.

From the very first day an attempt must be made to put these feeble infants to the breast; and if they be too weak to suck, the milk may be squeezed into the mouth, or first into a warm spoon and then given to the child. The mother's or nurse's milk, without dilution or addition, is the best food, though if this cannot be obtained modified cows' milk must be used. In these cases laboratory milk is very useful; the formula varies with the size and strength of the infant, but may be constructed from the following prescription :

Fat, 1 to 1.5 per cent.; sugar, 3 to 4.5 per cent.; albuminoids, 0.2 to 0.75 per cent.; alkalinity, 5 per cent.; heat at 155° F.

When the infant is very small, six to eight grammes (f℥ij) are enough for a meal; larger babies require from ten to fifteen grammes (f℥iiss–f℥iiiss). There should be at least twelve meals every twenty-four hours.

Gavage.—It often happens that the babe will drink badly and throw up half the liquid given. Under this deficient feeding the little sufferer gets rapidly worse, loses weight, and frequently has diarrhœa. In these cases "gavage" should be resorted to. The apparatus is quite simple, being nothing more than a urethral catheter of red rubber (Nos. 14–16 French), at the open end of which a small glass funnel is adjusted. The infant should be placed upon its back on the knee, with its head slightly raised; the catheter, being wetted, is introduced as far as the base of the tongue, whence, by the instinctive efforts at deglutition, it is carried as far down as the œsophagus and into the stomach. The liquid food is next poured into the funnel, and by its weight soon finds its way into the stomach. After a few seconds the catheter must be removed, and here is the great point in the operation: it must be removed with a rapid motion and at once, for if it be withdrawn slowly, all the food introduced will be vomited; at the same time the upper end of the tube must be tightly pinched to prevent any remaining fluid dropping into the pharynx, and after its removal the jaws should be held open for a short time to prevent gagging. The stomach should be washed (lavage) before the first feeding, and subsequently once each day to remove mucus and undigested food if any chance to be present.

The number and quantity of meals thus given must vary with the age and strength of the infant. The quantity varies from f℥ij to f℥ss, but the interval must be longer than in ordinary feeding, three instead of two hours. Mother's milk is the best for gavage, but properly modified milk mixtures may be used if it be impossible to obtain it.

Should the gavage be too copious, the infant gains rapidly in weight and size. This increase, however, is due to œdema, and quickly disappears when a proper quantity of food is administered. When excessive feeding is continued, indiges-

tion soon sets in, and the patient dies of gastritis or enteritis. As soon as the child gains strength this mode of feeding may be alternated with nursing or bottle-feeding, and gradually the breast or the bottle may be entirely substituted for it. Nevertheless, the least digestive disturbance indicates the necessity of a return to gavage.

Even when the child is old enough to nurse or take a bottle, should it be weak, it is useful, besides the regular feedings, to resort to gavage three or four times a day. This M. Tarnier calls *gavage de renfort*, as it keeps up the strength of the infant so that it can take food and digest well.

The absence of the sensation of hunger and of the necessary strength to suck are not contraindications to this mode of feeding; and by it, together with the use of incubators, the actual period of vitality has approached the legal period, which in French law is six months of intra-uterine life.

Lavage.—Of late years stomach washing has been practised in nursing children with good results. The apparatus employed consists of an elastic tube joined to a small glass tube, to the other extremity of which another piece of elastic tubing with a wide opening is adapted. Lavage may be practised a few days after birth without the least danger to the infant. The instrument is inserted while the child is in a sitting position, the trunk and arms being enveloped in napkins and protected by a rubber cloth. The child's mouth is opened by exerting slight pressure upon the chin, while the larynx is slightly pressed inward by the index finger of the right hand. The tube having been previously dipped in warm water is held as a pen, and the smaller extremity slowly introduced, advancing by the simple, repeated act of deglutition. The contact of the tube with the stomach causes contraction of the walls, thereby expelling a quantity of liquid through the tube, the broad end of which is depressed somewhat until the stomach is empty. The best fluid for lavage

is sterile normal salt solution (one drachm of table salt to the pint), at a temperature of 100° F. for ordinary conditions, but increased to 110° F. if there be great gastric irritation; the quantity to be introduced into the stomach at one time should not exceed the normal gastric capacity. The funnel-shaped end of the tube is raised to pour in the water and lowered to expel it. The washing may be repeated two, three, or more times in succession until the liquid returns quite clear.

In addition to its use in gavage, lavage is indicated: (1) In cases of repeated vomiting; (2) in cases where there is an affection of the mouth which is capable of extending to the stomach; (3) in cases of eclampsia caused by indigestible substances; (4) in cases of poisoning.

After the lavage the child should remain perfectly quiet for fifteen or twenty minutes before being fed.

II. Massage in Pediatrics.

Systematic manipulation is of great value both as a means of preserving health and as a scientific method of treating certain diseases in children.

Mere rubbing or friction of the surface cannot be included under massage in its literal sense, still it is a useful form of manipulation, and needs no special instruction, being possible to any intelligent, soft-handed mother or nurse.

Massage, on the contrary, is an art, and like every other art requires study and patient preparation for its successful practice. It is a powerful remedy, too, and, like other agents of its class, as potent for evil as for good in unskilled hands. Therefore, to insure good results, a trained masseuse is necessary—and she must act under the direction of the physician.

Massage includes several processes of manipulation. Those given by Murrell, from whose excellent little work * I have taken much of the description of the different "movements," are *effleurage*, *pétrissage*, *friction*, and *tapotement*.

Effleurage is a stroking movement made with the palm of the hand passing with more or less force over the surface of the body centripetally. The movements are made to follow as nearly as possible the direction of the muscle fibres, and for deep-seated tissues the knuckles can be used instead of the palm. This method is of minor value in itself, but of great use when combined, as is the rule, with the procedures to be described.

Pétrissage consists essentially in picking up a portion of

* "Massage as a Mode of Treatment." W. Murrell.

muscle or other tissue with both hands, or the fingers of one hand, and subjecting it to firm pressure, at the same time rolling it between the fingers and subjacent tissues. The hands must move simultaneously and in opposite directions, the skin must move with the hands to avoid giving pain, and the thumb and fingers must be kept wide apart in order to grasp a bulk of tissue, a whole muscle belly, for instance. The manipulation must be uniform, in a direction from the extremities toward the centre of the body, bearing in mind the arrangement of groups of superficial muscles and keeping well in the interstitia.

Friction, or *massage à frictions*, is performed with the tips of the fingers. It is a pressure movement rather than a rubbing. It is always associated with effleurage, and, to be of any use, must be performed quickly and readily.

Tapotement is a percussion, which may be made with the tips of the fingers, their palmar surfaces, the palm of the hand, the back of the half-closed hand, the ulnar or radial border of the hand, or with the hand flexed so as to contain, when brought in contact with the surface of the body, a cushion of air.

The hand of the masseuse must be perfectly clean and soft, and the fingernails short and smooth. The length and frequency of the sittings must vary with the individual case. Murrell is in favor of short and frequent *séances*, and also recommends *dry* massage—that is, without the use of oil, liniments, or ointments; vaseline especially is to be avoided.

Our knowledge of the physiological action of massage is based upon experimental research and clinical experience. Experiments were made by Dr. Gopadze (quoted by Murrell) upon four medical students, who were kept in hospital and subjected to systematic manipulations for twenty minutes or more daily. The séance began with effleurage, followed by pétrissage, friction, and tapotement, and ending with a second

effleurage. The results were increased appetite and a notable gain in body-weight. The axillary temperature fell, never more than 0.5°, for about thirty minutes after each massage; then it rose steadily, and an hour later was generally a degree higher than at the commencement of the operation. The respiratory movements were uniformly increased in frequency, depth, and fulness. The pulse varied with the kind of "movement" used—light surface effleurage increased its frequency, while pétrissage made it slower.

Zabludowski, experimenting on himself and two servants for eighteen days, noted increased bodily and mental vigor and improved appetite and sleep.

Clinical experience shows that massage increases the activity of the circulation, reddens the skin, and elevates the temperature in the part manipulated. It also increases the electrical contractility of muscular tissue, and stimulates the flow of lymph in the lymphatic vessels. Muscular stiffness and fatigue are relieved, nervous irritability is calmed, and restless and wakeful patients are soothed by it into refreshing sleep.

With these facts at hand, it is not difficult to see what a useful therapeutic agency we possess in skilfully employed massage. By its application we have the power to prevent the atrophy of muscles and to augment muscle tone; to build up such tissues as fat and blood; to improve nerve tone, both directly, by producing a better blood supply, and indirectly, by relieving and giving rest and sleep; and, finally, to hasten the absorption of waste tissue and of morbid effusions. At the same time it must always be remembered that massage is a powerful remedy. A short séance with gentle movements may do good in infantile palsy, for example, but it does not follow that by doubling the time or force twice as much benefit will be derived. In fact, the reverse of the proposition is true; short, gentle massage maintains the size and

tone of the muscles, while long, forcible manipulation causes them to atrophy quickly. The same truth runs through the whole question and must be observed.

Before entering upon the therapeutic application of massage proper, it will be well to revert to the process of simple rubbing, already mentioned. This is of much value as a general hygienic measure. Each day, after the bath, the skin having been thoroughly dried by a soft, warm towel, the whole surface should be gently rubbed with the palm of the hand, the process occupying from five to ten minutes. This increases the capillary circulation, encourages thorough reaction, aids nutrition, and adds vigor to the frame. Weakly children especially thrive under it. In older children friction with a soft towel may be substituted for hand-rubbing, but this change should not be made before the fifth or sixth year.

Sometimes it is well to rub certain portions of the body more thoroughly than others. Thus, in rickets the spine should receive especial attention; in indigestion and constipation, the abdomen; in weak ankles, the feet and legs, etc.; though even in these cases the general surface must receive a share.

Massage may be employed with advantage in the following diseases of childhood:

(*a*) Chronic gastro-intestinal catarrh. In this condition the skin is harsh, and often so dry that a shower of epidermic scales falls on the removal of the underclothing; the muscle tone is faulty, general nutrition is impaired, and there is a determination of blood from the surface toward the mucous membranes. To get the skin active, and in this way balance the circulation, is an important step in the reestablishment of normal digestion, secretion, and excretion, the essentials of perfect nutrition. To accomplish this, a full, warm bath is administered every evening, just before bedtime, the patient

remaining in the water for five minutes. Then the surface is thoroughly dried and warm olive oil is gently rubbed into the skin for fifteen minutes, the child enveloped in a light blanket and put to bed. After a little time diaphoresis begins. So soon as the sweating is free, the skin is again dried and the night-dress put on in preparation for sleep. Next morning, at some convenient time after breakfast, the child is subjected to twenty minutes' massage (pétrissage with effleurage). The inunctions are continued until the skin becomes soft and active, and massage is employed daily until there is a decided improvement in the amount of flesh and general strength, a period generally of two or three weeks. Afterward "movements" every third day will be sufficient to complete the cure.

In these cases massage not only aids the baths and inunctions in their general action, but directly and powerfully increases nutrition and muscle tone, and materially hastens an otherwise slow process of recovery.

(*b*) Constipation. Manipulation is a very efficient remedy in habitual constipation, and there are many cases that can be cured by it, combined with a properly regulated diet, without the use of drugs. Pétrissage of the colon is the best method, instructions being given to follow the natural course of the fæces through this portion of the gut; thus, beginning in the right iliac region, to proceed upward to the right hypochondrium, to cross over to the left hypochondrium, and then downward to the left iliac region. In this way the ascending, transverse and descending colon are manipulated in order.

Five or ten minutes every morning, or every morning and evening in obstinate cases, constitute the proper duration and frequency of the applications. The pressure must be gentle, as delicate tissues are being dealt with.

In this condition I have not found the *dry* method so efficient as the combination of massage with the inunction of

warm olive oil or a weak ammonia liniment. The addition of aloes to the liniment, a plan recommended by some authors, has never been necessary in my experience.

Sometimes tapotement with the flat hand, with the hand partly closed, forming a cushion, or with the margin of the hand, is necessary, but the course of the colon must always be followed. The therapeutic action of this mode of treatment is, undoubtedly, threefold: it increases the intestinal and other secretions; it increases the peristaltic action of the intestinal fibres; and it mechanically forces accumulated fæcal matter toward the rectum.

(*c*) Colic. Every experienced mother knows how often flatus, the cause of colicky pain, is expelled from the stomach or intestines by gently rubbing the abdomen with the hand. Any approach to scientific manipulation is much more efficient, and two or three minutes' effleurage may be resorted to, as the urgency of the symptoms requires, with the most satisfactory effect. In this connection it must be remembered, also, that rubbing of the feet to increase the circulation is an important aid in relieving colic.

(*d*) General debility and anæmia. These conditions are much benefited by short, frequently repeated courses of massage. In the convalescence from many diseases, both acute and chronic, in which these states exist, manipulation improves general nutrition, and strength is rapidly gained.

(*e*) Infantile paralysis. Here massage of the paralyzed muscles brings more blood into them and maintains their nutrition until, in favorable cases, new cells in the cord take on the function of those which have been destroyed.

In essential paralysis the affected members are always cold, and the muscles contract feebly, if at all, under the influence of electricity. By systematic massage—pétrissage combined with effleurage, and both performed centripetally—an improvement takes place with more or less rapidity. The first

indication of this is an increase in the temperature of the parts, continuing for several hours after the rubbing. Then the electrical contractility of the muscles begins to return, and they respond to a current that at the commencement is entirely inoperative.

In recent cases the sittings should be of short duration and frequently repeated—five or ten minutes, three or four times daily. As improvement advances, the frequency may be reduced, and in chronic cases twice a day will be sufficient at any time.

Electricity is of great aid in the treatment, but it does not take the place of massage, for while it causes contraction and congestion of the muscles and hyperæmia of the skin, it does not have the same power of arresting rapid wasting. The constant current is to be employed. In the beginning the current must be mild, so as not to produce pain or emotional excitement, and often it is well to apply the sponges without current for several sittings, to accustom the little patient to the novelty of the procedure without producing any sensation. The treatment may be begun about three weeks after the onset of the paralysis, earlier applications being attended by the risk of increasing spinal congestion.

Well wetted, large sponges should be used. The positive pole is kept stationary and placed close to the sacrum or lower part of the back when the legs are to be galvanized, or to the back of the neck in case the arms are the affected members. The negative pole is slowly moved up and down over the surface of the paralyzed limb, thus making and breaking the circuit gradually and without pain. The muscles that do not contract to faradism are the ones to be influenced by galvanism ; in other parts hyperæmia of the muscles and skin only is required.

Three or four electrical sittings a week are sufficient. They should be short at first, ten to fifteen minutes, and gradually

increased in duration and force as tone and contractility return, care being taken never to overfatigue the muscles.

(*f*) Chorea. So far as this branch of the management of chorea is concerned, it requires to be aided by proper diet and rest in bed. On the onset of an acute attack the patient is put to bed, given a full supply of good food, and allowed to rest for two days without massage. Should the choreic movements be very violent, the sides of the bed are padded to prevent the child bruising himself, or, if too violent for this, to give security, he is slung in a hammock.

At the end of this time the regular treatment is initiated. The plan, a slight modification of that recommended by Goodhart, is as follows:

The child—at seven years of age, for example—has at 5.30 A. M., a breakfast-cupful (f℥viij) of warm milk; 7 A. M., a breakfast-cupful (f℥viij) of warm milk, three slices (1 oz. each) of bread, buttered; 9 A. M., 2 to 4 tablespoonfuls (f℥j–ij) of a good liquid extract of malt; 10 A. M., massage for fifteen minutes, after which a teacupful (f℥vj) of warm milk; 12.30 P. M., dinner of well-cooked fresh vegetables, bread, a breakfast-cupful (f℥viij) of milk, with rice or other light pudding; 4.15 P. M., same as 7 A. M., with a soft-boiled egg; 7 P. M., extract of malt, as at 9 A. M.; 7.30 P. M., massage, followed by a teacupful (f℥vj) of warm milk. At the end of ten days or a fortnight, increase the amount of bread to four slices, add a lamb chop or a bit of chicken at dinner (12.30 P. M.), and increase portions of milk so that an extra pint is taken through the day. Time of massage is also to be extended to thirty minutes.

After two or three weeks the patient may be allowed to sit up in bed, well supported by pillows, and may have a few toys to play with. It is a golden rule, however, never to hurry a patient with chorea out of bed. The muscular strength is more quickly recovered while at perfect rest, and

too early exertion often causes a relapse. While carrying out this plan Goodhart employs no medicines, but in my experience recovery has been more rapid under the conjoint use of Fowler's solution, administered in daily increasing doses.

(*g*) Other nervous diseases in which massage is employed with success are pseudo-hypertrophic paralysis; facial paralysis; neurasthenia and spinal irritability occurring in girls about the approach of puberty.

(*h*) Pleuritic effusions (serous); fibroid pleurisy; enlarged lymphatic glands; stiffened rheumatic joints, and that ill-defined rheumatic condition so often encountered in young subjects, and known as "growing pains," are all benefited by rubbing. In these special instances the manipulations are generally combined with the use of embrocations, though the curative effects cannot be attributed to the latter alone.

In concluding the subject of massage in childhood, it is a point of importance to mention that those cases in which the manipulation is immediately followed by a sensation of comfort or by a refreshing sleep are most benefited by it. On the contrary, those cases that are rendered wakeful and irritable derive little benefit, and perhaps positive injury, from rubbing. This I have especially noted in cases of general debility and anæmia, and my own experience has been confirmed by practical observers in whose judgment one must have confidence.

PART I.

DISEASES PRODUCED BY IMPROPER FOOD AND IMPERFECT NUTRITION.

CHAPTER I.

SIMPLE ATROPHY.

Simple atrophy, or the slow wasting commonly termed "marasmus," is a familiar occurrence in hand-fed babies, and one of the most frequent causes of death in early infancy. It is a condition in which there is extreme wasting of the soft tissues of the body, either without special organic lesions or with catarrhal inflammation of the mucous membrane of the gastro-intestinal canal.

Etiology.—Wasting usually occurs during the first twelve months of life, though it may begin in the second year, and is most frequently encountered among children of the poor. It arises both in breast-fed babies and in those brought up by hand, being in either case due to insufficient nourishment. The child wastes because he is starved.

Food can be insufficient in two ways: first, when it is supplied in amounts too limited to meet the demands of the system; and, second, when it contains a minimum of the elements essential to nutrition or presents them in a form ill adapted to the feeble digestive powers of infancy. For example, nursing infants waste in consequence of feeding either from a breast that yields too little good milk, or from one that secretes abundantly a poor, watery fluid entirely unfit for

nourishment. With artificially fed children, on the other hand, it rarely happens that the quantity of food is too small; the fault lies, rather, in the direction of quality. Undiluted cows' milk, milk thickened with starchy materials, farinaceous foods, and even table food—meat, vegetables, and bread—are given to babies a few weeks or months old. Now, all these are highly nutritious, but the digestive apparatus is not sufficiently developed to prepare them for absorption. They are strong foods, adapted to nourish and strengthen much older children and adults; but as the infant cannot assimilate them, he starves no less surely, if more slowly, than when taking no food at all. Such aliment, also, while remaining undigested in the stomach and intestines, undergoes fermentation, with the formation of irritant products, causing vomiting or diarrhœa—conditions that still further lower the vital powers and hasten atrophy.

It is often possible to trace the disease directly to want of cleanliness in the feeding apparatus, and especially to the use of a form of bottle that has until lately been very popular in this country. This bottle has, in place of a plain gum tip, an arrangement of glass and rubber tubing of small calibre. One extremity of the rubber tubing, which is eight or nine inches long, terminates in a small nipple-shaped tip and bone shield; the other, often penetrating an ornamental rubber cork, is fitted to a bit of glass tubing long enough to extend quite to the bottom of the bottle. By this plan the trouble of holding the bottle and keeping it at a proper angle during feeding is avoided. This seeming advantage, though, is counterbalanced both by the minor drawback that the child, left to itself, is apt to continue suction long after the bottle is exhausted, thus swallowing a quantity of air, and by the greater disadvantage that the tubing can never be kept clean.

For a number of years the author made it a rule to ask for the bottle of every hand-fed infant presented for treatment, and

few days passed without his seeing several of the complicated contrivances referred to. In almost every instance, notwithstanding the most careful and frequent cleansing, a sour odor could be detected; and if milk were present, it contained numerous small curds; while in cases of carelessness the odor was intolerable, and the interior of the tubing was incrusted with a layer of altered curd. With simple bottles and tips, on the contrary, alterations in the character of the milk and coating of the interior of the tips were very infrequent. As there is little difficulty in keeping the bottles themselves clean, there can be only one reason for this difference: namely, in the simple instrument the nipple is readily removed and as easily inverted and cleaned, but in the other there is no way of cleaning thoroughly the twelve or more inches of fine tubing. The latter cannot be inverted, and the passage of a stream of water or of a stiff brush only imperfectly removes the milk clinging to the interior. This, of course, soon undergoes decomposition, and in this state quickly inaugurates change in the next supply of milk placed in the bottle. It is evident that a constant supply of food, no matter how good originally, thus rendered acid and partially curdled, and contaminated by bacteria, must, like an excess of farinaceous or other unsuitable food, produce irritation of the alimentary canal, interfere with the process of nutrition, and lead to a state in which the features of wasting and disordered digestion are combined.

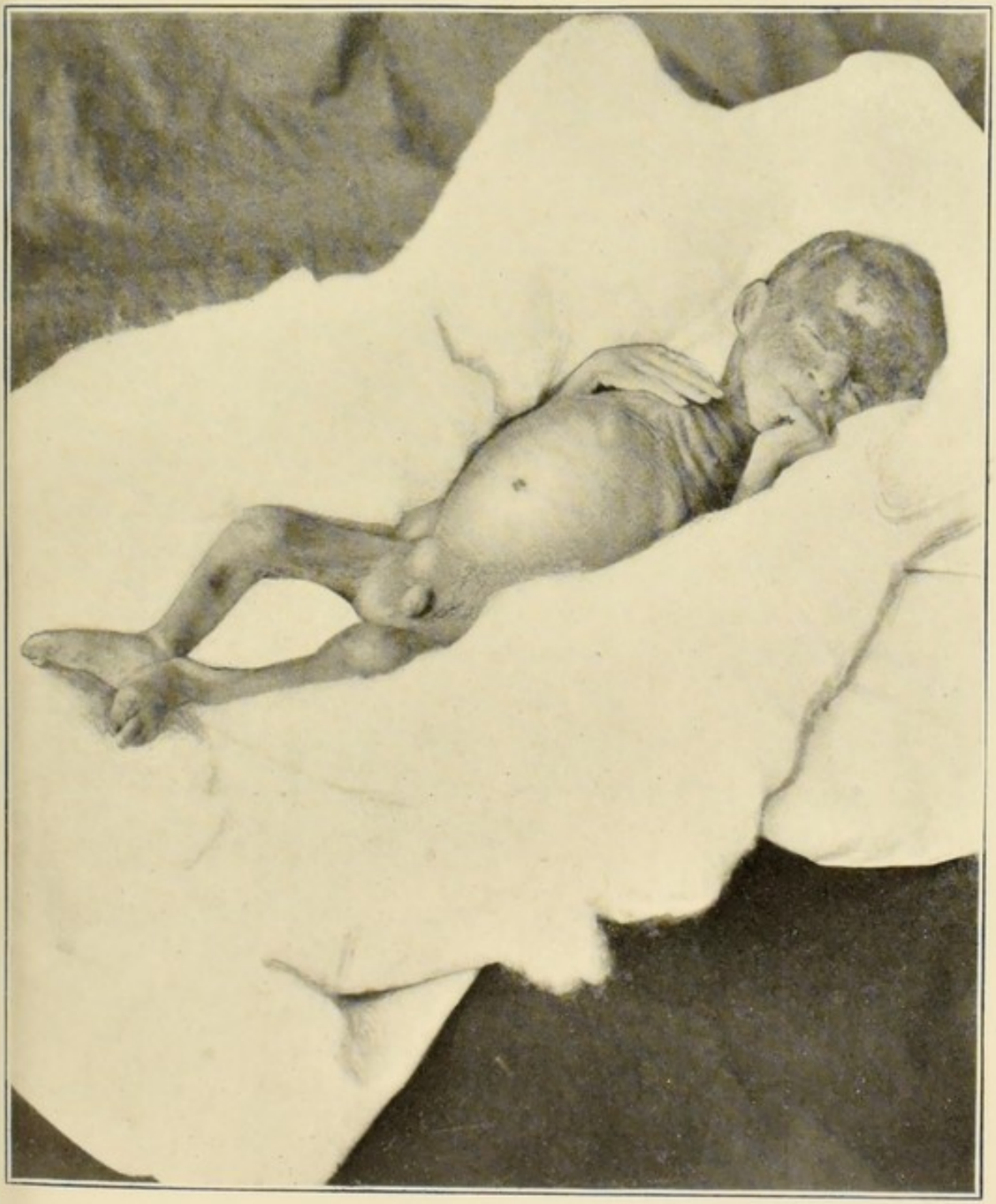
The custom of preparing in the morning, without Pasteurization, a supply of food sufficient for the whole day is another fruitful cause of atrophy. If this be done, no matter how carefully the mixture be proportioned or how well adapted to the age and digestion of the child, it becomes unfit for consumption after standing eight or ten hours. The change may or may not be appreciable to the senses, but test-paper will always show acidity and the microscope demonstrate the existence of actively moving bacteria.

Again, food upon which a child has thriven for three or four months, perhaps, can become unsuitable, and consequently lead to wasting, if the digestive powers be suddenly reduced by an intercurrent disease.

Wasting, while it is less serious in babies suckled at the breast, frequently occurs in a modified form under these circumstances. For this there are several causal factors. Thus, an infant may be given to a wet-nurse whose own baby is much older than her foster-child. In this case the milk is usually unsuitable, and the nursling, unable to digest and assimilate it, ceases to thrive, and may suffer from indigestion or diarrhœa. Human milk is also affected by dietetic and emotional influences, and, altering with the state of the general health of the mother, may deteriorate in quality or otherwise become unfit for food. Finally, it happens at times that, although the mother may be healthy and have an abundant breast, and although the infant may be robust, yet it does not thrive on the milk supplied. Here the fault is generally an overrichness in either casein or fats. While noting these facts, it must be remembered that in many cases of wasting in nursing infants the fault is not with the mother's milk, but with the child, an attack of catarrh having temporarily impaired the process of digestion. Without care and proper management this derangement may be prolonged, and not infrequently leads to unnecessary weaning.

Morbid Anatomy.—After death the muscular and other tissues are found in a state of atrophy, and there is a total disappearance of normal fat from the body. Fatty degeneration of the kidneys, lungs, and brain may be discovered; the stomach is sometimes ulcerated, and hemorrhagic effusions into the cranium are not uncommon.

Symptoms.—The clinical features differ materially according to whether the element of insufficiency be one of quantity or quality. They may, therefore, be divided into two classes:



SIMPLE ATROPHY. AGE, THREE MONTHS.

Weight at birth, 4 pounds ; weight at three months 3½ pounds. Fed on a mixture of cane-sugar and water.

viz., those developed by food that is suitable, but not sufficient, and those resulting from unsuitable food.

The first group of symptoms is most frequently encountered in children who have been nursed at the breasts of feeble or overworked mothers, in whom the milk is often both scanty and of poor quality. There is a gradual loss of plumpness, the muscles grow flaccid, and there seems to be an arrest of growth. The face is white, the lips pale and thin, the skin harsh and dry or too moist, and the anterior fontanelle level or slightly depressed. The temper is irritable and sleep restless and disturbed; or the child is abnormally quiet, dozing constantly, and sucking his fingers until they become raw. When nursed, the child will seize the nipple ravenously; then, if there be little milk, he quickly drops it to cry passionately, as if disappointed at not being able to satisfy his hunger; but if the milk be abundant, though poor, he will lie a long time quietly at the breast, and often fall asleep with the nipple in his mouth. The bowels are inclined to constipation, the stools being scanty, hard, and dry. Physical signs connected with the chest and abdomen are negative, and no indication of disease of any special organ of the body can be detected.

In the second class, features of wasting are associated with those of irritation of the alimentary canal, and the symptoms altogether are much more grave than in cases of the preceding group. The subjects are almost invariably hand-fed infants. Emaciation progresses with a rapidity and to an extent depending upon the original strength of the child's constitution, the age at which artificial feeding was begun, and the sort of food employed. It is often so extreme that an infant several months old weighs less and appears smaller than at birth, and this even after a large quantity of food, such as it is, has been consumed. The combination of great wasting with a voracious appetite is very striking, and is only apparently contradictory, since hunger—the demand of the

tissues for reparative material—cannot be appeased by food which, from its bad quality, is incapable of digestion or proper preparation for absorption and assimilation. Unsuitable food, too, by irritating the mucous membrane of the stomach, creates a fictitious appetite.

Sooner or later the face becomes pinched, the eyes sunken; the lips are pale, and when moved display a deep furrow about the angles of the mouth; the facial expression is uneasy or languid, and the anterior fontanelle is deeply depressed. The skin, generally, is dry, harsh, and yellowish, hangs in loose folds over the bones, and may be mottled by an eruption of strophulus or urticaria, or present red patches of intertrigo in the neighborhood of the genitalia and over the buttocks and inner surface of the thighs. The extremities are cold and the hands claw-like. The tongue is heavily furred or red and dry, and, with the mucous membrane of the mouth, may be the seat of aphthous ulceration or thrush deposit. As already stated, the appetite is often ravenous, and the cries of hunger are violent, oft repeated, and only temporarily silenced by food; thirst is increased; colic is common; the bowels are constipated, and the stools, which are voided with difficulty and straining, are composed of a few light-colored, cheesy lumps partly covered with greenish mucus.

Attacks of acute vomiting and diarrhœa often interrupt the regular course of the disease. At such times there is moderate fever during the night, though ordinarily the temperature is subnormal. Again, chronic vomiting and chronic diarrhœa are apt to arise as complications, and greatly increase the danger of a fatal termination.

Sleep is restless and disturbed, and many hours, particularly during the night, are spent in fretful crying. A common group of symptoms connected with the nervous system is a partial convulsive seizure, termed by the laity "inward spasms." When these occur, the upper lip becomes livid,

somewhat everted, and tremulous; the eyeballs rotate or there is a slight squint, and the fingers and toes are strongly flexed. They frequently usher in true convulsions.

Sometimes the nervous manifestations are much more complex. Thus, I have seen cases where there was retraction of the head, boring of the head into the pillow, an approximation to the "gun-hammer" decubitus, general hyperæsthesia, and the tache cérébrale—all suggestive of tuberculous meningitis. Such symptoms—spurious hydrocephalus—disappear under an appropriate diet with proper medicinal treatment, and are to be referred to an intensely excitable nervous system—a condition depending upon insufficient nourishment, and differing merely in degree from that leading to the partial convulsions.

There is, of course, extreme prostration, the cardiac action is weak, and the respiration shallow. The urine is citron-colored or very dark yellow, has a specific gravity of 1.009 to 1.0125, a strong, characteristic odor, and is diminished in quantity. It is always cloudy or milky, becoming clear only on the approach of recovery. The sediment deposited on standing contains certain variously shaped cylinders, fatty elements with tinted nuclei, mucus, colored uric acid, urates in a crystallized or amorphous condition, pigment, etc. The reaction is sometimes highly acid. The proportion of urates is decidedly, that of uric acid notably, and of coloring-matter and extractives somewhat, increased. Albumin is always present in variable quantity, and sugar also may be frequently detected.

Death may be preceded by convulsions or the symptoms of spurious hydrocephalus, or may result from prostration.

Diagnosis.—Great emaciation may result from inherited syphilis or acute tuberculosis, but both these conditions are attended by characteristic symptoms, rendering their diagnosis a matter of little difficulty. In inherited syphilis the

child snuffles and cries hoarsely. The skin is dry, wrinkled, old-parchment-colored, and mottled with coppery or rust-colored spots. Often the buttocks, perineum, genitalia, and upper portion of the thighs are the color of the lean of ham. Mucous patches are present at the margins of the anus and of the lips. The corners of the mouth are fissured, the nostrils red and excoriated, and the bridge of the nose is flattened. Enlargement of the spleen can frequently be detected on abdominal palpation.

In acute tuberculosis there is fever, the rectal temperature reaching 100° to 101° F. in the evening; cough with irregularly distributed râles, and usually slight œdema of the legs.

When symptoms resembling those of tuberculous meningitis are present, it is often necessary to delay a definite opinion. In simple atrophy, however, the open fontanelle is level or depressed; the belly is never scaphoid; the bowels, though frequently constipated, are never locked; vomiting is apt to be associated with diarrhœa; the respiration and pulse are regular in rhythm; the temperature, as a rule, is subnormal; there is no hydrencephalic cry; and the antecedent history and the course are different from the tuberculous disease.

Prognosis.—A vast number of cases die annually in our large cities, yet the results of appropriate management are often rapidly and surprisingly successful. Patients should never be given up unless there be extreme wasting and prostration, or unless the symptoms of spurious hydrocephalus arise, convulsions occur, or obstinate chronic vomiting or diarrhœa be developed.

Treatment.—For the arrest of wasting from insufficient nourishment, the first and main thing to be attended to is the diet. Without entering at length into this subject,* it may be stated, as a uniform rule, that in selecting a diet the object

* For the details of diet and general management, see Introduction.

should be to fix upon one suited to the age and digestive powers of the child, so that he may be able to digest, and, therefore, be nourished by, all the food consumed.

Generally, infants under twelve months who have to be either partially or entirely "brought up by hand" do well upon cows' milk, diluted with lime water or with barley water. Often it is well to Pasteurize the milk, or—a method which has been most uniformly successful in my hands—to add to the milk mixture peptogenic milk powder, and predigest at a temperature of 115° F. for six minutes. The food should be administered from a bottle capable of holding half a pint, made of colorless glass, so that the least particle of dirt can be seen, and provided with a soft india-rubber tip. Unless Pasteurized, the whole quantity of food intended to be given in a day should never be prepared at once, but each portion must be made separately at the time of administration. Thus, a bottle of the sort described, absolutely clean, may be filled with a mixture of one part of lime water to two or three of sound milk, or with one part of barley water to two or three of milk, to either of which may be added from one to two tablespoonfuls of cream and a teaspoonful of pure sugar of milk. The bottle must next be placed in hot water until the contents become warm, when it is ready for the child.

The degree of dilution of the milk and the proportion of cream added vary with the age and the feebleness of digestion, but it is upon the latter that we must chiefly base the composition of the food. Lime water is the preferable diluent when there is frequent vomiting or acid eructation. Both it and barley water are of service in preventing the formation of large, compact curds—an object that is even better accomplished by peptogenic milk powder, and by the process of partial predigestion. In some cases it may be necessary to discontinue milk foods entirely, putting the child temporarily upon weak broths or raw-beef juice.

After digestion has been brought into good condition, the food may be cautiously increased to a standard suitable for a healthy child of the same age.

Once daily the patient should be bathed in warm water, or at least sponged over with warm water, and every morning and evening warm olive oil or cod-liver oil should be rubbed, for five to ten minutes, into the skin over the abdomen and chest. At the same time the belly must be completely covered with a soft flannel binder, and the feet and surface generally kept warm by woolen clothing. In this way attacks of colic, if not entirely prevented, are rendered much less frequent and severe.

If there be intertrigo, cleanliness and the free use of oxide-of-zinc ointment usually suffice to effect a cure.

Of medicines, bicarbonate of sodium, pepsin, pancreatin, nux vomica, and cod-liver oil are perhaps the most useful. Cod-liver oil should not be given until the digestive powers have been brought into a comparatively normal state by proper food, antacids, and digestants, and the general tone increased by tincture of nux vomica. The oil is most easily borne when given in emulsion, and may be advantageously combined with lacto-phosphate of lime or with the hypophosphites.

Such symptoms as constipation, diarrhœa, and vomiting demand, of course, appropriate treatment.

CHAPTER II.

SCORBUTUS.

Infantile scurvy is a constitutional disease occurring usually before the end of the second year, depending upon continued faulty feeding, and presenting a well-defined complex of symptoms. The characteristic features are: First, immobility, progressing to pseudoparalysis; intense hyperæsthesia; and general swelling, situated most frequently in the legs, but not limited to these members; the investing skin is shiny and tense, but there is neither œdema nor local heat, and subsidence of the general swelling reveals deep fusiform thickening about the shafts of the long bones in the neighborhood of the joints. In extreme cases there is a tendency to fracture near the epiphysis. Second, the gums about erupted teeth are swollen and purple in color and, in marked cases, become spongy and readily bleed. Third, a rapid disappearance of all symptoms upon the institution of a proper, antiscorbutic diet.

Etiology.—Scurvy shows no preference for sex, occurs at any season, in any climate or locality, amidst the best or worst hygienic surroundings, and in every class, though wealth furnishes by far the larger number of cases. In the majority of instances the disease develops between the age of six months and the end of the second year, though this limit is by no means a fixed one; it is closely confined to artificially fed infants, there being but two recorded cases in nurslings.

The direct causal factor is the continued use of food that lacks some essential nutritive elements or presents them in a

form not readily assimilable. An analysis of the reported cases shows that the patients have received a great variety of foods, and, if the few instances in which the only traceable cause is simple poverty in diet be eliminated, the sole factor that is uniformly present is the absence of the quality of *freshness*,—the food is not "live." To put the whole question in a few words, the cause of scurvy in infants is the *continued deprivation of fresh food.*

The faulty foods may be classed in the order of their potency:

First, the different proprietary infants' foods administered without the addition of cows' milk. These foods are responsible for the greatest number of cases, and which variety most readily induces the disease depends chiefly upon the extent of employment or the fashion at the time.

Second, proprietary foods employed with the addition of insufficient quantities of cows' milk.

Third, oatmeal or wheat gruel, barley and other farinaceæ, administered with water alone, or with water and insufficient cows' milk.

Fourth, condensed milk and water.

Fifth, sterilized milk. Properly modified milk mixtures subjected to a temperature of 212° F. from thirty minutes to an hour or more.

Sixth, too dilute milk and cream mixtures. Laboratory mixtures with too low albuminoid percentage.

Consideration of these groups furnishes an explanation of the greater frequency of scurvy in infants reared in luxury than in the very poor. The proprietary foods, being expensive, are little used by the latter class; the processes of modifying and sterilizing cows' milk are troublesome and require too much thought and time, and the cares of housework and bread-winning prevent regular and accurate artificial feeding. In consequence the child of poverty is fed upon milk either

diluted or pure, as the chance may be, and, if this be not at hand, upon tea, potatoes, bits of bread, or other table food—a bad diet, and one which often leads to rickets or dangerous gastro-intestinal disorders, but which is too varied and "live" to produce scurvy.

The variations in the diet usually made at the end of the second year also explain the infrequency of the development of the disease after this age.

The essential cause of scurvy is unknown, but it is certain that it is some peculiar deprivation, and that the needed elements are present in fresh milk and the juice of fresh, ripe fruits.

Pathological Anatomy.—Very few postmortem examinations are on record; in fact, since infantile scurvy has been recognized as a distinct condition, and its treatment established, a favorable outcome is to be expected in the vast majority of instances. Of twenty-six cases that have come under my own observation during the past ten years, but one terminated fatally. This, my second diagnosed case, occurred in 1891.

The patient, a boy fifteen months old, had been ill nearly four months before I was consulted, and was so far reduced in flesh and general strength, was so anæmic, and had such grave intestinal complications, that all efforts at treatment were unsuccessful. After death the body showed extreme emaciation, the skin was inelastic, pale, and presented numerous ecchymotic spots of varying size. The gums about the eight incisor teeth that had been cut were deep purple in color, very much swollen and spongy, and covered with blood. Both legs were much swollen above the ankle joints, the right to the greater extent. On section, the lower third of the right tibia was found to be surrounded beneath the periosteum by a thick mass of dark, grumous blood; the lower epiphysis was detached and the distal end of the shaft, macerated and eroded, lay free in the disintegrating blood clot. The lower

third of the left tibia was surrounded by a similar, though less extensive, subperiosteal blood effusion; it was not fractured. The fibulæ, femora, and bones of the upper extremities were normal.

The intestines contained blood and blood-stained mucus, and the mucous membrane was thickened and studded, especially in the colon, with follicular ulcers.

Microscopic examination of the bone and periosteum showed no lesion beyond the mechanical one at the seat of fracture, and the same was true of sections from the liver, spleen, and kidneys, and of the blood.

These findings correspond very closely to those detailed by Barlow and Northrup, and the anatomical lesions of the disease may be briefly stated to be chiefly due to hemorrhage, the most characteristic being the subperiosteal blood effusions about the shafts of the femora and tibiæ, sometimes of the long bones of the arms, and occasionally those of the cranium and thorax.

Bleeding may also occur into the subcutaneous tissue (ecchymosis), and from the nose, stomach, bowels, and bladder.

J. J. Thomas * asserts that the kidneys are frequently involved in infantile scurvy, and attributes the lesion, catarrhal nephritis, to the presence of an irritant in the blood, which, by its effects upon the walls of the renal vessels, produces hemorrhages. While this is a condition one would naturally expect, it was absent in my single fatal case, and in none of the others was either albumin or blood present in the urine during the course of the disease.

Symptoms.—The scorbutic condition is produced gradually after weeks or months of improper feeding; there may be slowly increasing evidences of impaired nutrition before the characteristic symptoms appear, but usually these sud-

* "Boston Med. and Surg. Jour.," Sept. 3, 1896.

denly interrupt a state of apparent health. It is first noted that the infant is content only when perfectly quiescent; that he screams when lifted in the nurse's arms, or that he ceases to creep or walk. Soon it becomes evident that crying is produced most readily by movements involving the legs, and that either one or both limbs are held fixed, the thigh being drawn up toward the abdomen, the leg flexed and the foot drooped. Next swelling appears above the knee or ankle joints, and immobility and tenderness increase; the latter to such an extent that the patient stops crying only while lying undisturbed on a pillow. Then the gums about any teeth that may be cut become purple in color; in the beginning there is merely a narrow line of this discoloration, but it rapidly extends; the gum swells, grows spongy, and bleeds at the lightest touch. With these special symptoms there is moderate general debility and loss of flesh, restless sleep, impaired appetite, a tendency to constipation, a diminished flow of high-colored, lateritious urine, and in some cases moderate elevation of temperature, though absence of fever is the rule.

Without treatment, or when badly managed, the disease runs a chronic course, and the symptoms slowly but steadily increase in gravity, until emaciation becomes extreme, petechial spots appear on the surface, the swollen gums overlap the teeth, and there is a constant oozing of blood. The immobility, hyperæsthesia, and swelling affect the arms as well as the legs, epiphyseal separations may take place, and the child, irritable and prostrated, lies passive upon the bed, dreading the slightest attempts at movement or even the approach of its nurse.

These symptoms deserve a more detailed consideration, in the order of their development.

Hyperæsthesia is almost invariably the initial symptom; it appears in and may be limited to one leg, but often involves both. The infant first exhibits sensation of pain by changes

in facial expression or by crying when the affected member is moved in changing the napkin or in arranging the stockings and dress. If the child be old enough to creep, stand, or walk, it excites the mother's suspicion that something is wrong, by suddenly becoming inactive, and by lamentations when induced to attempt previously enjoyed use of the legs. The tenderness increases steadily in degree, and, if primarily seated in one limb, extends to its fellow, and, in severe, long-standing cases, to one or both arms; the little patient becomes helpless, suffers agony during the trifling movements necessary in making the toilet, and even anticipates pain and screams on the approach of the most gentle attendant. The characteristic of the pain is its production solely by movements of the parts involved, and, if the element of dread can be eliminated, moderately firm pressure upon or friction of the surface is readily borne.

Immobility is the natural sequence of hyperæsthesia, develops almost simultaneously, and with it increases in degree and extent. The decubitus is quite typical; the infant lies on its side with the trunk thrown a little forward, the thigh drawn half-way up to the abdomen, the leg semi-flexed, and the foot drooped. When long maintained, this posture produces slight œdema of the dorsum of the foot; this is not sufficient to show pitting on pressure, though the skin looks puffy and is shiny. When the upper extremities are affected, the forearm is semi-flexed and rests on the trunk. This posture is maintained for hours, with no attempt at movement and no complaint while undisturbed.

The immobility is not paralytic in character, and if, despite the suffering produced, the limbs be manipulated, the joints are always found to be readily movable and free from stiffness.

Swelling of the soft tissues about the bones is a common feature; it varies in degree, though never very marked, and

is quite distributed, spreading over the area of the bone affected; thus, when the femur is involved the tumefaction extends from the knee nearly to the hip-joint; when the tibia, from the ankle nearly to the knee; if the arm bones are affected, swelling, while present, is less noticeable. The swelling is greatest over the distal end of the bones. It never involves the joint.

Any pressure that does not move the limb is painless, there is no pitting, the skin is normal in color, and there is no increased local heat.

As the case progresses the tumefaction subsides to a certain extent, tends to become limited to the lower third of the bone, and, beneath it, deep pressure reveals a firm fusiform enlargement of the shaft; this is due to subperiosteal hemorrhage, and varies greatly in extent in different cases.

Lesions of the gums are observed only in cases in which one or more teeth have been cut; they appear early, but often escape attention until sufficiently far advanced for hemorrhage to take place. Primarily the gum margin about the necks of the teeth becomes deep red in color and slightly swollen; soon the color changes to deep purple, the area of discoloration extends, the swelling increases, and ultimately the whole alveolar mucous membrane in the neighborhood of erupted teeth becomes ecchymotic; the swelling is so extreme that the thickened gum margin overlaps the teeth; the tissue is spongy, and hemorrhage is produced by the lightest touch or takes place spontaneously, blood constantly oozing in small quantities. Rarely sloughing occurs; and occasionally, when the gum lesions are very marked, the teeth are temporarily loosened in their sockets; they should be maintained in position, if possible, however, since they become firmly set again as the patient recovers.

The general features are very diverse in degree of prominence. Often, when the scurvy is mild in grade, the infant

is seemingly so well nourished and in such apparent health that the parents are surprised at the sudden development of local symptoms. Usually, however, even in these cases, the trained observer is able to detect evidences of malnutrition in the slight anæmia and muscle flabbiness.

In well-marked instances there is emaciation ; dry, pale, or sallow skin ; debility, indicated by an irritable weak pulse and loss of muscle tone ; the tongue is lightly coated, the appetite capricious, and the bowels tend to constipation, the evacuations being rather scanty and clay-colored, showing deficient biliary secretion. Occasionally there is diarrhœa with greenish, mucoid discharges, and at times the fæces contain blood. There may be more active indications of gastric indigestion, and very frequently there is an antecedent history of great difficulty in feeding on account of proneness to gastro-intestinal disturbance.

Fever is not a symptom of scurvy, and, when present, is due to some accidental complication, as intercurrent acute intestinal catarrh. Under these circumstances the temperature is generally but moderately elevated, the thermometer ranging from a little above normal to 100° or 101° F.

The urine is diminished in quantity, high-colored, often laden with urates, and increased in gravity. It has been asserted that albumin is frequently present and that the evidences of nephritis have been observed, but this is not borne out by my own experience. In grave cases there may be hæmaturia.

Hemorrhage is a late feature, appearing after prostration is advanced and the blood crasis has deteriorated. It takes place first in the subcutaneous areolar tissue, especially in dependent parts of the body, and beneath the mucous membrane of the mouth. The ecchymotic spots are deep purple in color and range in size from that of a pin's head to patches one-fourth of an inch or more in diameter.

Bleeding from the gums has been already mentioned, and is an earlier symptom than subcutaneous ecchymosis. Later, epistaxis and hæmaturia may be observed, and, much more frequently, hemorrhage from the bowels, the leakage either merely staining the discharges from the rectum, or appearing as pure, though dark-colored and altered blood. The loss of blood directly increases the cachectic condition noted in severe cases, and, if at all profuse, plays an important part in exhausting the vitality in fatal cases.

Fracture of the femur, tibia, or humerus is a late symptom, and shows an extremely grave type of affection. Separation at the lower third of the tibia existed in my single fatal case, and I know of no instance of recovery after its occurrence. In fact, it is doubtful if reunion of the soft, macerated, and eroded lower end of the shaft of the bone with its epiphysis could be accomplished, even granting the possibility of the infant's recovery from the condition of extreme prostration and malnutrition that is invariably present before fracture takes place.

The bone lesion gives rise to characteristic deformity; when the femur is involved, there is a distinct downward bend in the thigh, situated a short distance above the knee joint, and due to weight traction of the part of the limb below the seat of separation; with the tibia the same bending is observed above the ankle joint, but it is less in degree, because the fibula acts as a partial splint and the depressing weight is not so great. Palpation does not yield crepitation, and it is difficult to feel the end of the bone through the surrounding soft tissues and the mass of extravasated blood.

Diagnosis.—As the greater number of scurvy cases are quite typical, the diagnosis is usually attended with little difficulty.

The distinguishing features are: The development in infants from six months to two years old—after the prolonged

use of unsuitable food—of extreme hyperæsthesia and immobility of the limbs; swelling of the thigh above the knee joint and of the leg above the ankle joint; fusiform enlargement of the lower third of the shaft of the femur and tibia; deep purple discoloration (ecchymosis), swelling, and sponginess of, and hemorrhage from, the gums surrounding erupted teeth; general cachexia and anæmia; and, finally,—the test feature,—rapid disappearance of symptoms and complete recovery following the adoption of an antiscorbutic diet, and —the negative symptom—non-involvement of the joints.

The pain produced by movement and the immobility of the limbs are responsible for most of the errors in diagnosis, scurvy being frequently mistaken for rheumatism, hip-joint disease, paralysis, and affections of the spine.

Considering the very uniform and characteristic complex of symptoms in scurvy, it is difficult to understand why this confusion should occur, but I have seen two cases in which a reputable surgeon had applied dressings for hip disease during a period of four and six weeks, and many in which counsel was requested because a supposed rheumatic attack obstinately resisted every method of treatment. However, since the disease has been more carefully studied, illustrative cases reported, and the subject given a place in text-books, mistakes in diagnosis are becoming more and more infrequent.

The question of the relation of scurvy and rickets has been much discussed. Before the former disease had been carefully studied rickets was supposed to uniformly precede or accompany it, and prior to the publication of the observations of Cheadle and Barlow it was classed as "acute rickets." Both diseases develop during infancy, and both are caused by food that is deficient in certain essential qualities, but here the similarity ends; for the lesions of rickets are found in the bone tissue, those of scurvy in the blood-vessels, and, while the effects of these are readily and completely removable in

scurvy, in rickets their mark is left permanently in bone thickening and deformity. Again, alterations in diet that quickly terminate scurvy are inoperative in rickets. The two conditions, therefore, are not generically related; one may appear without the other, or they may coexist in the same patient, though such an association is exceptional in my experience.

The symptoms of rickets show little similarity to those of scurvy and make the differentiation an easy matter. The most uniformly present and characteristic, in the type of cases in which there is most likelihood of confusion, are profuse perspiration about the head and chest, anæmia and evidences of malnutrition, delayed dentition, enlargement of the joints, bending of the long bones, craniotabes, misshapen head with prominence of frontal and parietal bones, rachitic rosary, deformity of thorax with depressed ribs and projecting, distorted sternum, and prominent abdomen.

Purpura may be distinguished from scurvy by its etiology, unsuitable food not being an essential cause, and by the absence of hyperæsthesia, immobility, spongy, bleeding gums, and deep subperiosteal hemorrhage. The leakage of blood in purpura has a tendency to be general and more superficial, being most marked in the subcutaneous tissue and from the various mucous surfaces and the kidneys.

Prognosis.—When treatment is not guided by a correct diagnosis, scurvy runs a protracted course, and the patient gradually passes into a condition of such profound cachexia that death may take place from exhaustion. On the other hand, prompt detection and judicious management almost certainly lead to rapid recovery, improvement beginning after a few days and all symptoms disappearing in from two to three weeks.

The following table of twenty-six cases occurring in my own practice is of interest as an illustration of the clinical features in infantile scurvy of the type ordinarily encountered:

TABLE OF CASES OF INFANTILE SCURVY OCCURRING IN THE AUTHOR'S PRACTICE FROM 1890–1900.

Race, Sex, Class.	Age.	Prior Duration of Symptoms.	Symptoms.	Etiology.	Grade.	Treatment.	Result.
White, F., Wealthy.	10 months.	3 months.	Swelling of both legs above ankle joints, immobility; hyperæsthesia. Gums about the 4 erupted teeth purple; swollen, spongy, bleeding. Ecchymosis, slight at seat of swelling. Impaired digestion, tendency to constipation, marked emaciation, anæmia and prostration; urine high-colored, scanty. Temperature 100°–101° F. No rickets.	Proprietary foods, then condensed milk mixture.	Severe.	Home modified milk mixture (raw). Digestants and tonics (not sufficiently anti-scorbutic, being my first case).	Recovery slow.
White, M., Wealthy.	10 months.	4 months.	Marked swelling of right leg with separation of epiphysis of tibia; moderate swelling at lower third of left leg and above both wrists. Immobility; hyperæsthesia. Gums about the 6 erupted teeth extremely swollen, spongy, deep purple, sloughing, bleeding. Distributed petechiæ, most numerous over swelling. Anorexia, tendency to vomiting and diarrhœa with blood-stained, mucoid evacuations; extreme emaciation, anæmia and prostration; urine scanty but normal; temperature ranged from 99°–102° F. No rickets.	Condensed milk from birth.	Fatal.	"Humanized milk." Beef juice; iron; cod-liver oil; stimulants.	Death after five months' illness.
White, F., Wealthy.	5 months.	3 months.	Marked swelling above right ankle, less above left, considerable ecchymosis in these positions; immobility; great hyperæsthesia; no teeth; gums normal; anorexia; irritable stomach; diarrhœa; emaciation; anæmia; great prostration. Temperature range about 100° F. No rickets.	Artificial food from birth; condensed milk; proprietary food. Attack began while taking sterilized cows' milk mixture.	Severe.	Home modified milk mixture (raw), orange juice, raw beef juice; iron tonic, alcoholic stimulants.	Scurvy symptoms disappeared in four weeks. Restoration of general health slow—about three months.
White, M., Moderate.	7 months.	3½ months.	Great enlargement of lower third of right femur, skin over this region purplish; hyperæsthesia; immobility. Emaciation and prostration marked; anorexia; occasional	Nursed one week, then fed upon strong oatmeal water with a little	Severe.	"Humanized milk," raw beef juice, digestants, stimulants, cod-	Recovery progressive but slow; complete in three months.

			vomiting; tendency to diarrhœa, with green, undigested evacuations; urine normal; no fever, no rickets. During treatment the lower incisors appeared, and the gums, previously negative, at once became purple and swollen.	cows' milk. Attack followed one month's feeding on sterilized milk.		liver oil. (Early case, diet not sufficiently antiscorbutic.)	
White, M., Moderate.	8 months.	3 weeks.	Slight fusiform swelling at lower third of each thigh, and less above each ankle. Hyperæsthesia; immobility; gums about 4 incisor teeth livid purple, very much swollen, bleeding readily. Appetite fair, bowels regular, urine normal; slight pallor and muscular flabbiness; no emaciation, no fever, no rickets.	Artificially fed from birth; properly proportioned cream and milk mixture, sterilized.	Mild.	Sterilization discontinued.	Recovery in three weeks.
White, M., Moderate.	8 months.	3 weeks.	Swelling at lower third of each femur, and to less extent above ankle joints. Immobility; hyperæsthesia. Gums about 4 incisor teeth purple, swollen, and bleeding at slightest touch. Weakness, moderate anæmia. Muscles flabby, no emaciation. Afebrile, no rickets.	Weaned at sixth week, then fed on a mixture weak in cows' milk, strong in a proprietary food.	Average.	Home modified cream and milk mixture (raw). ℥ij raw beef juice and ℥j orange juice, three times daily.	Improvement after four days. Recovery in three weeks.
White, F., Moderate.	11 months.	2 months.	Considerable swelling above each knee joint, less above the ankles. Hyperæsthesia. Immobility. Dentition normally advanced, gums purple, swollen, bleeding. Anæmia, prostration, some emaciation, appetite poor, bowels constipated. Urine scanty but normal. No fever, no rickets.	Mixed feeding in early months. Weak condensed milk mixture. Attack followed severe epidemic influenza.	Average.	Home modified cream and milk mixture (raw). Orange juice. Raw beef juice.	Improvement in four days. Recovery in two weeks.
White, F., Moderate.	9 months.	2 months.	Swelling above both knees and ankles. Hyperæsthesia. Immobility. Two incisors cut, gums purple and swollen. Anorexia, impaired digestion, irregular bowels. Emaciation and prostration. No fever, no rickets.	Artificial feeding from birth. Sterilized weak milk mixture with proprietary food. Attack followed measles.	Mild.	Cream and milk mixture predigested at 115° F. Sterilization stopped. Raw beef juice. Tonics.	Improvement in seven days. Recovery in four weeks.
White, F., Wealthy.	8½ months.	2 weeks.	Hyperæsthesia and immobility of both legs, but no swelling. Two incisors cut, gums livid purple, much swollen. Irritable, no prostration or emaciation, some pallor. No symptoms of rickets.	Fed at breast for one month, then on condensed milk and a proprietary food.	Very mild.	Cream and milk mixture (raw). Orange juice. Raw beef juice.	Improvement in three days. Recovery in two weeks.

TABLE OF CASES OF INFANTILE SCURVY OCCURRING IN THE AUTHOR'S PRACTICE FROM 1890–1900—(*Continued*).

Race, Sex, Class.	Age.	Prior Duration of Symptoms.	Symptoms.	Etiology.	Grade.	Treatment.	Result.
White, M., Moderate.	12 months.	2 months.	Hyperæsthesia, immobility of both legs, and some swelling above the knee joints. Six incisors cut, gums purple and swollen. Irritable, emaciated, anæmic; anorexia, tendency to vomit, irregular bowels. No symptoms of rickets. Feeble from long-continued malnutrition.	Artificial food after first week; first condensed milk, then cows' milk and cream mixture sterilized.	Very mild.	Pasteurization substituted for sterilization. Orange juice. Raw beef juice.	Immediate improvement. Recovery in three weeks.
White, M., Moderate.	15 months.	3 weeks.	Swelling above the knees and ankles. Hyperæsthesia. Immobility. Dentition normally advanced, gums purple, swollen, readily bleeding. Marked anæmia, emaciation and prostration. No symptoms of rickets.	Weaned at fourth month. Cows' milk mixture to seventh month, then and at time of onset a proprietary food.	Severe.	Home modified cream and milk mixture (raw). Orange juice. Raw beef juice.	Recovery in two weeks.
White, F., Wealthy.	8 months.	6 weeks.	Swelling of lower third of both legs. Hyperæsthesia. Immobility of both legs and left arm, no swelling of latter. Two incisors cut, gums purple and swollen. Anorexia, constipation. Anæmia, muscle flabbiness, and slight emaciation. No fever, no rickets.	Mixture of milk, water and a proprietary food sterilized and predigested.	Average.	Sterilization stopped. "Humanized milk." Orange juice. Raw beef juice.	Improvement in two days. Recovery in two weeks.
White, F., Wealthy.	12 months.	3 weeks.	Swelling above the right knee and ankle. Hyperæsthesia, immobility not complete. Upper and lower central incisors cut; lower gums show purple line; upper, deep purple and swollen. Anorexia, constipation; moderate pallor, weakness and emaciation. Urine scanty. No fever, no rickets.	Artificially fed from birth on proprietary food.	Mild.	Partially predigested cream and milk mixture. Orange juice and raw beef juice.	Recovery in two weeks.
White, M., Wealthy.	15 months.	6 weeks.	Scurvy followed prolonged illness. Chronic enterocolitis, bronchitis, mastoid disease. Hyperæsthesia and immobility of left leg. Ten teeth cut, gums deep purple, much swollen, readily bleeding. No symptoms of rickets.	Long-continued illness. Food on account of impaired digestion, too low in albuminoid percentage.	Mild.	Added to dilute milk mixture, mashed potatoes, dry bread, and stewed fruit. Raw beef juice.	Recovery rapid.

White, M., Wealthy.	13 months.	6 weeks.	Swelling above both knee joints. Hyperæsthesia. Immobility. Dentition normally advanced, gums purple, swollen, bleeding, teeth loose. Marked emaciation, prostration and anæmia. Temperature ranged from 98.4° to 103° F. No rickets.	Condensed milk feeding from birth.	Severe.	Home modified cows' milk mixture (raw). Orange juice. Raw beef juice.	Recovery in about three weeks.
White, M., Wealthy.	15 months.	3 months.	Child feeble from birth, difficult to feed, and badly fed and managed. Swelling of both legs above ankles. Hyperæsthesia. Immobility. Dentition normal, gums purple, extremely swollen, bleeding. Anorexia, feeble digestion, obstinate diarrhœa with fetid discharges. Emaciation, anæmia, prostration. Fever moderate. No rickets.	Persistent bad feeding.	Severe.	Egg-albumin, water, and raw beef juice, gradually built up to broths and milk mixtures, stimulants. Complicating diarrhœa treated.	Active scorbutic symptoms disappeared in two weeks, but restoration to health slow.
White, F., Wealthy.	10 months.	3 months.	Swelling of lower third of right femur and lower third of right leg. Hyperæsthesia. Immobility. Dentition normal, gums purple, swollen. Moderate pallor, weakness and emaciation. Anorexia, constipation. No fever and no rickets.	Artificially fed from birth. Food too low in albuminoid percentage.	Mild.	Home modified milk mixture (raw). Orange juice. Raw beef juice.	Recovery in about four weeks.
White, M., Wealthy.	15 months.	6 weeks.	Marked fusiform enlargement of lower third of right femur. Hyperæsthesia. Immobility. Dentition normally advanced, gums purple, very much swollen, readily bleeding. Anorexia, constipation. Emaciation, anæmia. Weakness. Urine scanty, high colored. No fever, no rickets.	Artificially fed from birth. Weak cows' milk mixture with a proprietary food.	Severe.	Home modified milk mixture (raw). Orange juice. Raw beef juice.	Improvement noticed in two days. Recovery complete in eighteen days.
White, F., Moderate.	15 months.	3 months.	Swelling of both tibiæ above ankle joint, right most marked; slight swelling of both arms above the wrists. Hyperæsthesia. Immobility of legs complete, of arms partial. Seven teeth cut, gums purple, swollen, bleeding; first molars in upper jaw nearly erupted, investing gums, swollen and purple. Anorexia, constipation, poor digestion, prostration, great emaciation. Urine scanty, high colored. No fever, no rickets.	Weaned at second month, then fed on sterilized milk (long process), and then on sterilized milk alternating with a proprietary food.	Very severe.	Home modified milk mixture predigested with peptogenic milk powder at 115° F. for four minutes. Orange juice, raw beef juice.	Improvement at once. Recovery in two weeks.

TABLE OF CASES OF INFANTILE SCURVY OCCURRING IN THE AUTHOR'S PRACTICE FROM 1890–1900—(*Continued*).

Race, Sex, Class.	Age.	Prior Duration of Symptoms.	Symptoms.	Etiology.	Grade.	Treatment.	Result.
White, M., Moderate.	13 months.	3 months.	Hyperæsthesia and immobility of legs; no swelling. Eight teeth cut, gums purple, greatly swollen, readily bleeding. Appetite poor. Irregular bowels, tending to constipation. Moderate anæmia and emaciation. No fever, no rickets.	Bottle-fed from birth; milk mixture, properly proportioned, but sterilized (long process).	Mild.	Sterilization discontinued.	Improvement immediate. Recovery in three weeks.
White, F., Moderate.	10 months.	6 weeks.	Hyperæsthesia and immobility of both legs, some swelling above knees. Six teeth cut, gums purple, slightly swollen; anæmia, poor appetite, regurgitated a portion of each feeding. Obstinate constipation. No fever, no rickets.	Bottle-fed from birth; food too dilute.	Very mild.	Home modified milk mixture (raw). Orange juice, raw beef juice. Laxative suppositories.	Improvement immediate; recovery in ten days.
White, M., Moderate.	14 months.	2 weeks.	Hyperæsthesia and immobility of both legs, no swelling about bones. Six teeth cut, gums purple and moderately swollen; poor appetite, impaired digestion, constipation, anæmia, moderate prostration, little emaciation. No fever, no rickets.	Breast-fed for two months, then on varying foods, condensed milk, and several proprietary foods.	Very mild.	Home modified milk mixture (raw). Orange juice, raw beef juice.	Recovery rapid.
White, M., Moderate.	12 months.	2 weeks.	Some swelling above left ankle, both legs hyperæsthetic and immobile. Six teeth cut, gums purple and much swollen; anæmia, muscle flabbiness, anorexia, emaciation, irregular bowels with undigested evacuations. Temperature 98.5°–101°; urine normal. No rickets.	Artificially fed from birth to seven months. No milk diet three weeks. Wet-nursed from seven weeks' breast. Proprietary food.	Average.	Home modified milk mixture (raw). Orange juice, raw beef juice.	Marked improvement in three days; recovery in three weeks.
White, M.,	14 months.	6 weeks.	Fusiform swelling above both ankle joints. Hyperæsthesia. Immobility. No swelling,	Breast-fed for three months;	Average.	Home modified milk mixture	Recovery in two weeks.

Wealthy.			but hyperæsthesia and partial immobility of left arm. Ten teeth cut, gums deep purple, very much swollen, readily bleeding. Appetite normal, bowels tend to constipation. Urine high colored, some emaciation, anæmia and prostration. No fever, no rickets.	then proprietary foods.		(raw). Orange juice.	
White, M., Moderate.	9 months.	4 weeks.	Fusiform swelling above left ankle joint, with legs hyperæsthetic and immobile. Six teeth cut, gums deep purple, greatly swollen and bleeding; anæmia, constipation, urine scanty but normal, emaciation, weakness. No fever, no rickets.	Artificial feeding from birth; too weak milk mixture.	Mild.	Home modified milk mixture (raw). Orange juice.	Recovery rapid.
White, F., Wealthy.	10 months.	1 week.	No swelling, but hyperæsthesia and immobility of both legs. One lower incisor cut, gums purple and slightly swollen. Constipation, pallor, and muscle flabbiness, but general nutrition good. No fever, no rickets.	Artificially fed from birth. Laboratory milk: fat, 4; sugar, 7; albuminoids, 1.	Very mild.	Home modified milk mixture (raw). Orange juice.	Recovery in one week.

Dangerous symptoms are extreme anæmia and prostration, epiphyseal separation, the appearance of petechial spots, the expulsion of blood from the bowels, and hæmaturia. Extreme gastric irritability, making feeding difficult, and the intercurrence of enteric catarrh materially add to the gravity of the prognosis.

Treatment.—The management of scurvy is very simple, depending entirely upon the substitution of a fresh, antiscorbutic diet for whatever form of unsuitable food may have been the causal factor. If a proprietary food has been employed, it must be abandoned; sterilization must be discontinued as a process of preparation; condensed milk or food too rich in farinaceous material must be changed to a properly modified, untreated, cows' milk mixture, and if the food has been simply deficient in proteids, it must be strengthened so far as the digestive powers admit, and any deficiency supplemented by the use of some other form of albuminoid, as raw-beef juice.

Briefly stated, the essential treatment is the employment of a food composed of cows' milk, cream, water, and milk sugar, properly proportioned to the age of the infant, and given, so far as the cream and milk are concerned, in the natural, fresh state: *i. e.*, not passed through the separator and not sterilized.

Pasteurization and predigestion at a temperature of 115° F. are admissible in certain cases, but should never be employed when the cream and milk are carefully handled at the dairy and can be kept clean and sound, and when the infant's digestion is even moderately active.

The juice of fresh ripe fruit—orange juice especially—is a useful addition to the diet, and when, as is usually the case, it can be taken without producing diarrhœa, is an efficient aid to rapid recovery.

For scurvy in an infant of eight months an appropriate food schedule is:

First meal, 7 A.M.—

Cream, ... f℥ss
Milk, ... f℥ivss
Milk sugar, ... ℥j
Water, ... f℥iij.

At 9 A.M.—One to two teaspoonfuls of fresh orange juice, according to effect on bowels.

Second meal, 10.30 A.M.—Same as first.

At 11.30 A.M.—Two teaspoonfuls of raw-beef juice, free from fat and with a little salt.

At 1 P.M.—One to two teaspoonfuls of fresh orange juice.

Third meal, 2 P.M.—Same as first.

At 3 P.M.—Two teaspoonfuls of raw-beef juice with salt.

At 5 P.M.—One to two teaspoonfuls of fresh orange juice.

Fourth meal, 6 P.M.—Same as first.

At 8 P.M.—Two teaspoonfuls of raw-beef juice with salt.

Fifth meal, 10 P.M.—Same as first.

If orange juice cannot be obtained, or should it disagree, good substitutes are two to four teaspoonfuls of scraped ripe apple (raw), two teaspoonfuls of fresh grape juice, or six solid grapes from which the skins and seeds have been removed.

In addition to alteration of the diet, very little treatment is necessary. Gentle inunction of the limbs with warm olive oil may contribute to the comfort of the patient, and some acceptable preparation of iron, as the ferrated elixir of cinchona, will assist in restoring the strength and building up the blood. If there be great prostration, strychnia and alcoholic stimulants should be administered, and all complications must be met as they arise.

CHAPTER III.

RACHITIS.

Rickets is a constitutional disease characterized by marked impairment of general nutrition, a peculiar softening and arrest of development of the bones with enlargement of their articulating extremities, broadening of the proliferating cartilaginous zone, relaxation of the ligaments about the joints, allowing of knock-knee and flat-foot, and various secondary alterations in the viscera. Additional symptoms are: Muscle weakness, resembling, and in severe cases often mistaken for, paralysis; nerve irritability, evidenced by such complications as laryngismus stridulus; profuse sweating; anæmia; and a tendency to catarrhal affections. The most striking features are the osseous softening, permitting the production of special deformities which become more or less fixed as the disease runs its course and the bones again harden, and the arrest of development, causing stunting of the frame.

Etiology.—Rickets, while an easily preventable disease, is of frequent occurrence, asylum and hospital statistics showing that from 28 to 30 per cent. of children under five years of age, and of the class that enter such institutions, are subjects of the disease in its mild or incipient form; the strongly marked, grave type being comparatively uncommon in this country.

The disease shows no preference for sex. It is not confined to any class or race, but is more frequently encountered among the poor than among the rich, in squalid, overcrowded portions of cities than in the open country, and is much more prevalent in negroes than in whites; the latter

being due to the peculiar tendency to malnutrition and lack of resisting power inherent in the African race.

It may develop during intra-uterine life, but usually the initial symptoms are not observed before the seventh month; the greatest number of cases arises in the second half of the first year, and the second and third years; after this, to the end of the fifth year, the frequency diminishes steadily and rapidly, and still later in life it originates with great rarity.

Rickets is never inherited; rachitic parents may have rachitic offspring, but one must look to the coincident prevalence of the disease and to impairment of the function of nutrition, which can be inherited, for an explanation of the causation, rather than to direct transmission. Parents weakened by overwork, bad and scanty feeding, dissipation, and exhausting diseases—as tuberculosis and, especially, syphilis—are apt to produce children showing evidences of malnutrition and predisposed to the development of rickets under the influence of certain well-defined conditions. These are improper feeding, residence in ill-ventilated, damp, dark, and overcrowded rooms, and want of personal cleanliness. As to improper food, the most potent of these factors, the fault may be either in too prolonged feeding from a breast that yields an insufficient quantity or a poor quality of milk, or in the administration of unsuitable artificial food. With substitute foods the error usually committed is in the direction of over- rather than under-feeding. The tendency is to give strong food, with the idea of producing strength, and to make additions to meet the feebleness of the infant, without reference to the capacity for digestion and assimilation, which diminishes in direct proportion to the general loss of tone. Too often there is a total disregard or ignorance of the fact that a dilute food is often a better tissue-builder because it is more readily and completely digested and absorbed. This is seen especially among the poor, whose infants of a year or less are fed

at the table on tea, bread, potatoes, and even meat, on the supposition that they ought to agree because they are suited to the older members of the family. Among the well-to-do the fault lies in employing insufficiently diluted cows' milk mixtures or in adding too much farinaceous or proprietary food to the diet. Of the different artificial foods, the farinaceæ, the proprietary foods in which the starch has been incompletely converted, and condensed milk are the most active etiologically. All these are deficient in animal fat, the first two in proteids and phosphate of lime, for it has been proved by clinical observation and experiments on animals that the main factor in the production of rickets is the failure to receive in, or assimilate from, the food supplied these three essential ingredients—animal fats particularly, proteids and salts to a less, though appreciable, extent.

The exciting causes are all influences tending rapidly to lower the vitality of a child with previously impaired nutrition; as an attack of measles, varicella, or any of the acute exanthemata, a severe and continued bronchitis, an acute gastro-intestinal catarrh, or any protracted and exhausting disease.

Morbid Anatomy.—Pathologically, rickets is a dyscrasia affecting the nutrition of various tissues of the body, and causing lesions of the bones which are probably inflammatory in nature. These osseous changes pass through three stages during the course of the disease: (1) Proliferation and altered nutrition of the cartilage and periosteum; (2) deformity; (3) reconstruction.

1. Normally the long bones increase in length by the formation of bone in the cartilage between the diaphysis and epiphysis; in thickness, by a similar formation beneath the periosteum. The flat and short bones grow in breadth by the development and ossification of their cartilaginous borders, and in thickness from the periosteum. The cartilage consists

of a matrix containing cells; the distal and greater portion presents the appearance of a white zone, and is made up of dense hyaline matter and a few cells; passing inward, the cells become more numerous and the matrix less, until, close to the bone, there is a layer composed almost entirely of cartilage cells. This, the proliferating zone, has very little depth, and shows as a thin layer of reddish-gray color upon the end of the bone shaft.

Increase in thickness is accomplished in a soft, vascular, germinal tissue which springs from the under surface of the periosteum, rapidly receives lime salts, and is transformed into bone; this germinal tissue is composed principally of capillaries originating in the fibrous tissue of the periosteum, and is a very thin, scarcely visible substance, subject to constant changes from rapid ossification.

In rickets both conditions of growth are vastly different. The proliferating zone, crowded with cartilage cells, is greatly increased in size, occupies nearly the whole of the epiphyseal cartilage, forms a broad, soft, translucent, grayish mass, and produces the characteristic swelling about the joints. With these changes in the cartilage there is a modification or complete arrest of the ossifying process. Usually, however, there is some effort at bone formation. The Haversian canals, surrounded by capillary loops, extend irregularly from the extremity of the shaft into the proliferating zone, the matrix being absorbed and intervening cell-groups appropriated. At the same time granules and masses of lime are deposited throughout the cartilage and a few spiculæ and nodules of true bone spring from the shaft. The subperiosteal tissue, under the irritating influence of the disease, increases more rapidly than in health and, ossification taking place imperfectly or being suspended entirely, becomes a thick layer, resembling spleen-pulp in color and consistence. This appearance is due to the growth of very numerous large and thin-walled

capillaries from the under surface of the periosteum. Over the cranial bones the vascular outgrowth is much less uniform than over the shafts of the long bones, being thicker in some places than in others; this explains certain peculiarities noted in these bones during the later stages of the disease. Some attempt at ossification takes place in this exuberant tissue, but it is abortive, and results in the formation of vascular and fragile osteophytes. Preformed bone is not softened by rickets, but, after the onset of the disease, the new layers are not consolidated as they form, and, the old layers being destroyed by the progressive formation of medullary cavities, the result is a soft, brittle osseous tissue.

In this stage the bone becomes bluish or dark-red in color from excessive vascularity, and the normal relation of inorganic to organic constituents (two to one) is altered, the organic matter greatly preponderating, though the degree of excess varies with the severity of the disease. This also influences the distribution; in mild cases a few bones only are affected, while in grave types the whole skeleton may be involved.

2. Deformities differ in degree and vary in the period of their appearance, according to the severity of the attack and the age of the patient; softening and consequent distortion occurring much more rapidly and much more extensively in infants than in older children, probably because they are more profoundly influenced by malnutrition and its consequences.

The bones most frequently involved are those of the cranium; the ribs, especially at their sternal ends; and the radii at their distal extremities, and, although the disease may involve the general skeleton, these bones are the first and most markedly affected.

The deformities embrace alteration in shape, enlargements of articulating extremities, rounding of projecting points, and curvatures and twists of the bone shafts due to the pressure

of position and weight of the body, or to muscular action. Rickets also arrests the development of the skeleton, both during and after the active period of disease, so that rachitic children, independently of curvatures, have less than the average height after reaching adult life. The stunting is greatest in the bones of the face, pelvis, and legs.

The bones of the skull are subject to certain special changes. Their edges, which correspond to the epiphyseal cartilages of the long bones, undergo a similar proliferation and thickening. This, together with delayed union of the sutures, produces grooves that are appreciable to palpation and are often visible. Retarded ossification also causes a large size and increased patency of the fontanelles, and postpones their closing until long after the usual time. The cranium is misshapen, and measurement shows an actual increase in size, though the enlargement is more apparent than real on account of the stunting of the facial bones. In addition, the special change *craniotabes* occurs. This is almost peculiar to very early infancy, being usually noted before the eighth month or the end of the first year. It consists in thinning of isolated areas of the softened bone by pressure from the brain within and the pillow without, and is, in consequence, most marked in the occipital and the posterior portions of the parietal bones. The thinned spots are to be

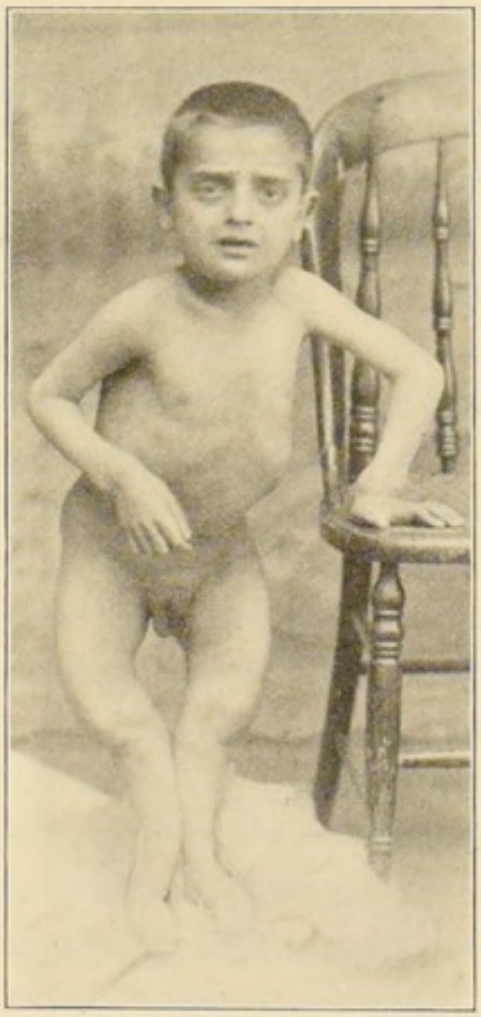


FIG. 5.—THE DEFORMITIES OF RICKETS.

searched for over the body of the bone; they are soft and yielding to pressure, and in the cadaver are translucent when the bone is held between the eye and a light. They differ in degree, in some cases being simple depressions resembling erosions, a thin bony layer remaining, while in others the absorption of bone is complete and the brain is covered only by the dura mater and scalp.

Dentition is markedly affected by rickets. The process is not only greatly delayed, but such teeth as do appear during the course of the disease are deficient in enamel, break and crumble easily, and decay readily.

3. Reconstruction. During the first and second stages the vascular periosteum is drawn tightly over the convexities of the bones, this pressure diminishing the hyperæmia and the amount of exudation; over the concavities the membrane is loose, is intensely hyperæmic, and the interspace between it and the bone is filled with a soft gelatiniform exudate. Repair begins with the deposition of earthy salts from the blood into whatever open space there is beneath the periosteum, and takes place most easily and rapidly where there has been free exudation with no compression of the capillaries: that is, on the concave surfaces of the bones, the long bones especially. At first the lime salts are deposited in hard compact masses, like the callus formed about a fracture, and with small and imperfectly formed Haversian canals and lacunæ; later, after complete recovery from the disease, there is a return to normal bone formation.

Recovery is always protracted: the proliferation of cartilage and periosteum slowly ceases, hyperæmia lessens, and the osseous system gradually resumes its normal function and development.

The ligaments are relaxed and flabby, giving unusual mobility to the joints, and knock-knee and flat-foot are often present, even in cases of such mild type that there is very little

bone deformity. The fibrous bands uniting the vertebræ participate in the relaxation, and this, associated with rachitic changes in the bones and intervertebral cartilages, permits backward, forward, or lateral curvatures of the spinal column to take place.

While the most prominent lesions of rickets are seated in the bones, the disease, being systemic, also affects the soft tissues and viscera.

Emaciation is not very decided, though the muscles may become shrunken and flabby, partly from the general malnutrition and partly from want of use; under the microscope their fibres appear softer and paler than natural and the striæ are very indistinctly marked.

Anæmia is present in severe cases, and in all instances the mucous membranes generally, but especially those lining the gastro-intestinal canal and the bronchial tubes, are prone to show the evidences of a low grade of catarrhal inflammation.

The liver is often enlarged, hard and elastic to the touch, anæmic, and pale in color. The fibroid tissue is universally increased; in the smaller portal canals the fibroid sheath is doubled in thickness, and the yellowish acini are bounded by a thin pink or gray line. In the acini the cells are more closely packed than normal. Sometimes, as in other conditions attended by malnutrition, the enlargement of the liver is due to fatty infiltration; at others the organ, while unaltered, gives a false impression of increase in bulk by occupying an unnaturally low position in the abdomen, being carried downward by the depressing force of the deformed thoracic walls.

The spleen is more frequently increased in size than the liver. In some instances it is merely perceptible below the margin of the ribs; in others, it extends downward as far as the mid-line of the abdomen, measuring as much as eight inches in vertical and four inches in horizontal diameter. The viscus is indurated; its substance is tough and elastic and

contains very little blood. It is deep red or purple in color, the surface is mottled with smooth white spots,—enlarged Malpighian corpuscles,—and under the microscope the trabeculæ are found to be irregularly swollen, the walls of the meshes are thickened, and the corpuscles are greatly increased in number and crowded together.

The lymph glands, especially the mesenteric glands, are quite uniformly enlarged and hardened; they are white and opaque and their corpuscular elements are greatly augmented.

The brain may be enlarged, and hydrocephalus sometimes occurs as a complication, but it is difficult to establish any pathological connection between these conditions and the rachitic dyscrasia.

Distortion of the thorax consequent upon softening of the ribs, and enlargement of the costochondral articulations, produce special lesions of the lungs, which are invariably present and always occupy the same position in the pulmonary tissue. These are emphysema and collapse. The emphysema is due to overdistention of certain air vesicles from unequal thoracic expansion during the inspiratory act, and involves nearly an inch of the whole anterior free border of both lungs. The collapsed tissue forms a groove immediately outside of the emphysematous margin, separating it from the healthy lung; it is produced by direct pressure from, and corresponds to, the line of the enlarged sternal ends of the ribs. Isolated areas of collapse may also occur throughout the lung, as a result of a plug of mucus entering a small tube when there is a complicating bronchitis.

The enlarged extremity of the fifth rib coming in contact with the pericardium over the apex of the left ventricle produces a circumscribed opacity—"white patch"—of the membrane. The same may be formed on the capsule of the spleen by attrition against a projecting rib nodule during the respiratory movements of the diaphragm; in this position the

opaque spot is distinguished from embolism by extending only as deep as the fibrous investment of the organ.

Symptoms.—The actual beginning of the disease is preceded by a pre-rachitic stage, in which the patient presents symptoms closely allied to those of simple atrophy. These are prostration ; pale or muddy skin ; wasting of the general subcutaneous adipose tissue ; muscle flabbiness ; drowsiness and lethargy by day, and restlessness and broken sleep at night. Thirst is increased ; the appetite is usually voracious ; there is abdominal pain, and the action of the bowels is irregular, a day or two of relaxation being followed by an equal period of inactivity ; again, there may be obstinate constipation. The evacuations, which are usually voided with considerable straining, are extremely offensive, and consist of whitish, putty-like material mixed with mucus, and in some instances the food seems to pass through the alimentary canal with little change except in the way of putrefaction. The urine is passed in large quantities and abounds in phosphates.

Sometimes if the infant be taking a large quantity of fat-forming food, the frame may be sufficiently rounded and plump, but the flesh is too soft and flabby.

The onset of the disease is marked by two symptoms—perspiration, and a desire on the part of the child to lie cool at night.

Sweating takes place from the skin of the head, or from the head, neck, and upper part of the chest ; it is almost uniformly profuse, the moisture standing in large drops upon the forehead and running down over the face, and is constant, though most extreme during sleep or when the little patient is excited or exposed to an elevated temperature. With the perspiration there is enlargement of the superficial veins of the forehead and of the jugular veins, and there may be visible pulsation of the carotid arteries ; while, from irritation,

crops of miliaria appear upon the temples and close to the roots of the hair.

In contrast to this overactivity of the skin of the upper part of the body, the abdomen and legs are usually dry and hot.

The desire to lie cool at night is quite characteristic. Even in winter the child will kick off the bedclothes, or throw his naked legs outside of the coverlet, and the mother, with no idea of the meaning of the symptom, grows anxious and adopts the bag night-dress or other means to keep her child covered and prevent his taking cold.

Tenderness, formerly considered an important initial symptom, may sometimes be elicited by pressure over the epiphyses, but it is not uniformly present even in severe cases, is absent in those of mild type, and if acute enough to cause the patient to scream when handled or to produce immobility of the limbs, is an indication of infantile scurvy rather than of rickets.

These early features are accompanied by all the symptoms of the pre-rachitic stage, and by the changes in the osseous system, which soon become evident as deformities. The first bones to be affected are the cranial, the ribs, and the radii. Primarily in the long bones, the articulating extremities enlarge at the point of junction of the shaft with the epiphysis; both ends suffer, but the swelling is naturally most apparent at the superficial end. The ribs at their sternal ends are attacked early; next the radii, at the wrists; and, as a rule, the enlargement is more marked in the bones of the upper than of the lower extremities. The flat bones—cranium, scapulæ, pelvis—are thickened, and there is softening of all the bones that may be involved, leading to the various distortions that characterize the disease.

The extent of softening and deformity depends upon the gravity of the attack: if mild, the change is limited to the

bones of the skull, the ribs, and the radii ; if severe, all the bones of the frame suffer. In either case the relation between articular enlargement and softening varies, sometimes one, sometimes the other, being most prominent.

Changes in the Bones of the Head and Face.—The cranium is increased in size, the veins of the scalp are distended, and, in marked cases, the growth of hair is scanty. In shape the head is either square or oblong, the antero-posterior diameter being increased ; the vertex is flattened and the forehead is high, square, and projecting, and is out of proportion to the face. The actual enlargement is exaggerated by the arrest of development of the upper jaw, malar bones, and face generally. The surface is irregular, the rachitic thickening being greatest along the edges of the bones, and at the centres of the parietal and the bases of the temporal bones. Deep fissures indicate the position of the open sutures ; the fontanelles, especially the anterior, remain widely open long after the normal period of closing ; and over the occipital bone and the posterior portions of the parietal bones, isolated areas of osseous thinning—craniotabes—can be felt. These spots vary in size from one-eighth to one-third of an inch in diameter, and to the finger, which should always be gently applied in the search, they are perceived as depressions in the bone which are elastic, like stiff paper, or, when the absorption has been complete, feel like the surface of a fully distended bladder.

With the general stunting of the bones of the face, special changes take place in the jaw bones, which affect the position of the teeth. The lower jaw becomes polygonal, with the alveoli inclined inward, the arch thus being shortened from before backward. This distortion is attributed to the action of the masseter, the mylo-hyoid, and the genio-glossus muscles, and to pressure from the lips. In the upper jaw the lateral pressure of the zygomatic arches elongates the bone

and alters the shape of the arch and the position of the teeth. Hence the external incisors are forced into a lateral position, and, when the jaws are closed, the superior incisors and molars overlap the corresponding lower teeth in front and at the sides.

The process of dentition is greatly influenced by rickets. Should the disease develop before the eruption of any teeth, their appearance is indefinitely delayed: if some teeth have been cut, further evolution is arrested and those present soon grow black from decay and become loose in their sockets. This retarding influence is peculiar to rickets, not being a feature of other diseases accompanied by impaired nutrition, as simple atrophy, scurvy, chronic diarrhœa, tuberculosis, or congenital syphilis.

Changes in the Ribs.—The "rachitic rosary" appears early in the disease. It is due to the enlargement of the costochondral articulations, and consists of a series of nodules extending from the clavicle to the base of the chest and resembling a row of large beads underneath the skin.

Softening of the ribs permits of distortion by muscular action and by the force of external atmospheric pressure, in the absence of proper osseous resiliency. The resulting deformity is very characteristic; the thorax, being flattened posteriorly and projecting sharply anteriorly, loses its normal rounded outline and becomes more or less triangular. From their vertebral attachment the ribs extend almost horizontally outward, then bend, at an acute angle, at the junction of the dorsal and lateral portions, and thence pass forward and inward toward the sternum. The costal cartilages curve outward before turning in to articulate with the sternum, and this bone is forced forward, increasing the antero-posterior diameter of the chest and producing the condition termed "pigeon-breast." The lateral diameter is greatest at the acute angle formed by the ribs, least at the costochondral junction. The

bending inward of the ribs and outward of the cartilages forms a depression on the antero-lateral aspect of the chest, extending from the first to the ninth rib, and being deepest immediately outside of the line of the rachitic rosary. On the left side the depression is less deep between the fourth and sixth ribs, on account of the partial support given the chest wall by the heart; and on the right side the liver diminishes the depth of the groove below the sixth rib. On both sides, below the eighth or ninth rib, there is a more horizontal depression,—Harrison's groove,—which corresponds to the upper borders of the liver, stomach, and spleen; these organs supporting the parietes and preventing their sinking in, under the external air pressure. During the inspiratory act the sternum is pressed forward, the abdomen expands, and all the grooves become more marked, presenting an appearance similar to that observed when a moderate obstruction to the entrance of air exists in the larynx or trachea.

Changes in the Bones of the Upper Extremities.—Swelling of the distal extremity of the radius is one of the earliest symptoms of rickets, but the arm bones are less frequently curved and distorted than those of the legs. The radius and ulna may be bent outward and twisted on their long axis; the humerus is sometimes bent, most often at the upper third, from the powerful action of the deltoid muscle in lifting and supporting the arm. The clavicle may be curved in two directions: one backward, near the scapula; the other and longer, near the sternum, in a forward and upward direction. The scapulæ occasionally show thickened margins, like the other flat bones. The curvatures in the bones of the arms and in the clavicles are partly due to pressure occasioned by the child's supporting himself, while in a sitting posture, upon the hands held palms downward and pressed upon the bed or floor.

Changes in the Vertebræ.—The spine is bent by the weight of the shoulders and head. The degree of curvature is pro-

portionate to the muscle weakness, and its direction depends upon whether the child can or cannot walk. In the latter case the anterior cervical curve is increased, and the normal backward curve from the first dorsal to the last lumbar vertebra is greatly exaggerated. The augmented cervical curve and attendant muscle weakness deprives the head of efficient support; it therefore tends to fall backward, and gives a very characteristic attitude in the sitting posture. Lateral curvatures are less common than the antero-posterior; they depend upon position, and may be produced by the nurse habitually carrying the child over one arm.

If the child be able to walk, the dorsal spine is bent backward, the lumbar forward. Usually the curvatures disappear when the patient lies down, or is lifted by the hands placed under the arms so as to take the weight of the head and shoulders from the spine; but when the disease is severe, and so long continued that the vertebræ and intervening cartilages have become wedge-shaped, these curvatures either are with difficulty rectified by mechanical appliances or become permanent.

In rare cases the curvature is sufficiently extreme to interfere, by compression, with the function of such important organs as the heart, lungs, or great vessels.

Changes in the Pelvis.—Rachitic deformities of the pelvic bones are of great importance in the female, as they involve serious consequences in the event of future marriage. They produce various alterations in the shape of the outlets, but the tendency is to change the normal oval to a triangular form. Elongation of some and contraction of other diameters occur, when the child is standing, from the weight of the head, arms, and trunk; the promontory of the sacrum, especially, being carried forward by this pressure, as it supports the weight of the spine. Again, the heads of the thigh bones in standing, and the tuberosities of the ischia in sitting, exert a double

pressure from below, and effect a narrowing of the outlet of the pelvis.

The degree of deformity depends greatly upon the age of the patient at the time of the onset of the disease, or upon the completeness of the ossification, for the cartilages are less yielding than the bones themselves.

Changes in the Bones of the Lower Extremities.—Beyond enlargement of the articulating extremities of the bones, the legs may escape deformity if the child has not walked before the rachitic changes begin. In such instances the muscles are flabby and the limbs are weak and look too short, but the bones remain straight.

The distortion of the femur shows in a curving forward of the shaft if the infant has not walked; this is due to the weight of the feet and legs pulling upon the lower end of the femur while the patient sits in the nurse's lap. If the child can walk, the curve is an exaggeration of the normal forward and outward bend; at times the head of the bone is bent at an angle, acute or obtuse, to the shaft.

The tibia, before walking, is curved outward, due to pressure upon the external malleolus as the infant sits cross-legged on the bed or floor. After walking, the weight of the body bends the bone at its lower third, the curve being abrupt and directed either anteriorly over the foot or laterally over the outer malleolus.

In addition to softening and resultant deformity, the growth of the bones is arrested by rickets, both during the progress of the disease and after apparent recovery. The stunting is most constant and decided in the bones of the face, pelvis, and legs, though it may be apparent in all the members of the skeleton, and, when combined with curvature of the leg bones, accounts for the short stature of many adults who have suffered from the disease in childhood. The arrest in the growth and development of the pelvis is the most serious form of

stunting, as it may interfere with certain bladder operations in the child, and in the adult female is a grave complication during parturition.

The articulations are involved in the enlargement of the extremities of the long bones, and become bulbous and knotted, the increase in size being exaggerated by wasting of the muscles.

At the same time the ligaments surrounding the articulations and holding the bones together are relaxed, and the joints become loose and abnormally mobile. This relaxation is an early symptom, is often marked when the changes in the bones are slight, and may affect all the joints of the frame. In the lower extremities it greatly impedes walking and gives rise to knock-knee, eversion of the foot, or flat-foot. In the spine the weakness of the ligaments connecting the vertebræ with each other and with the sacrum, and the sacrum with the pelvis, combined with the same condition in the legs, produces the inability to hold the body upright and to walk, which are so typical of the disease.

While the bone softening and distortion are in progress the profuse sweating continues; the appetite may be excessive, but usually is diminished and capricious; sick stomach sets in, with sour breath and acid eructations or vomit, and the bowels are either obstinately constipated or there is diarrhœa with offensive, liquid evacuations, green in color and containing mucus. So soon as the gastro-intestinal disturbance begins, the patient, though sufficiently plump before, rapidly loses flesh, and any pre-existing anæmia and weakness increase. The skin becomes pale and muddy, the face grows old, the eyes look large and lack speculation, and the general expression is one of indifference. If the muscle weakness be not great enough to prevent, the child will sit for hours with the legs stretched forward and the trunk supported by the arms, content to be inactive and undisturbed. The respiratory

movements are increased in frequency and labored, and if there be much softening and retraction of the ribs, every energy is devoted to the act of breathing, and the little sufferer has no breath to waste in complaining or crying. The abdomen is greatly distended and in marked contrast with the contracted chest. The enlargement is due to depression of the diaphragm, and, with it, of the liver and spleen; to flatulent distention of the bowels, favored by weakness of the muscles of the intestinal walls and abdominal parietes; and to shallowness of the pelvic cavity. In addition to being depressed downward, the liver and spleen may be enlarged. Enlargement of the spleen is more common and excessive than that of the liver, though the edges of the latter are often harder and sharper than normal. Under these conditions the lymphatic glands of the neck, armpits, and groins are increased in size, become easily perceptible as hard, readily movable nodules, and there is extreme emaciation and anæmia, with slight anasarca, and waxy appearance of the skin.

The general prostration attending severe rickets diminishes the resisting power and opens the way to any infection that may be prevalent, but the disease especially predisposes the patient to attacks of bronchial catarrh, diarrhœa, laryngismus stridulus, convulsions, and chronic hydrocephalus. These intercurrent affections, particularly bronchitis, are responsible for the majority of fatal terminations.

When death is caused by the intensity of the disease alone, the patient gradually becomes weaker, loses power of supporting the body, and can scarcely move. The difficulty of breathing becomes extreme, the face grows livid, sweating is profuse, there is complete anorexia, the flesh melts away, greatly exaggerating the prominence of the distended abdomen, and finally the child expires asphyxiated or exhausted.

When the disease tends to recovery, the symptoms gradually improve. As the bones begin to harden, the breathing

becomes less difficult, mental activity returns, and the child takes an interest in his surroundings. The sleep is sounder and quieter, the appetite increases, the bowels become regular and the evacuations more healthy, dentition recommences and progresses rapidly, flesh is regained, the muscles resume their tone and begin to develop, and the abdomen resumes its normal size. Sweating and the tendency to lie cool at night are the most stubborn features, but slowly disappear.

As recovery progresses, the bones become much straighter than their previous distortion would lead one to expect, and the thickening of the flat bones and the enlargement of articulating extremities diminish greatly. The bones become very thick and strong, but grow in length slowly and insufficiently, and a stunted form is carried into adult life.

Diagnosis.—Rickets of marked type is readily recognized by the profuse sweating, anæmia, loss of flesh, lassitude and inertia, muscle weakness, labored respiration, delayed dentition, and disordered gastro-intestinal functions; by the enlarged, misshapen head, with its square, prominent forehead, open, depressed fontanelle and craniotabes; by the small face, beaded ribs, distorted chest, distended abdomen, curved limbs, and enlarged, loose joints; and, when the sitting posture is assumed, by the bowing of the spine and falling backward of the head.

It is in cases that develop late—after the end of the second year—or in the incipient or mild forms that the diagnosis is difficult and most important, for the disease is as easily curable in its early stages as it is fatal if neglected. The distinguishing features are increased perspiration from the head, neck, and chest, so that the pillow becomes wet during sleep; a tendency to be restless at night and to kick off the bed-clothes and "lie cool"; delay in the closing of the anterior fontanelle until after the sixteenth month; retarded dentition, the tenth or twelfth month passing without the appearance of a tooth;

beading of the ribs, often only to be detected by palpation; slight enlargement of the wrist and ankle joints; prominence of the abdomen, and late efforts at standing or walking. These patients are prone to catarrhs of the bronchial and gastro-intestinal mucous membranes; they may be somewhat anæmic, and muscularly weak, but there is often no loss of flesh; in fact, an abundance of flabby flesh is no more proof of the absence of rickets than excessive emaciation is of its presence.

The enlarged rachitic head may suggest hydrocephalus. In the latter condition the head is more regularly enlarged and more globular, the forehead projects markedly, the disproportion between the cranium and the face is greater, the eyes are deflected downward, the iris partly covered by the lower lids, and nystagmus and oscillatory movements are present; the bones of the skull are not thickened, the fontanelle is more open and bulging, and the sutures are wider and not bounded by ridges of thickened bone. When the two conditions coexist, the head, and skeleton generally, show the features of rickets, the fontanelle is large and projecting, and the sutures widely open and fluctuating.

The inability to stand or walk, depending upon muscle weakness and relaxation of the ligaments of the spine and about the knee and ankle joints, as encountered in association with bone softening in severe cases of rickets, may be mistaken for essential paralysis. The muscles, however, while feeble, are not powerless, for the child will move and draw up the legs if the soles of the feet be tickled. Again, when the loss of muscular tone is extreme, the incapacity is general and is not confined to a single group or several groups of muscles, while other characteristic symptoms of the disease are always present.

Infantile scurvy is readily differentiated from rickets, by the purple, swollen, bleeding gums, the extreme hyperæsthesia

and immobility limited to the affected limbs, and by the bone swelling being fusiform in shape and seated *above* the joints. The etiology of scurvy is well established, and differs from that of rickets; and the rapid recovery under the employment of "fresh" food and fruit-juice is quite distinctive.

Prognosis.—Rickets is slow in development and in recovery, and fatal cases run a protracted course unless life is cut short by one of the ordinary complications or by some intercurrent affection, measles and whooping-cough being especially dangerous. The type of the disease is determined by the intensity and continuance of the etiological factors.

Cases of the grade ordinarily met with in this country recover, with little deformity, when early recognized and properly treated. The prognosis is very favorable so long as the affection remains simple and the bone softening is moderate. The outlook is different when there is marked malnutrition and extreme softening of the bones, the danger in any given case being measured by the degree of distortion of the chest and the character of existent complications. If the ribs be much softened and the chest greatly deformed, respiration becomes difficult, the blood is poorly aërated, oxidation of waste material is incomplete, and there is increased impairment of nutrition. The slightest bronchial catarrh adds to the difficulty of breathing. As rickety patients are very sensitive to changes of temperature, they very readily take cold, and a trifling attack of bronchitis under these conditions often leads to fatal collapse of the lungs. The gravity of the bronchial complication is in direct proportion to the degree of recession of the thoracic walls during the inspiratory act.

Of the other complications, diarrhœa is the most serious. Convulsions in the rachitic are not, in themselves, especially dangerous, but cases in which they have been severe and repeated are apt to drift later into epilepsy. Laryngismus stridulus is but rarely a cause of death, and the occurrence

of hydrocephalus is of minor importance. Enlargement of the spleen, liver, and lymphatic glands, while indicating a condition of grave cachexia, does not warrant a fatal prognosis.

Exclusive of stunting of the frame, the health of a child who has passed through even a severe attack of rickets may be as perfect as if he had never had the disease, unless marked deformity of the chest has become set during the stage of bone hardening. Then, the consequent impairment of the respiratory function produces anæmia and arrests development, and the child is feeble and subject to bronchitis or pneumonia, and may become tuberculous.

Treatment.—As rickets can be readily prevented, attention must be paid to this branch of treatment if the disease has appeared in former children of the family. The mother should avoid all influences which impair the general vigor, especially during the period of gestation. She should live in healthful surroundings—the country, if possible; should eat easily digestible and nutritious food, meats, sound milk, fresh vegetables; retire early to bed and secure plenty of sleep, and in every way lead a quiet regular life, taking sufficient exercise in the open air to insure a good appetite and maintain as perfect a condition of health as possible. After birth, the infant should be fed from the mother's breast if the milk, on analysis, is found to be normal in composition; otherwise, a good wet-nurse, or, preferably, artificial feeding, may be employed.

In artificial feeding a home-modified cows' milk mixture, with the fat, proteids, and milk sugar properly proportioned to the age of the infant, is to be selected. The use of a small quantity of properly prepared farinaceous material for its mechanical attenuant action is often useful, but the farinaceæ in bulk, the proprietary foods, and condensed milk, except as a temporary substitute, are to be strictly avoided, as they are all deficient in fat, the ingredient

of the diet most essential to the prevention of rickets. Premature weaning from a good breast is to be forbidden, as well as prolonged nursing after the mother's milk has become thin and poor. Should the time for weaning—the tenth month ordinarily—transpire at the beginning of summer, the child must be carried through the hot season by mixed feeding, the mother's milk being supplemented by two or three bottles of carefully prepared artificial food.

In addition to proper feeding, absolute cleanliness, warm clothing, sunlight, fresh air, regularly heated chambers, and sanitary surroundings are essential. Infants predisposed to rickets are best reared in the country, but in America it is possible for those obliged to live in cities, even the poor, if they will take the trouble, to keep their babies clean and comfortably clad, and to obtain for them open air, sunlight, and milk food.

During the actual presence and progress of rickets the same general hygienic measures must be enforced and due attention paid the feeding. The following is a suitable diet for an infant at the age of eighteen months when the disease is uncomplicated by diarrhœa :

First meal, 7.30 A. M.—A breakfast-cupful (f℥viij) of milk, with a tablespoonful (f℥ss) of cream ; on alternate days the yelk of a soft-boiled egg, with a little butter, salt, and bread-crumbs, and two to four tablespoonfuls of well-cooked and strained cracked-wheat porridge with cream and salt.

Second meal, 11 A. M.—A breakfast-cupful (f℥viij) of milk, with a tablespoonful (f℥ss) of cream and a slice of whole-wheat bread.

Third meal, 2 P. M.—A good tablespoonful of well-minced and pounded mutton or chicken, with gravy and a little crumbled stale bread ; a tablespoonful of purée of spinach or stewed celery or asparagus tops or cauliflower-tops ; thin bread and butter.

Fourth meal, 6 P. M.—Milk and cream as at first and second meals; thin bread and butter.

For drink, pure water.

Avoid excess of farinaceous food.

Should there be complicating diarrhœa with liquid, offensive evacuations, a diet containing a minimum quantity of casein should be adopted, as:

First meal, 7 A. M.—Veal broth (½ lb. of veal to a pint of water) and barley water, equal parts (f℥iij–iv).

Second meal, 10 A. M.—Cream, f℥ss; whey (freshly prepared), f℥vj.

Third meal, 1 P. M.—Same as first, with chicken broth in place of veal broth.

Fourth meal, 5 P. M.—Same as second.

Fifth meal, 10 P. M.—Same as first.

If feeble, one meal at 4 A. M., same as second.

In extreme cases it may be well to limit the food to raw-beef juice in one to three teaspoonful doses every two hours, with the following mixture twice each day:

The yelk of a raw egg;
Ten (10) drops of brandy;
One (1) teaspoonful cinnamon water; and
One (1) coffeespoonful white sugar, well beaten up.

While on raw-beef juice the patient must take from 12 to 24 fluidounces of pure water, barley water, or white-of-egg water each twenty-four hours; these must be given in small doses at short intervals.

Milk feeding must be resumed gradually after this restricted feeding, and partially peptonized milk food is the best intermediate diet.

In feeding rachitic subjects it must never be forgotten that if there be marked debility, the strength of the food must be proportionately weakened without regard to the age of the patient; for the digestion takes its tone from the systemic con-

dition, and the feebler, the more nearly does the digestive power approach that of the newly born.

Fresh air is an essential in the successful management of the disease. The living rooms must be light and well ventilated, and if the child be too ill to be taken out of doors, he should be well wrapped up and placed in his bed near an open window, out of a draught and in the sunlight, for an hour or more every day. If well enough, the patient must be taken into the open air regularly, the duration of the outing being lengthened as strength increases. This routine should only be interrupted by extreme cold or storms, but in winter the abdomen must be covered and supported by a flannel binder, the limbs and body protected by woolen underclothing, and the feet warmly shod. If the means permit, great benefit will be derived from a change of air, from the city to the country or to a seashore resort where the air is dry and bracing.

Cleanliness must be strictly enforced. The patient's whole body should be thoroughly sponged each morning with soap and warm water, and each evening with warm water alone; or tepid salt and water (℥ss sea-salt to Oij water) may be used with advantage, especially over the back and loins. After the morning bath the child should be placed prone on the bed, and the whole back, from the neck to the buttocks, gently rubbed for ten minutes with the open hand. A five minutes' inunction of the surface with warm olive-oil twice daily after the spongings is also very useful.

The mattress and bed coverings must be removed from the sleeping room every morning and well aired, and the sheets must be renewed frequently.

When the bone softening is sufficient to threaten deformity, standing and walking must be prevented as much as possible until recovery is under way and the bones harden. In graver cases the patient must be confined to bed, and lie upon an even, soft mattress; and light, carefully padded splints, long

enough to extend well below the extremity of the limbs, may sometimes be applied. If there be craniotabes, the pillow should be soft and care should be taken that the yielding parts of the cranium are not subjected to undue pressure.

The first step in the medicinal treatment is to aid in the restoration of normal nutrition by correcting any disordered condition of the gastro-intestinal canal. Diarrhœa, with the expulsion of mucus and offensive fæcal matter, being ordinarily present, it is well to begin the treatment by clearing out the alimentary tract by a mild cathartic, such as one or two teaspoonfuls of castor oil guarded by 10 drops of paregoric, or by a teaspoonful of spiced syrup of rhubarb combined with half a teaspoonful of Husband's magnesia. This is followed by a digestant and astringent, as :

℞. Bismuth. subcarb., ... ʒ ij
Phenolated essence of pepsin, ... f ʒ iij
Syr. acaciæ, ... f ʒ j
Elix. aromat., ... q. s. ad f ʒ iij. M.
Sig.—One teaspoonful every two hours (for a child of one year), interval to be increased as diarrhœa improves.

When there is constipation, the bowels should first be unloaded by a mild course of calomel and soda (gr. ss calomel, gr. vj sod. bicarb., in divided doses) and regularity maintained by one or two teaspoonfuls of milk of magnesia from once to three times daily, given with the milk food, or by small doses of resin of podophyllum (gr. $\frac{1}{24}$ to $\frac{1}{12}$) in alcoholic solution.

Flagging appetite and general tone may be increased by tincture of nux vomica in doses of one to two drops three times daily ; this may be given with the bismuth mixture, or when the diarrhœa is relieved, and in other cases, in the following prescription :

℞. Tr. nucis vom., ... ♏ xxiv
Essence of pepsin, ... f ʒ iv
Elix. aromat., ... q. s. ad f ʒ iij. M.
Sig.—Teaspoonful three times daily before food (for a child of one year).

Should head sweating require attention, one or two drops of tincture of belladonna may be added to this mixture.

Cod-liver oil is the most successful remedy in rickets, being almost a specific, and producing rapid improvement when well borne by the stomach, and assimilated. It may be administered pure, or, more efficiently, in combination with lactophosphate of lime in the form of a fifty per cent. emulsion. The oil should be given three times daily, directly after food; for an infant of one year, twenty drops to one teaspoonful of pure oil, or one to two teaspoonfuls of the emulsion, are sufficient. The initial doses must be small until the toleration is estimated, and during the course of treatment the fæcal evacuations should be occasionally examined; a marked fishy odor or the appearance of drops of oil indicating that the doses are too large.

Phosphorus is another useful drug, particularly in cases where the disease begins toward the end of the second year. It must be employed in minute doses, gr. $\frac{1}{200}$ to $\frac{1}{100}$, according to the age of the patient, and administered three times daily, after taking food. It may be prescribed as oleum phosphoratum or in the form known as "Thompson's mixture."

The former is:

Take of:

Phosphorus,	1 part	
Ether,	9 parts	
Almond oil,	90 parts.	M.

Each minim contains $\frac{1}{100}$ of a grain of phosphorus.

The formula for Thompson's mixture is:

℞.	Phosphori,	gr. j	
	Alcoholis (absolut.),	♏cccl	
	Spt. menth. pip.,	♏x	
	Glycerini,	f℥ij.	M.

Ten minims contain $\frac{1}{132}$ of a grain, and thirteen minims $\frac{1}{100}$ of a grain. The dose for a child of two years is six minims, thrice daily.

Alcoholic stimulants are often required in severe rickets. Brandy or whiskey is to be selected, and should be given well diluted and in doses and at intervals suited to the age of the patient and the depth of the prostration.

Of the complications, bronchitis requires the most active treatment. At the first indication of catarrh, maintained counterirritation of the thoracic surface must be instituted; this may be accomplished by the constant, careful application of hot poultices composed of one part mustard and five parts flaxseed meal, or, better, by the following ointment, as it does not require such frequent changing, and thereby lessens the risk of chilling:

Take of:

Oil of turpentine, ... 1 oz.

Olive oil, } . . . . . each 4 ozs.

Mutton suet, }

Mix without heating.

This is to be thickly spread on two pieces of flannel cut in the shape of ordinary chest protectors, one for the front, the other for the back of the chest, and the whole surrounded and held in position by a broad flannel roller; the dressing should be renewed twice daily, the original flannel being used. At the same time, such relaxants as liquor potassii citratis should be employed to produce, as rapidly as possible, free, liquid secretion from the bronchial mucous membrane. When the cough has become quite loose, aromatic spirit of ammonia, in appropriate doses, may be added to the potash solution, or the patient may be put upon simple mixtures containing chloride or carbonate of ammonium.

Emetics, syrup or wine of ipecacuanha, are occasionally indicated, when there is lividity of the lips, greatly embarrassed breathing, and an excessive accumulation of mucus in the bronchial tubes.

Diarrhœa has been already referred to, and requires the

same dietetic and medicinal treatment as when it occurs as a distinct disorder.

Convulsions demand the administration of the bromides and chloral, and laryngismus stridulus the same drugs, with the application of a hot-water compress to the throat during the presence of the actual paroxysms.

In the treatment of rickets the point to be emphasized is that drugs are without avail in restoring health if the essential dietetic and hygienic measures be neglected.

CHAPTER IV.

LITHÆMIA.

Lithæmia is a term employed to designate an abnormal condition of the system, characterized by variously grouped symptoms, and depending upon the presence in the blood of an excess of uric or lithic acid, and other alloxuric substances, as xanthin, hypoxanthin, heteroxanthin, and paraxanthin.

While the clinician searches the urine for uric acid, lithates, and other imperfectly oxidized products of nitrogenous waste as proof of the existence of this disorder, lithæmia is not caused by any morbid condition of the kidneys, but depends upon a temporary or persistent functional derangement of the liver, leading to imperfect metamorphosis of albuminoids absorbed from the food into the blood, with the production of insoluble uric acid, instead of soluble urea.

This incomplete oxidation may be due, on the one hand, to some innate want of power, often inherited, in the liver, in consequence of which its healthy functions are deranged by food in quantities and of a quality ordinarily easily digested; on the other, to the supply of aliment being so abundant and rich in proteids that the organ is overburdened, and cannot fulfil its whole duty.

Uric acid and its associate products are excreted by the kidneys, the skin, and the mucous membrane of the intestinal canal, the kidneys taking the greater share of the work. The waste materials are taken from the blood by the kidney cells and passed into the urine, so that an excess of uric acid in the latter fluid demonstrates that it pre-existed in a proportionate excess in the blood.

It is quite common for healthy children, after a surfeit of food, to void urine laden with uric acid; this also occurs in attacks of acute indigestion and of affections attended by pyrexia, but the patient cannot be classed as lithæmic, unless the condition be persistent and attended by definite symptoms.

Etiology.—The manifestations of lithæmia may appear at any period of infancy or childhood, and are not confined to either sex. Cases are most numerous among the well-to-do, partly because the supply of food is apt to be better and stronger in proteids, but chiefly on account of inheritance, a gouty parentage or ancestry being traceable in the great majority of instances.

Season has a decided influence upon the disease, "lithæmic attacks" being much more frequent and severe in winter than in summer. This is readily explained by the fact that perspiration is much increased in hot weather, and the skin, being active, assumes a fair proportion of the work of elimination which in winter must be mainly done by the kidneys and intestines.

Insufficient exercise and too much confinement in-doors, particularly when combined with a too abundant supply of albuminoids, are important factors, complete oxidation of waste material requiring a due amount of muscular exercise and exposure to sunlight and fresh air.

The first manifestations of lithæmia are sometimes observed after certain of the exanthemata, as measles or other acute affection attended by marked gastro-intestinal disturbance, especially epidemic influenza. As a temporary condition it is a common associate of all febrile attacks.

Symptoms.—A number of cases are encountered in practice in which the excessive formation of uric acid and its analogues gives rise to a condition of general ill health; these patients are, as a rule, somewhat advanced in childhood, four

years old and upward, and are nearly always the offspring of more or less gouty parents. The child may be well nourished, or, at the worst, is a trifle thin and flabby; the skin is dry, pale or sallow, and shows, especially on the face about the mouth, circumscribed, dry scaly patches, or there may be more general and marked eczema, or outbreaks of urticaria.

Mental activity is decided, but there is irritability, uncertainty of temper, a want of fixedness of purpose, and a tendency to tire readily on sustained mental or physical effort. Sleep is restless and the patient wakes in the morning unrefreshed and heavy-eyed, and, if old enough to describe sensations, complains of fullness or pain in the head, which passes away while the toilet is being made. Sleep may be disturbed by bad dreams, or by the peculiar sensation of discomfort in the legs known as "growing pains."

The tongue is lightly coated, flabby, and marked along its edges by the teeth; the appetite is fanciful, sweets and highly seasoned dishes being preferred to plain, wholesome food; there is moderate flatulent distention of the abdomen and pain in the umbilical region, most marked between meals and often relieved by taking food; the bowels are inclined to constipation and the evacuations are lumpy, hard, and not uniform, clay-colored and deep brown masses of fæces being mingled in the same action.

At intervals, showing some tendency to periodicity, and apparently without exciting cause, the regular course is interrupted by attacks of acute digestive disturbance, in which there is nausea, vomiting, increased pain and fever, with a laden tongue, fetid breath, and ill-smelling evacuations from the bowels. The abdomen is often moderately distended and tender to the touch, and some care may be required to exclude a diagnosis of appendicitis.

The mucous membranes of the bronchial tubes and pharynx are very susceptible to catarrhal inflammation, the tonsils often

become enlarged, and the child complains of aching in the throat and sharp pain on swallowing; these attacks are of short duration, and follow indiscretions in diet more frequently than exposure to cold.

The urine is acid in reaction, high-colored, deposits on standing an abundant sediment of pink or brick-red crystals of uric acid, and is often voided involuntarily during the hours of sleep.

This group of symptoms is always more marked, and in the great majority of cases is only present, during the winter months; the exercise and out-of-door life incident to the summer season, and the activity of the skin, produced by hot weather, favoring perfect oxidation and free elimination.

The features of lithæmia, however, may be more specialized, affecting one set of organs or one system.

At times newly born infants eliminate an excess of urates during the first few days of life, and uric acid crystals may be precipitated in the tubules of the kidneys, producing great pain and irritation. Such cases have a lithæmic family history. There are frequently repeated straining efforts at urination, but the excretion is voided only at long intervals,—once in twenty-four hours, for instance,—the quantity is small, may be tinged with blood, and leaves a deposit like fine pink sand on the napkin. There is severe and protracted crying and evidently great pain, increased thirst, frequent pulse, dry skin, and a temperature ranging from 102° to 104° F. When, after several days, free secretion is established, the symptoms rapidly subside, the patient becomes cool and placid, and large quantities of uric-acid laden urine are voided. The uric acid infarctions may be the origin of renal calculi, or, being washed from the tubules of the kidneys into the bladder, may form the nuclei of vesical calculi.

As such infants become older they frequently suffer from attacks of painful micturition. During these the urine is voided

infrequently, the act being instinctively postponed as long as possible on account of the pain it causes; there is fever, restlessness, and fretfulness, which increase as the time approaches when the bladder must be emptied, and during and after expulsion there is violent crying. The urine is high-colored, acid, contains an excess of urates and oxalates, and is often so irritating that it produces vulvo-vaginal inflammation in the female and severe irritation of the urethra in the male. This quality also produces irritability of the neck of the bladder, and if associated, as it often is, with an unstable condition of the nerve centres of the spinal cord, leads to nocturnal incontinence of urine.

The gastro-intestinal form of lithæmia is probably independent of excessive uric acid formation, being due to auto-intoxication by other alloxuric substances. The condition is characterized by a series of well-defined, self-limited paroxysms of violent digestive disturbance, which occur at intervals varying from one or two weeks to several months, and may arise in both infants and older children having a gouty ancestry. Without any apparent exciting cause, the attacks begin suddenly, with nausea, vomiting, abdominal pain, and fever. The breath is offensive, having a sweet ethereal odor; there is total absence of appetite; everything, even the simplest liquid, forced into the stomach is rejected, and occasionally, when there is excessive retching, blood is vomited; the bowels are sluggish, with putrid, sometimes oily evacuations; there is pain and tenderness, usually moderate, but sometimes very severe, in the epigastric or umbilical regions. The temperature is elevated, ranging about 102° F. generally, but at times running as high as 104° or 105°; the pulse is frequent and feeble; the breathing is markedly hurried and difficult, though no abnormal physical signs can be detected on examination of the lungs; and there is progressive prostration and rapid emaciation. After a period of from three to

seven days the vomiting stops almost as suddenly as it began, and the patient passes into a slow convalescence, abdominal tenderness and the evidences of irritation of the stomach and bowels remaining for some days.

As age advances the type of the attacks may change; instead of the obstinate vomiting, fever, and dyspnœa, there is violent headache, attended by nausea and followed by prolonged and profound sleep, from which the patient wakes improved and refreshed; in other words, the attacks assume the characteristics of migraine.

The urine voided during a lithæmic attack is diminished in quantity, very acid in reaction, high-colored, increased in specific gravity, and on standing deposits uric acid and urates in the form of fine red or pink particles. In that passed after the paroxysm is over, the poisonous xanthin bodies, paraxanthin and heteroxanthin, are, according to Rachford,* found in enormous excess of the normal quantities existing in the urine of non-lithæmic subjects.

Albumin is sometimes present in the urine, both during and after the attacks; it is usually transient, but is an evidence of irritation of the kidneys and an indication for care lest these organs become permanently diseased.

In the intervals between the attacks the patients may be perfectly well, though more frequently they are pale, fretful, and ailing, and present the general symptoms already detailed.

While a nervous element runs through all the acute manifestations of lithæmia and lies at the foundation of the obstinate vomiting, the dyspnœa and the migraine, with its deep sleep of auto-intoxication, the condition may also give rise to recurrent convulsions, which may be sufficiently long continued to develop into the migrainous type of epilepsy.

Migraine usually appears after infancy, and may, as already

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*"American Text-book of the Diseases of Children."

indicated, take the place of the storms of acute gastro-intestinal disturbance. It occurs at more or less regular intervals in self-limited paroxysms which ordinarily cannot be traced to an excitant cause. The pain is unilateral, is often attended by disorder of vision, and may or may not be associated with nausea, vomiting, and abdominal pain, so that there are two distinct forms, one nervous sick-headache, the other migrainous neuralgia. The paroxysms end in a prolonged toxæmic sleep, from which the patient wakes free from pain, but pale and languid, until health is restored by a day of rest and a night of normal sleep.

On the skin, lithæmia manifests itself by several forms of eruption. Eczema occurs in patches and as a passing symptom in many cases of the disorder; but, as an extended and continued cutaneous affection, appears most frequently in infancy; in fact, many instances of eczema in early life are due, as can be determined by the family history and by examination of the urine, to lithæmia, and are best relieved by a diet and treatment directed to the prevention of the excessive formation of uric acid.

Urticaria is frequently observed, either in the form of ordinary nettle-rash or hives, characterized by evanescent efflorescences termed wheals, or as lichen urticatus, in which, after the wheals have disappeared, white or red papules appear, more or less discretely scattered over the surface. Both forms are attended by a sensation of burning and by intense itching; the latter is worse at night, when the child is warmly covered in bed, and the consequent scratching produces various excoriated and crusted lesions of the skin.

The occurrence of what, for the want of a better term, may be called a **roseolous rash** is not uncommon in lithæmia. This rash is preceded for several days by gastro-intestinal disturbance, appears first upon the face and neck, and gradually sweeps over the whole surface of the body, occupying

one, two, or even three days in the transit and fading on the old as new localities are involved. The eruption is frequently attended by considerable itching, and consists of irregularly circular, rather large clusters of red or deep rose-colored macules or slightly raised papules, separated by areas of normal skin ; it has a superficial resemblance to measles, more rarely to scarlatina, and is probably often mistaken for rubella. Before efflorescence there may be a febrile elevation of one or two degrees, and the cardiac action is moderately increased in frequency, but the temperature and pulse become normal as the rash appears. The tongue is lightly coated, there is loss of appetite, and the bowels are constipated, as a rule, though there is sometimes diarrhœa. The urine is high-colored and laden with urates. There are no catarrhal symptoms and no sore throat ; indeed, the patient has little to complain of, and after the course is run, a period of from three to five days, rises from his bed without weakness or other sequel.

Diagnosis.—Given a distinct family history of gout, and the decided alterations in the condition of the urine, there should be little difficulty in recognizing the form of lithæmia attended by general disturbance of the system, with its disordered digestion, localized patches of eczema, nocturnal incontinence of urine and bone pains, and its development in quick-witted, bright-faced children, having active and irritable nervous organizations.

The gastro-intestinal form is marked, in addition, by the periodical, self-limited attacks of obstinate vomiting, abdominal pain, fever, and the peculiar dyspnœa without pulmonary lesion.

The migrainous form is readily distinguished.

Of the skin eruptions, the roseolous rash alone presents difficulties in diagnosis. This may be mistaken for measles, scarlet fever, or rubella.

The distinctions from measles are the absence of a pre-

monitory catarrhal stage, of Koplik's spots, and of an eruption upon the mucous membrane of the soft palate; the minor degree and the less regular course of the temperature range; the lighter and more distinctly rosy color of the rash and its less papular character.

In scarlet fever the sudden onset, preceded, as a rule, by vomiting; the high fever; rapid pulse; the strawberry tongue; the reddened throat with swollen tonsils and enlarged submaxillary glands, and the scarlet color and distinctly maculated character of the rash, are the distinguishing features. At the same time, certain very mild cases of scarlatina will tax the skill of the diagnostician to positively exclude the lithæmic rash.

In the absence of an epidemic, it is often very difficult to establish the diagnosis of rubella, and it is probable that many supposed isolated cases of the exanthem are in reality lithæmic. However, rubella often shows some prodromal symptoms—malaise, irritability, pain in the limbs, moderate suffusion of the conjunctivæ, lachrymation, coryza, hoarseness, sore throat, slight cough, and sometimes, though by no means regularly, a rise of from 1° to 3° in the temperature. The rash appears behind the ears and on the face, and extends rapidly over the surface of the body; it consists of maculopapules, pale rose in color, and varying in size from a pin's head to a split pea. When the papules are discrete and large, the eruption resembles that of measles; when confluent and small, it is very like scarlatina.

The average duration of the rash of rubella is three or four days, during which the symptoms noted in the prodromal stage continue, though the temperature, if elevated, declines after the second day; as the rash fades, brownish or yellowish discolorations are left, and there is often a trifling furfuraceous desquamation.

With such meagre points of distinction, it is always well,

before asserting the presence of rubella, to remember the possibility of a very similar lithæmic rash, and to look into the previous history of the case and carefully examine the urine.

Little reliance is to be placed on swelling of the post-cervical and post-auricular lymphatic glands as a diagnostic feature, as these are enlarged so frequently and from so many different conditions in children.

Prognosis.—As nature's scheme of development, under favorable conditions, tends to the physical perfection of adult life, and as in children the function of nutrition is so much more readily influenced and put upon the right path by proper feeding and hygiene, the prognosis of lithæmia is much more favorable in the young than in adults, who have attained their prime and are, so to speak, set and functionally unalterable.

The grade of the condition giving rise to general symptoms and to skin eruptions can be eradicated in time (two to five years) by careful attention to the child's diet and mode of life, with the assistance of judiciously selected drugs.

The paroxysms of vomiting in the gastro-intestinal form are usually free from risk to life in themselves, though by the prostration produced they open the way for intercurrent diseases and make them more dangerous. They are entirely uninfluenced by medicines, but by properly directed treatment in the intervals the attacks gradually grow less frequent and severe, and finally cease altogether.

The nervous forms are still more obstinate, convulsions, if often repeated, ending in epilepsy, and migraine frequently being a source of life-long suffering to the gouty.

Treatment.—Little can be accomplished in the relief of lithæmia without careful regulation of the diet.

In breast-fed infants this is difficult to accomplish, but the milk must be analyzed, and any abnormal condition corrected, as far as possible, by attention to the mother's feeding, exer-

cise, and general hygiene, and by the employment in her case of an antilithic treatment.

When the feeding is artificial, a home-modified cows' milk mixture of proper average composition for the case in hand should be employed, and variations made in the proportion of cream and milk as the symptoms demand. Poland water, as it increases the activity of the kidneys, is a better diluent than plain water, and if the digestion will not permit of the addition of sufficient cream to maintain a free action of the bowels, from one to five grains of phosphate of sodium may be added to each bottle of food.

For children of four years, a suitable diet is :

First meal, 8 A. M.—Milk, 7 fluidounces ; Vichy water, 1 fluidounce (one or two portions); one or two yelks of soft-boiled eggs with salt, or a bit of fresh fish or sweetbread ; or one or two slices of bran or whole-wheat bread, dry.

Second meal, 1.30 P. M.—A teacupful of clear meat broth ; a bit of chicken, turkey, wild fowl, or fish ; one well-cooked green vegetable—*i. e.*, spinach, celery, young onions, cauliflower ; one or two slices of dry bran or whole-wheat bread ; junket or rice-and-milk pudding ; cooked fruit with very little sugar.

Third meal, 6.30 P. M.—Milk as at first meal ; sweetbread or milk-toast ; dry bran or whole-wheat bread.

For drink, Poland water or Vichy (domestic); use either freely.

Avoid fats, starches, sweets, raw fruits, and red meats—*i. e.*, beef or mutton.

In still older patients, ten years and upward, a wider range is permissible, and the meals may be selected from the following list, which gives the foods allowed as well as those to be avoided :

Breakfast :

Milk, salted, if desired ; weak cocoa with very little sugar.

Bran bread; whole-wheat bread; dry toast; zwiebach.

Oatmeal or cracked wheat porridge, well cooked, with salt and milk.

Eggs, yelk of soft-boiled or poached; French omelette.

Chicken broiled.

Fresh fish: rockfish, perch, bass (no oily fish).

Dinner:

Oysters (in season).

Clear soup.

Beef, mutton, or lamb; poultry or game, small quantity (roasted or broiled, and one kind only).

Two green vegetables: spinach, celery, peas, string beans, cauliflower, onions, turnips, vegetable marrow, okra, parsnips, carrots, egg-plant, tomatoes raw or baked.

Rice, hominy, or macaroni (cooked plain).

Bread as above.

Light pudding; apples baked with very little sugar; stewed apples; stewed prunes; grapes in moderation, melons.

Supper:

Milk or cocoa, as at breakfast.

Bread as above; toast or zwiebach.

Chicken or game (roasted or broiled); oysters (in season) stewed or roasted. Fresh fish; sweetbread, stewed.

One green vegetable, as above.

Cooked fruit, with very little sugar.

Lithia water to be taken freely.

No food between meals. Supper two hours before retiring for the night. If much sugar is demanded with food, saxin to be employed as a substitute.

Articles to be avoided:

Cream. White of egg; eggs cooked with milk. Crabs, lobster; salmon and all rich oily fish. Veal; pork; ham; dried, smoked or pickled meats of all sorts; twice cooked meats. All

fried food. Pastry ; cake ; hot bread or rolls ; prunes ; confectionery of all sorts ; jams ; jellies. Rhubarb ; beets ; cabbage ; old peas ; old beans ; potatoes (white or sweet) ; asparagus ; radishes ; all raw fruits (except as mentioned above), especially strawberries, raspberries, and pears. Fruit cooked with much sugar ; dried fruit (figs, dates) ; nuts. Mushrooms. Pickles ; vinegar ; spices ; condiments (salt excepted).

The object of both of the diets given is to allow a minimum of albuminous food, to diminish the formation of uric acid and its analogues, and a minimum of carbohydrates (sugar and starch) to afford the albuminoid waste an opportunity of being freely oxidized. From the two lists it is not difficult to formulate a diet for intervening ages.

During the obstinate vomiting of the gastro-intestinal form, everything taken into the stomach may be rejected ; still the prostration caused by the attack is diminished if the patient be forced to take one or two teaspoonfuls of raw-beef juice at regular periods,—every two hours, for example,—with sips of water, or, better, white-of-egg water in the intervals. At the same time, rectal injections of peptonized milk or broth must be administered. These enemata should not exceed in quantity two fluidounces at the age of three years, should be given at a temperature of 98° F., and at intervals of four hours ; and once daily the rectum must be washed clean with warm normal saline solution (one teaspoonful of table-salt to each pint of water).

In addition to careful feeding, the child must live in clean, light, and well-ventilated rooms, must have plenty of sunlight and regular exercise in the open air, care being taken to avoid overfatigue and exposure to the extremes of weather. It is very important to keep the skin active, by daily sponge baths and friction of the surface. The bath should be given in the morning, in the following way : Draw into the tub three inches of hot water ; let the patient stand in this, to prevent

chilling, and rapidly sponge the whole body with water at 75° F., taking not more than one minute for the operation; then rub the whole surface gently but thoroughly for ten minutes with a soft Turkish towel. At night, before going to bed, the ten minutes' dry friction should be repeated. Infants may be sponged in the lap with warmer water (85° to 90°) and rubbed in the same way. When eczema develops, and involves a large extent of surface, sponging should be discontinued, and as little water as possible applied to the affected skin, the necessary cleansing being done by fresh olive-oil on pledgets of cotton.

The medicines of most value in the lithæmic state are the salts of lithia, phosphate of sodium, and the alterative tonics, but to be efficient they must be given continuously, brief periods of rest being allowed from time to time. At the age of four years one to two grains of citrate of lithia, or two to three grains of the benzoate, may be ordered three times daily; the citrate may be given dissolved in water, but the benzoate, being less agreeable to the taste, is best administered incased in gelatin, if the child be sufficiently advanced to swallow a capsule. Phosphate of sodium should be given in solution * or capsule, in doses of gr. 5 to 10 three times daily.

Of the alteratives, arsenic and iodine are to be selected, and should be given alternately; thus, one drop of Fowler's solution in a teaspoonful of water three times daily after food for two weeks, followed by a similar course of syrup of hydriodic acid, in doses of ten to fifteen drops, in water, three times daily; then a return to the arsenic, and so on.

During the treatment pepsin or pancreatin may be required to assist digestion; nux vomica may be indicated as a bitter

* Solutions of phosphate of sodium are now in the market, of which each minim represents one grain of the salt.

tonic; saline laxatives, as phosphate of sodium or magnesia, may sometimes be necessary; and occasionally a course of calomel, in broken doses, may be demanded.

The attacks of prolonged vomiting are seldom curtailed by medicines; still, good is sometimes done by a continued course of calomel, in doses of gr. $\frac{1}{24}$ with sodii bicarb. gr. ½, every two hours until a grain of the mercurial is taken, or by hourly doses of five to ten drops of brandy in one teaspoonful of lime water, and, finally, by minute quantities of creasote, ♏ $\frac{1}{12}$, with sodii bicarb. gr. ½, every second hour. When the attack is so protracted and violent as to threaten serious results from extreme exhaustion, a small suppository, containing ext. belladonnæ gr. $\frac{1}{12}$ and ext. opii gr. ⅛, may be administered, to a child of four years, every twelve, eight, or six hours, according to the urgency of the symptoms. Or if these be quickly expelled from the rectum, gr. $\frac{1}{24}$ of morphine sulph., with gr. $\frac{1}{200}$ of atropine sulph., should be introduced, at twelve-hour intervals, hypodermatically. Subcutaneous injections of sulphate of strychnia, in doses of gr. $\frac{1}{120}$ every six hours, may be called for in very grave cases.

The pain of migraine can be safely relieved by the following combination:

℞. Phenacetin, ... gr. iv
Salophen, ... gr. vj
Caffeine citrat., ... gr. ij.
M. et ft. chart. No. xij.

A child of six years should take one powder every hour until three are taken, unless relief is obtained before, and the same course can be repeated after a period of six or eight hours.

A convulsive seizure must be taken in hand energetically. After the force of the attack has been broken by immersion in a hot bath, the lower bowel must be emptied by an enema, a dose of calomel administered, and a course of bromide of

potassium or sodium, either alone or combined with chloral, instituted; these drugs are best given by the mouth, but if this be impossible, the rectum must be used.

Lithæmic eczema requires the ordinary local applications. When extended urticaria or a general roseolous rash appears, the patient should be put to bed, a free action of the bowels secured by a mild saline laxative, a light diet ordered, and a simple diuretic, as the solution of citrate of potassium, administered in appropriate doses.

The treatment employed for the relief of vomiting and pain, for convulsions, and for the skin affections is merely symptomatic, and if the patient is to be led to recovery, the general measures detailed for the management of the lithæmic condition must be rigorously enforced during the free intervals.

PART II.

DISEASES OF THE DIGESTIVE ORGANS.

CHAPTER I.

AFFECTIONS OF THE MOUTH.

CATARRHAL STOMATITIS.

The **anatomical lesion** in this affection consists of a simple hyperæmia of the mucous membrane of the mouth, with its attendant redness, swelling, and altered secretion. This hyperæmia varies both in extent and degree. Sometimes it is limited to small, circumscribed points of the membrane, at others it extends over large patches, or involves the entire surface. In the latter cases it is most intense; the mucous glands of the lips and cheeks participate, becoming enlarged and prominent, and occasionally small herpetic patches appear.

The disease may be primary or secondary.

Etiology.—The causes of primary stomatitis are the ingestion of food or drinks which are acrid and irritating or too hot; the presence of decaying teeth; want of cleanliness or too persistent cleansing of the mouth; the use of certain drugs, as mercury, iodine, antimony and arsenic, and, perhaps, the influence of bacteria acting mechanically or chemically. The secondary form occurs during the course of acute febrile diseases, as measles, scarlatina, typhoid fever, and in disordered

conditions of the stomach, particularly those attended by acid eructations. Catarrhal stomatitis is also met with in the earlier stages of more serious diseases of the mouth.

While not limited to any special age, the disease occurs most commonly during infancy, since at this period several of its causes are apt to be simultaneously operative.

Symptoms.—These are mainly local. The lips are unnaturally full and red, and the skin at the angles of the mouth and on the chin may be excoriated by the dribbling saliva. The oral mucous membrane presents either a punctated, a patchy, or a diffuse redness. It is moderately swollen, and hot and tender to the touch. At first the mouth is dry, but soon the salivary flow is increased, the secretion becoming acid in reaction, and sometimes viscid and flocculent. The mucous glands of the cheeks and lips may project as yellowish-white or transparent nodules, yielding a drop of mucus on pressure. Infrequently, too, isolated collections of small vesicles develop and then quickly dry up, leaving scales behind them. The tongue is either red and smooth, with enlarged and reddened fungiform papillæ, or covered with a white frosting, through which the papillæ project in scarlet points. The last condition is most frequently seen when the stomatitis is secondary to gastric catarrh. The acts of sucking and eating are painful, and resistance is offered to inspection of the mouth. Cold drinks are craved.

Restlessness, irritability, slight heat of skin, anorexia,—depending chiefly upon the local tenderness,—and constipation are the general symptoms of primary catarrhal stomatitis. In the secondary variety the general symptoms depend upon, and vary with, the originating disease. The local features, however, remain the same, with the addition of certain special features, as Koplik's spots and maculation of the soft palate in measles, and the punctation of the pillars of the fauces in scarlatina.

The course of the disease depends upon the cause and the treatment adopted, though it is usually acute, rarely lasting longer than a week.

Treatment.—After attending to the removal of the exciting cause, if this be possible, the diet must be regulated. To sucklings, the breast or the carefully prepared bottle alone should be allowed, and milk guarded by lime water must constitute the food of older children. If the act of sucking be so painful as to cause the infant to refuse the breast or bottle, it is necessary to give food, temporarily, from a spoon or glass.

The mouth should be thoroughly but very gently washed, at intervals of an hour, while the patient is awake, with a solution of sodium borate or sodium salicylate in rose water (gr. x to f℥j). After taking food, particularly, the mouth ought to be cleansed with cool water, and the lotion used. A little mass of absorbent cotton twisted around the end of a probe, or a soft rag folded around the index finger, is the best vehicle for carrying the lotion. In obstinate cases a weak solution of nitrate of silver (gr. j–f℥j) should be applied once daily.

Regular evacuation of the bowels must be secured by saline laxatives. If the skin be hot and dry, liquor potassii citratis, in doses of a fluidrachm every two or three hours, for a child one year old, is indicated. When the tongue is heavily coated, and the stomach disordered, recovery may be much hastened by gr. ½ of calomel given in broken doses with bicarbonate of sodium and followed by a digestant, as:

℞. Sodii bicarbonatis, ... gr. xxiv
Pulv. pepsini (Fairchild's), ... gr. xij
Pulv. aromatici, ... gr. iij.
M. et ft. chart. No. xij.

Sig.—One powder four times daily, administered in milk or syrup, for a child between seven and twelve months old.

APHTHOUS STOMATITIS.

This is a much more common disease than uncomplicated catarrhal stomatitis, and is most frequently met with in children between the ages of six and fifteen months.

The **anatomical lesions** are hyperæmia of the mucous membrane of the mouth, and the formation of *aphthæ* or small, superficial, yellowish-white ulcers.

Etiology.—Any condition which reduces the general strength and interferes with nutrition may exert a causal influence. For instance, overcrowding; residence in damp, ill-ventilated houses or rooms; insufficient food and clothing; various acute affections, as ague, pneumonia and the exanthemata, and chronic diseases, especially of the digestive tract. The direct agent may be bacterial, but it is certainly some, and probably a varying, form of deleterious material, circulating in the blood, and acting on the nerves in such a way as to produce an herpetic eruption upon the mucous membrane of the mouth; the aphthæ being undoubtedly herpetic in character.

The exciting agencies are: want of proper attention to the cleanliness of the mouth; foul nursing bottles; the administration of sour milk, or an excess of farinaceous food. In older subjects an indulgence in pastry or candy is often followed by an attack of aphthæ, and certain children always suffer after eating some particular article of food, as honey, walnuts, or salted fish. All these causes are active in the production of a catarrhal state of the stomach, which invariably precedes and attends the disease under consideration.

The disease is not contagious, but at times a sufficient number of cases occur simultaneously to constitute an epidemic.

Symptoms.—For twenty-four hours prior to the appearance of aphthæ, there is fretfulness, increased thirst, and poor appetite. Next, the mouth becomes hot, and a few hours

later the ulcers appear. The lips, swollen and vividly red, are held somewhat apart, and clear saliva drops from the mouth, excoriating the skin of the lower lip and chin. The oral mucous membrane is red, swollen, and hot, and presents the characteristic ulcers. These are usually discrete, and make their appearance first on the inside of the lower lip and the edges of the tongue, though they may, subsequently, extend to the cheeks, gums, soft palate, and even the tonsils. Their number varies from one to twenty; and their size, from that of a pin's point to a split pea. The ulcers—oval, round, or, more rarely, linear in shape—are slightly elevated above the surrounding surface, have deeply reddened edges and whitish or yellowish-white floors. They are excessively sensitive, and thus mechanically interfere with sucking, chewing, speaking, or other movement of the mouth. The edges of the tongue are clean and red, while its dorsum is covered with a thick, white coating. There is often moderate enlargement and tenderness of the submaxillary lymph glands.

Together with these local symptoms, there is restlessness, increased pulse rate, elevated surface temperature, dryness of the skin, thirst, anorexia, nausea with frequent eructations of acid liquid and occasional vomiting, and either constipation or diarrhœa. The loss of appetite is due both to the painful condition of the mouth and to the disordered state of the stomach.

When all the ulcers appear simultaneously, the disease runs its course in from four to seven days. The fibro-cellular exudation covering their floors then disappears, leaving the mucous membrane beneath intact, but intensely red, though occasionally shallow, clean ulcers are left, which quickly heal. At the same time the local and constitutional symptoms rapidly subside. If, on the contrary, the ulcers develop in successive crops, as is sometimes the case, the duration may be prolonged for a fortnight or more.

There is another form of aphthous stomatitis, termed *confluent*, in which the aphthæ are very numerous, and tend to run together, forming large, irregular ulcers. The symptoms are proportionately severe. It occurs secondarily to grave constitutional diseases—namely, measles, variola, scarlet fever, diphtheria, typhoid fever, pneumonia, and whooping-cough.

The **diagnosis** of the ordinary, discrete form is unattended with difficulty. Thrush bears the closest superficial resemblance; but in this disease the creamy-white spots are slightly raised above the surface, being deposits upon the mucous membrane. There are no ulcerations, the color of the free membrane is rather purplish than scarlet, and finally the thrush fungus is discoverable by the microscope. The graver, confluent form is distinguished from ulcerative stomatitis by the absence of fetor, and by the different seat and appearance of the lesions. The ulcers in the latter disease always begin at the margins of the gums, extend rapidly, and present grayish floors.

Aphthous stomatitis is usually a mild disorder, recovery taking place quickly and without difficulty. The confluent form, besides running a longer course, is more difficult to cure, on account of the general debility induced by the associated disease.

Treatment.—Since some disturbance of digestion is constantly at the bottom of the local trouble, attention to the feeding apparatus and to the diet is of great importance. Absolute cleanliness of both bottles and tips must be insisted upon, and if a complicated, patent arrangement of rubber and glass tubing has been used with the bottle, it must be at once discarded and a simple rubber tip substituted. Regular hours for meals—the frequency varying with the age of the child—are as essential as the selection of suitable food and its administration in proper quantities.

A child of six months should be fed every three hours, between 6 o'clock in the morning and 9 o'clock in the evening. A mixture such as the following—

Sound milk,	f ℥ iij
Cream,	f ℥ j
Lime water,	f ℥ ij
Sugar of milk,	ʒ j ;

may be made immediately before the time of feeding ; poured into an absolutely clean bottle, to which a clean tip is fitted, and the whole placed in a water-bath and heated to a temperature of about 98° F. This preparation is easily digested, contains enough lime water to prevent rapid and firm clotting of the milk, and is not so great in quantity as to overdistend the delicate stomach and cause vomiting.

Children of two years of age and over should be placed on a simple diet: a breakfast, luncheon, and supper of stale bread and milk guarded by lime water (one part to three) and a midday dinner of broth and well-boiled rice.

The disease usually makes its appearance too long after the causative error of diet to be stayed by the administration of an emetic. If, however, an overloaded stomach be indicated by fever, restlessness, and epigastric pain and distention, a dose of the wine or syrup of ipecacuanha* should be given. If the bowels be constipated, a gentle laxative is required. Probably the best is calomel ; for a child from six to twelve months old a powder containing half a grain of the mercurial and five grains of sugar may be placed dry upon the tongue in the evening, to be followed next morning by a small teaspoonful of magnesia in milk or lemonade. If, on the contrary, there be diarrhœa, the bowels should be first cleared of irritating materials by a teaspoonful of castor oil, into which

* For a child one year old the emetic dose of wine of ipecacuanha is fifteen drops ; of the syrup, half a teaspoonful, repeated if necessary.

five drops of paregoric have been dropped, and the following prescription given :

℞. Sodii bicarbonatis, ... gr. xxiv
Syr. rhei aromatici,
Syrupi, ... aa f℥ss
Aq. menthæ piperitæ, ... q. s. ad f℥iij. M.
SIG.—A teaspoonful every three hours.

The fever, when very moderate in degree, requires only a plentiful supply of cool water to drink, and a hot mustard bath in the evening. The strength of the latter should be one teaspoonful of strong mustard to as much water as will cover the child's legs and hips when in a sitting posture. The duration of the bath should be from five to ten minutes. If the skin be quite hot and dry, a saline diaphoretic is necessary. The best is liquor potassii citratis, in doses of one teaspoonful every two hours. Sometimes it is well to add one-fourth of a drop of tincture of aconite to each dose of the potash solution.

Locally, the best results will be obtained by lightly touching each ulcer with a point of lunar caustic. The pain incident to the application may be prevented by the previous application of a 4 per cent. solution of cocaine. In ordinary cases one such application suffices; in severe, it is necessary to repeat it daily for a week or more. In addition, the mouth must be washed thoroughly and frequently, particularly after food is taken, with cool water; with a solution of permanganate of potassium, gr. iij–f℥j, or of chlorate of potassium, as :

℞. Potassii chloratis, ... gr. xx
Vini opii, ... ♏v
Glycerini, ... f℥j
Aquæ rosæ, ... q. s. ad f℥j. M.

After the fever has subsided, a digestant will be required for a few days. Thus, twenty drops of essence of pepsin three times daily may be ordered; or, if there be acidity, with a

coated tongue, the powder recommended, under the same circumstances, in catarrhal stomatitis.

The local treatment must be persevered in until the ulcers have healed and the mucous membrane has returned to its normal condition.

BEDNAR'S APHTHA is the term applied to an ulceration of the soft palate or of the mucous membrane covering the hard palate. The condition arises in early infancy, and is due to rough cleaning of the mouth, or to the friction of an overlong or badly shaped bottle tip. The ulcer is irregularly triangular or Y-shaped, in the latter case being linear and situated over the palatine suture and the line of junction of the hard and soft palates; the ulcers are shallow and covered by a gray or yellowish coating.

This form of aphtha yields readily to proper treatment, which consists in gentle cleansing of the ulcer with dioxide of hydrogen diluted with an equal quantity of water; the daily application of a weak solution of nitrate of silver (gr. v–f℥j), and the frequent use—every two hours—of a 1 per cent. solution of salicylate of sodium.

ULCERATIVE STOMATITIS.

This affection of the mouth is quite common in childhood. It is usually seen in children between three and eight years of age; is never met with before the commencement of dentition, and is not contagious, though it sometimes occurs in almost epidemic profusion.

The **anatomical lesions** consist of parenchymatous inflammation of the gums, and often of the tongue and cheeks, with ulcerative destruction of the mucous membrane. The tissue destruction may extend to the periosteum and, in extreme cases, produce necrosis of the jaw bone. Microscopical

examination of the floors of the ulcers reveals pus corpuscles, isolated blood corpuscles, and granulated cells, embedded in an amorphous, finely granular mass which is filled with various bacteria. There is no trace of pseudo-membrane.

Etiology.—As the disease is not contagious there is probably no specific epidemic influence in its causation. When groups of cases, large enough to be classified as epidemics, do occur, they are generally limited to single houses or institutions, and may be traced to bad hygienic surroundings affecting alike all the inmates. Insufficient or bad food and residence in unhealthy, cold, damp, ill-ventilated houses constitute one set of causes.

Again, ulcerative stomatitis is very apt to follow in the wake of typhoid fever, scarlatina, measles, variola, and dysentery; and since each of these primary diseases usually occurs as an epidemic, a similar tendency in the sequelæ is readily explained.

A certain amount of reduction of the constitutional vigor seems to be an essential precedent to the development of the disease. Sickly, rickety, and tuberculous children are susceptible subjects, and when the gums are loose, soft, and hyperæmic they are more readily affected than when firm and closely applied around the teeth. I have, however, seen it occur in healthy children. For instance, I lately saw it developed in two children of four and seven years, who had returned to the city after a summer in the mountains, during which there had not been a single day of illness, and, on the whole, two more robust specimens of healthy childhood could not well be found. The attack seemed to be attributable to the opening of a sewer within a block of their home.

The presence of decaying teeth, want of cleanliness of the mouth, and the careless administration of such medicines as mercury, lead, and phosphorus, are exciting causes.

Symptoms.—At first there is a sense of heat and pain in

the mouth, and the breath grows offensive in odor. Next the gingival mucous membrane, immediately about and between the teeth, becomes red and swollen. The swelling rapidly increases, the points of the gum between the teeth standing out like flasks, and the whole margin becoming so soft and tender that it bleeds upon the lightest touch. In the course of twenty-four hours the edge of the gum, where it touches the teeth, changes from a bright red to a yellow or yellowish-gray color, and softens, breaking down into ulcers.

Ulceration generally commences on the external surface of the lower gum, and in the beginning appears as a more or less extended, narrow, and indented gray band, following the line of the teeth. Later it may appear on the outer surface of the upper gum ; on the internal surface of both the lower and upper gums ; on the edges of the tongue, at points where the organ presses against the teeth ; and finally on the cheeks. In the latter position it often happens that the ulceration corresponds exactly with that of one or both gingival borders, forming a single or double strip running parallel with the jaws.

The ulcers are depressed, have a ragged, dirty gray or brownish floor, and intensely red, swollen edges. The mucous membrane not involved shows the characteristics of catarrhal stomatitis.

When the disease is fully developed, the lips are tumid and red. They are held apart, and a stream of yellowish, sometimes bloody, always ill-smelling, acid and viscid saliva constantly drips away, excoriating the skin over which it flows. If the mouth be kept closed, as it sometimes is, half an ounce or more of this fetid fluid gushes out whenever the lips are parted in speaking or in taking food. The submaxillary glands and the lymph glands of the neck are moderately enlarged, and there is often œdema of the face, limited or general, according to the extent of the ulceration.

The mouth is the seat of constant burning and pain ; is hot and tender to the touch, and chewing causes great suffering. Between and upon the teeth there is a deposit of yellow unctuous material. The tongue, in addition to presenting the marginal ulcers, is swollen and heavily coated with a dirty, yellowish-white fur. The speech is thick ; the breath has a characteristic heavy odor ; there is loss of appetite, due principally to the pain produced by chewing and the contact of food with the ulcerated mucous membrane ; thirst is moderately increased ; and the bowels are normal, or inclined to constipation. The little sufferer is restless and sleeps badly. The pulse is feeble, and there are other evidences of general debility, but there is little febrile reaction, the temperature, even in well-marked cases, rarely reaching a higher marking than 99.5° F. in the evening.

In severe and protracted attacks the ulcers increase in breadth and depth, become covered with a gray or brownish pulp, and the teeth, deprived of the support of the gum, grow loose and are easily removed from the alveoli. Sometimes the periosteum of the jaw is destroyed, and more or less extensive necrosis results. Exceptionally, in very weak and badly nourished children the stomatitis runs into actual gangrene or noma.

The symptoms ordinarily reach their height in from two to four days, and, under proper treatment, disappear in as many more, the ulcers cleaning off and healing without cicatrization. Severe or badly managed cases go from bad to worse for a time, and rarely recover under three or four weeks, during which the suffering is extreme. Those involving necrosis of the jaw, and those terminating in noma, run a still more protracted course.

Diagnosis.—The appearances of the gums before ulceration the position in which this process begins, the character of the individual ulcers, and the odor of the breath, furnish a train

of symptoms distinguishing ulcerative stomatitis from any other affection of the mouth.

The **prognosis**, in the vast majority of instances, is most favorable. When necrosis of the jaw occurs, the duration is greatly prolonged, but ultimate recovery is the rule. Intercurrent noma, on the contrary, often leads to the death of the child, and, under the best of circumstances, leaves its traces in permanent deformity of the face.

Treatment.—The first step is to improve the sanitary surroundings of the patient, or, if this be impossible, to remove him to healthful quarters. The importance of cleanliness, fresh air, and sunlight are not to be lightly estimated.

The diet should be liquid, but nutritious. Apart from the fact that solid food will be refused on account of the pain caused by mastication, milk and animal broths are better suited to the somewhat enfeebled digestive powers, and should be relied upon entirely. Cool water ought to be allowed in sufficient quantities to satisfy the thirst.

Of drugs, chlorate of potassium is the most important, since it ranks almost as a specific for this disease. It may be given alone, simply dissolved in water, or combined with dilute muriatic acid, as in this prescription :

℞. Potassii chloratis, ... gr. xlviij
Acidi muriatici dil., ... f℥j
Syrupi, ... f℥ss
Aquæ, ... q. s. ad f℥iij. M.

S.—One teaspoonful, diluted, every two hours, for a child three years old.

In this combination the chlorate of potassium, being eliminated by the salivary glands, constantly comes in contact with, and acts as an alterative upon, the ulcers. The muriatic acid aids digestion, and acts as a tonic. If a more decided tonic effect be required, one-fourth to one-half of a grain of sulphate of quinine may be added to each dose.

Chlorate of potassium, too, constitutes the main element of

the local treatment. Its action is somewhat improved by the addition of carbolic acid, as in the following wash :

℞. Potassii chloratis, ... gr. lxxx
Acidi carbolici, ... gr. ij
Glycerini, ... f℥j
Aquæ, ... q. s. ad f℥viij. M.

A bit of absorbent cotton saturated with this wash should be thoroughly applied to all the ulcers at least once in every hour ; or, at the same intervals, the child may take a quantity into the mouth, move the cheeks and tongue in such a way as to bring it in contact with the whole mucous surface, and then expel it. Should there be much pain, a four per cent. solution of cocaine may be applied to the ulcerated surfaces two or three times daily. I have also had good results from salicylate of sodium or permanganate of potassium applied as a wash at intervals of two hours.

After the ulcers have healed, the specific treatment may be discontinued, and the patient placed upon a simple tonic, as ferrated elixir of cinchona, in doses of half a fluidrachm three times daily, until the health is perfectly restored.

As additions to this treatment, iron and stimulants will be required in severe and protracted cases. The tincture of the chloride is the best form of iron. It should be given in doses of three drops (♏iss) every two hours for a child three years old, and may be combined very well with the mixture of potash, acid, and quinine (p. 187). The best stimulant is whiskey, in doses of one-half to one teaspoonful, in milk or water, every three or four hours. Indolent ulcers may be stimulated to heal by touching them lightly with the solid stick of nitrate of silver, the parts being first anæsthetized by cocaine. Loosened teeth must always be allowed to remain in position, as they often become firm again after the termination of the disease.

When necrosis occurs, no change is necessary in the gen-

eral plan of treatment. Especial attention, however, must be paid to the cleanliness of the mouth, and hot compresses should be kept constantly applied to the cheek of the affected side. Surgical interference may become necessary.

GANGRENOUS STOMATITIS—NOMA.

This affection consists of a rapid gangrenous destruction of the cheek and adjacent parts, occasionally beginning on the lips, but usually near one corner of the mouth. It is generally asymmetrical, the left cheek being attacked in the majority of instances, but sometimes both cheeks are simultaneously involved.

Etiology.—Noma is, fortunately, an uncommon disease. Sucklings seem to be exempt from it, and most of the cases occur between the ages of two and twelve years. Girls are more liable to be attacked than boys. It is always of secondary origin, following severe maladies, such as measles, typhoid fever, gastro-intestinal catarrh, ulcerative stomatitis, scarlet fever, smallpox, broncho-pneumonia, tuberculosis, protracted intermittent fever, and whooping-cough. This order also represents the etiological activity of the diseases mentioned. These, then, may be looked upon as predisposing causes; but, despite the presence of any one of them, noma only occurs in those children who have been previously weak, ill housed, and ill nourished.

There is no evidence to show that it is contagious, though it sometimes occurs as an endemic in overcrowded hospital wards and children's homes. These endemics may be explained in the same way as similar outbreaks of ulcerative stomatitis.

Symptoms.—During convalescence from measles, or other of the diseases mentioned, a nodule, from a quarter to half an inch in diameter, appears spontaneously upon the child's cheek,

in the neighborhood of the corner of the mouth. This can be easily detected from the outside, but it is best felt by opening the mouth and grasping the cheek between the thumb and forefinger. It is extremely hard, and very sensitive, especially at the periphery. If the case be seen during the first few hours, the mucous membrane over the mass will be observed to be converted into a flat, ichorous bulla. Usually, however, this membrane is found hanging in ragged shreds from a black, gangrenous base. The skin over the induration is pale or mottled with purple spots, tense and shiny as if oiled.

After twenty-four hours the investing integument becomes bluish, the epidermis scales off, and a black eschar forms. This has a tendency to shrink, and in so doing leaves a linear depression filled with ichor, which separates it from the healthy skin. Notwithstanding this line of demarcation, the tissue destruction rapidly extends, both in superficial area and depth. Soon the cheek is perforated, and a dirty, stinking, ichorous saliva, filled with shreds of broken-down tissue, flows out beside the eschar and over the cheek. At the same time the lips, chin, and uninvolved portions of the cheek become œdematous, the skin being tight and glistening, and the adjacent cervical glands enlarged.

At the very outset there are few constitutional symptoms. The child complains of little or no pain, persists in his amusements, has a good appetite, a temperature but slightly above the normal, and a pulse but moderately increased in frequency. As the eschar forms, the scene changes, symptoms of constitutional depression setting in. The face is pale and expressionless on the affected side, the skin cool and dry, though rarely there is high fever of the hectic type ; the pulse is feeble and frequent—sometimes counting 120 or 140 beats per minute—and there is œdema of the feet. The mind is apathetic, no complaints of pain are made, and at most a sense of discomfort is indicated by constant whimpering. The mouth

is held partly open, the breath is extremely fetid, the teeth and tongue are covered with sordes, and there is an abundant flow of bloody or dark-colored saliva. Severe hemorrhage never occurs, as the blood-vessels are closed at an early stage. The appetite is often retained, the thirst is intense, and the bowels are usually relaxed. In spite of the food taken, the strength rapidly declines; sometimes, though, it is wonderfully retained, the patient being able to sit up, and even leave his bed, until a few hours prior to death.

The air of the sick-room has a characteristic gangrenous odor.



FIG. 6.—GANGRENOUS STOMATITIS.

Perforation of the cheek occurs about the third day of the disease, and many cases die at this time. Others linger until the end of the first or second week. Under these circumstances the gangrene invades the lips as far as the median line, the corresponding ala of the nose, and the cheek as far as the lower eyelids, the tragus, and the inferior border of the lower jaw. Extending inward, the gums and periosteum of the jaws are destroyed; the bone becomes necrotic, and the teeth so loose that they can be readily pushed out by the finger, together with pieces of the alveoli. Finally the cheek is cast off in large, black sloughs, leaving huge openings, with black, ragged, and indurated edges, through which the blackened and necrosed bones and loosened teeth can be seen. The child's face is then unrecognizable; the symptoms of constitutional depression are greatly intensified; there is subnormal

temperature, delirium, profuse diarrhœa, purulent and even gangrenous infiltration of the lungs, and occasionally, also, gangrene of the genitalia, in females. Death is the only result to be expected.

Exceptional cases do recover. In these, the gangrenous edges become clean and covered with granulations, the necrosed bone is thrown off, and, after months, cicatrization takes place, with great disfigurement.

Pathology and Morbid Anatomy.—The fact that noma makes its appearance uniformly at one point, on the cheek, and is unilateral, suggests a localized causative lesion. The most natural theory, that of embolism of a large arterial branch, due to weakness of the cardiac muscle or increased coagulability of the blood,—effects of the primary disease,—is untenable, because, with the given conditions, emboli ought, at least occasionally, to be found in other positions, which does not happen. It is necessary to look rather to the nerves: namely, the trifacial, the facial, or the vaso-motors. That the gangrene is due to a lesion of one of these, seems to be borne out by experiments. Thus, Magendie found that division of the trifacial in dogs caused destruction of the corresponding eyeball, and half of the tongue became dry, brown, and fissured, the gums spongy and hemorrhagic, and the teeth loose. "In animals tenacious of life, the batrachians, for example, the soft portions of the face are cast off in shreds, just as in spontaneous gangrene. After three or four weeks only one-half of the face remains." *

A variety of bacteria can be found at the seat of lesion, but their presence has no etiological significance. The body of a child dead from noma has a gangrenous odor and decomposes quickly; the skin is shriveled, and the face and the feet are œdematous. The gangrenous parts are converted into a

* Vogel, "Ziemssen's Cyclopædia," vol. VI, p. 812.

blackish-brown mass, and the maxillary bones are naked, brownish in color, and brittle. The nerves, when examined microscopically, are yellowish in color but unaltered in structure, and the blood-vessels are thickened and filled with thrombi. In the uninvolved parts of the cheek there is a dense exudation, while the palate, tongue, and tonsils are swollen and covered with black scales and crusts. The lungs are the seat of hemorrhagic infarctions, lobular or metastatic lobar pneumonia, and sometimes gangrene. The intestines are catarrhal. Evidences of the primary disease may also be present; for example, the lesions of typhoid fever or dysentery.

Noma of the genitalia, though rare, is occasionally encountered. I have seen several cases within the last three years. The local appearances and the clinical history as to causation, and so on, correspond with what has already been stated. The possibility of such an occurrence should be borne in mind as a matter of interest.

Diagnosis.—Noma is readily distinguished from other oral affections by its course, its peculiar and almost uniformly identical seat, and its well-marked local features.

Ulcerative stomatitis is the only other of the class at all likely to be confounded with it. This begins with ulceration of the gingival margin, and when the cheek becomes involved, the ulcers situated there are linear in shape and have a grayish floor. There is no sloughing or gangrene of the mucous membrane. The cheek never presents a circumscribed induration, being at most simply œdematous. The skin shows no tension, unctuous appearance, or discoloration, and perforation of the soft parts never occurs. The breath is fetid but not gangrenous; salivation is less, and the saliva, though sometimes bloody, is not mixed with shreds of gangrenous tissue. The course is much less rapid, and the ulcers, while they extend in area, retain the same appearances throughout.

Finally, the general symptoms are distinctive, the results of treatment are most satisfactory, and a fatal termination is extremely uncommon.

Malignant pustule closely resembles noma. The former, however, always begins on the exterior, involving the epidermis first and extending through the successive layers of skin to the deep structures.

The **prognosis** is most unfavorable. Vogel sets the mortality at 80 to 90 per cent.,* and out of one hundred and two cases that came under the observation of Steiner,† only four recovered. Death may occur at any time between the third and fourteenth day; a rapid course, however, is very much more frequent than the reverse. Even when recovery does take place, the patient is permanently disfigured by scars, or crippled by the development of ectropion, or of restricted movement of the jaw, in consequence of cicatricial contraction, or by the loss of teeth and portions of the maxillary bones. Such cases also drag through a very protracted convalescence.

Treatment is most unsatisfactory. Something can be done in the way of prophylaxis by a proper management of the known predisposing diseases. Secure sound hygiene in the sick-room; give good nourishment, and avoid the abuse of mercurials and debilitating treatment generally.

If, notwithstanding these precautions, noma appears, it is of the first consequence to maintain the strength by the use of concentrated liquid food, tonics, and stimulants. When perforation of the cheek takes place, the act of swallowing is mechanically interfered with. It is necessary then to resort to nutritious enemata, suppositories of quinine, and even the rectal administration of stimulants.

The room in which the treatment is conducted must be large,

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* "Ziemssen's Cyclopædia," vol. VI, p. 812. † "Diseases of Children," p. 218.

airy, and so situated as to be exposed, for a part of the day at least, to the sun's rays. In summer the windows should be kept constantly open, and in winter they must be raised for at least fifteen minutes several times daily, the patient being warmly covered in the mean time. The air of the chamber must also be kept as pure as possible by the use of disinfectants. For this purpose cloths saturated with a solution of chlorinated soda or with Platt's chlorides may be hung about the bed.

Early, bold cauterization with the thermo-cautery of Paquelin or the galvano-cautery is the most promising procedure; strong sulphuric or muriatic acid, or the solid stick of nitrate of silver, are also recommended. All sloughs must be removed by scissors. The gangrenous spots should be frequently bathed with a strong solution of chlorate or permanganate of potassium, carbolic acid, or chlorinated lime. Pieces of lint soaked in one of these solutions may, with advantage, be left in contact with the ulcer, if the child will tolerate a fixed dressing. In cases of perforation, much of the wash will run into the mouth, and care must be taken to prevent its being swallowed. The mouth must be kept as clean as possible by repeated syringings with a solution of chlorate of potassium and carbolic acid, ten grains of the former and one grain of the latter to the fluidounce.

When recovery occurs and is fully established, loss of tissue and the deformities resulting from cicatricial contraction may be, to some extent, remedied by plastic surgery. Early operations are not advisable, on account of their tendency to reestablish the disease.

PARASITIC STOMATITIS—THRUSH.

Thrush is characterized by the appearance of numerous, rapidly growing, white, curd-like flakes upon the oral mucous

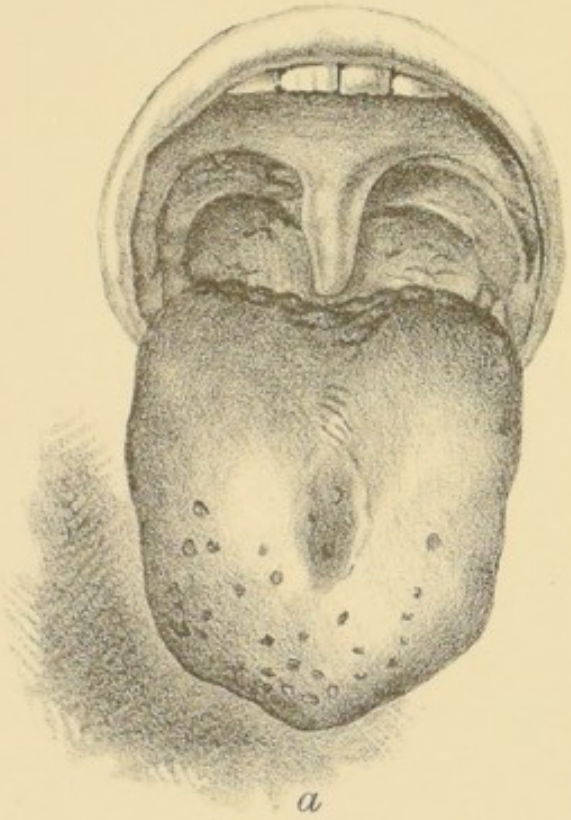
membrane; the latter being in a more or less catarrhal condition, injected, swollen, hot and tender to the touch. The flakes are due to the development of a peculiar vegetable parasite, the saccharomyces albicans. Thrush occurs both as a primary and a secondary affection.

Etiology.—The disease attacks sucklings, and is met with most frequently during the first three months of life. Children nursed at a healthy breast are never attacked, and rarely those belonging to the well-to-do classes, because of the attention given to cleanliness of the mouth and feeding apparatus.

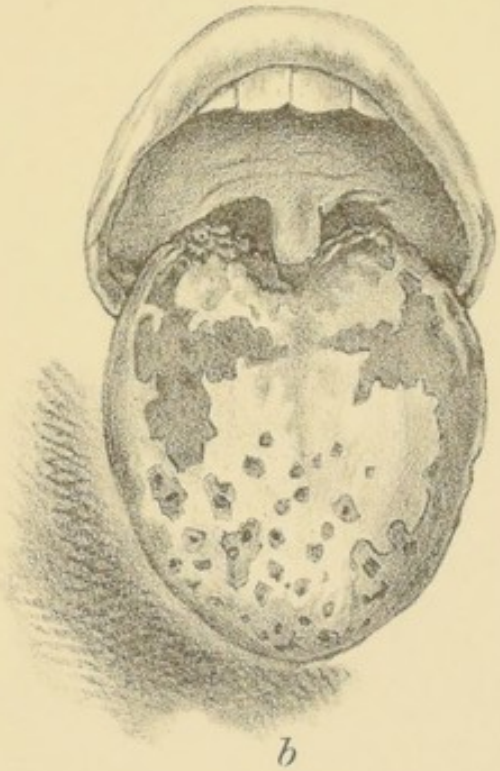
Neglect of this fundamental principle, cleanliness, lies at the foundation of every case of primary thrush. Foulness of the mouth implies a condition in which the secretions and the food clinging to the mucous membrane are undergoing acid fermentation, a necessary precedent to the development of the fungus. Given this condition, thrush originates by contact with other cases, through the media of bottle-tips, spoons, tumblers, or cups used in common, or may arise without traceable contagion from carelessly kept and foul feeding utensils.

The secondary form has the same direct causes, but arises during the course of gastro-intestinal disorders, especially those resulting from a too free dietary or the overuse of farinaceous food. It may occur, also, as a complication of diseases that greatly impair the general nutrition, as the exanthemata, tuberculosis, spinal caries, etc. The disease is most prevalent during the summer months.

The **morbid appearances** are the same in both forms. Prior to the appearance of the flakes, the oral mucous membrane is purplish-red and sticky, and its secretion, which is acid in reaction, shows, under the microscope, numerous spores, egg-shaped, sharply outlined, and hanging together in twos and threes. Soon, isolated white points, as large as a



a



b

PLATE I. DIAGRAMS OF TONGUE IN MUCOUS DISEASE.

a. GLAZED TONGUE *b*. WORM-EATEN TONGUE.

TO FACE P. 142.

pin's head, appear on the inside of the cheeks. These rapidly increase in extent and number, involving other parts of the mucous membrane, and, often as early as the second or third day, large white flakes are formed. Later still, the whole cavity of the mouth, and in some cases even the pharynx and œsophagus, are covered.

The patches, at first white, may become yellow, and sometimes brown, if bleeding occur from rough handling of the mucous membrane. Their surface is somewhat velvety, and they are soft, breaking down like curd under the finger. During the first few days they adhere firmly to the mucous membrane ; afterward they become quite loose, and can be wiped off quite readily, leaving the epithelial surface intact.

Microscopic examination of the fully formed patches reveals numerous irregularly developed fungoid filaments, with laterally branching arms and buds, interspersed with round or oval sporules, and embedded in an amorphous, granular mass. A hardened section of a patch and the mucous membrane to which it adheres shows, in addition to these characters, a partial loss of epithelium, and a tendency on the part of the filaments to penetrate into the mucous glands and between the cells of the deeper layers of the epithelium.

The fungus seems to grow most freely upon squamous epithelium. It is never found in the nasal cavities, the larynx, or the trachea, and the presence of loose masses of it in the stomach may be regarded as accidental. On the other hand, it may be formed upon the lower segment of the rectum, the female genitals, and on abraded surfaces about the mouth, chin, and neck.

Symptoms.—The primary form begins with heat, dryness, tenderness, slight swelling, and uniform redness of the mucous membrane of the mouth ; in other words, catarrhal stomatitis. The redness is combined with a purple tinge, which is most marked on the dorsum of the tongue. Here, too, prominence

of the fungiform papillæ is noticeable. The child takes his food moderately well, but the meals are frequently interrupted on account of the pain caused by sucking. He is fretful and sleeps poorly. The bowels are moderately relaxed, the stools being liquid and yellow in color. In the course of twenty-four hours the thrush patches appear on the inside of the cheeks, and then extend to the lips, tongue, and palate. While extending they increase in size, though they usually remain isolated and rarely overstep the limit of the posterior border of the soft palate. With the appearance of the patches, there is increased fretfulness, more pain on sucking, occasional vomiting, and frequent evacuation of the bowels, the motions becoming green and acid. At some period, varying from six to twelve days from the beginning of the disease, the patches become loose and are removed by the act of sucking or in making applications to the mouth. The mucous membrane is left red but free from ulceration, and it soon returns to the normal condition. At the same time the general symptoms subside, and health is soon restored. Sometimes there are several crops of the fungus, but those coming last, being less firmly rooted than the first, are dislodged quickly and seldom prolong the course of the disease beyond two or three days.

In secondary thrush a history of previous gastro-intestinal or other disease will be obtained, together with an account of an immediately preceding diarrhœa and fever. Sometimes, however, the local symptoms are the first indications that the weak, badly nourished child is ill. The preliminary catarrh of the mouth is very marked, the mucous membrane being intensely red and shining. The patches are thick, are apt to change from a white to a yellow or brown color, soon cover the whole oral cavity, and frequently extend into the pharynx and down the œsophagus. They retain their attachment to the mucous membrane for a much longer period than in the idiopathic form. When they fall off they are quickly replaced

by others, and a succession of crops is the rule up to the termination of the case in death. The mouth is hot, dry and tender to the touch, and throughout presents an acid reaction to chemical tests.

The appetite is gradually lost; there is vomiting, either occasional or so constant that every morsel of food taken into the stomach is rejected at once, and obstinate diarrhœa, the stools being numerous, liquid, green in color, and acid. The abdomen is distended by flatus, and is tender to pressure, particularly in the epigastrium and right iliac region. Colic is a constant and annoying symptom. The pain is most severe just before or at the moment of an evacuation of the bowels.

The skin is hot and dry and the frequency of the pulse increased, a rate of 120, 140, or 160 beats per minute being not unusual.

The child sleeps badly, is restless and fretful, and when the pharynx is covered by the fungus, has a muffled, hoarse cry. The skin grows pale and inelastic, and the folds of the nates, the inner surface of the thighs, and the heels are reddened and eventually excoriated by the contact of the acid fæces. The strength and flesh are lost rapidly, the anterior fontanelle sinks, the eyeballs lie deep in their sockets, and the nose and chin are pointed. Toward the latter end of the attack, which is rarely protracted more than a few weeks, the patient assumes the facies of a little, wrinkled old man. His skin is cool, and he lies in an apathetic condition on the bed or nurse's lap, with scarcely enough strength to whine over his suffering until death, from exhaustion, ends the miserable life.

Diagnosis.—Fragments of curdled milk adhering to the soft palate and cheeks resemble very closely the thrush patches in their earlier stage. The normal condition of the mucous membrane, and the readiness with which the curds can be wiped away, constitute the distinctive characteristics.

Aphthous stomatitis bears a certain superficial likeness to

thrush, but the differentiation is easily made by noting the fact that the yellowish-white spots of the former are depressed below the surface of the mucous membrane, being, in reality, the floors of ulcers, which in time are bounded by dark red borders.

Microscopic examination is always the crucial test, and the presence or absence of thallus-fibrils and spores decides the question as to the nature of any deposit in the mouth.

Prognosis.—The primary form is a very trifling affection and almost uniformly ends in recovery. In the secondary form the result is very often unfavorable. This is especially apt to be the case when the disease occurs in a child who has been much weakened by a continued course of improper food. Here, the hope of improvement depends upon the rapidity and completeness with which new material for nutrition can be introduced into the system. Anything, therefore, that tends to prevent this introduction deprives the child of his only chance of recovery, and the existence of thrush implies a condition of the digestive tract extremely unfavorable to the assimilation of food. Attendant diarrhœa aids, too, in precipitating the fatal result.

The mere presence, then, of the thrush patches is not to be regarded with as much anxiety as the conditions accompanying their formation.

Treatment.—Much may be done to prevent the development of thrush by keeping the mouth clean and free from the abrasions caused by rough manipulation. A strict rule should be made to carefully wash out a child's mouth directly after each meal. This is best done with a large camel's-hair brush or a pledget of absorbent cotton moistened with warm water. The bottles and tips must also be kept immaculately clean. An equally important precaution is to select a proper diet. The question of diet is, of course, a very comprehensive one, and no further consideration can be given it in this place than

to state the general law. Babies under six months old, who are unfortunate enough to be deprived of their mothers' milk, must be fed upon cows' milk so prepared that it may resemble as nearly as possible human milk. If farinaceous articles be used, they must be employed with the object of rendering the cows' milk more digestible by separating the curd, and not as the staple of the food. The regularity and the length of the intervals between meals, the selection of the proper quantity of food, and the preparation of each portion immediately before it is given, are matters worthy of the most careful attention.*

Such measures, together with attention to general hygiene, constitute an important part of the curative treatment after the appearance of the fungus. In idiopathic or in mild cases all that is required in the way of general treatment will be an alkali combined with a digestant, as in the formula already given for catarrhal and aphthous stomatitis ; † or, if the stools be numerous, green, and very acid :

℞. Magnesii carbonatis, ... ℥j
Syr. rhei aromatici, ... f℥ij
Syrupi, ... f℥ss
Aq. menthæ piperitæ, ... q. s. ad f℥iij. M.

Sig.—Teaspoonful every two or three hours, for a child three to six months old.

The local treatment consists in keeping the mouth perfectly clean. It should be thoroughly washed, every hour at least, with absorbent cotton wrapped around the finger and wet with warm water. Immediately afterward, either one of the following lotions may be applied, upon a fresh piece of cotton :

℞. Sodii bicarbonatis, ... gr. x
Aquæ, ... f℥j. M.

* See Introduction.

† See page 177.

℞. Sodii hyposulphitis, ... gr. x
Aquæ rosæ, ... f℥j. M.

℞. Acid. carbolici, ... gr. ij
Sodii salicylatis,
Sodii boratis, ... āā gr. xxx
Glycerini, ... f℥ij
Aquæ rosæ, ... q. s. ad f℥j. M.

It is essential immediately to destroy the cotton or other instrument used in cleansing the mouth or in carrying the lotion.

The same principles are applicable to the treatment of secondary thrush. Every means must be employed to arrest the vomiting and diarrhœa, to improve the digestive powers and maintain the strength by proper food and stimulants. In some cases the abandonment of artificial feeding and the employment of a wet-nurse are essential to recovery.

MEMBRANOUS STOMATITIS.

A croupous membrane—that is, one in which the Klebs-Loeffler bacillus is absent—is sometimes encountered in the mouth, but this condition is extremely rare, the vast majority of cases of membranous stomatitis being diphtheritic.

Diphtheria of the mouth may occur as a primary disease, though it is usually secondary, the membrane extending from the tonsils to the soft palate, tongue, gums, cheeks, and lips. When primary, the deposit appears first upon the lips, and thence may spread to any portion of the mucous membranes of the mouth; it often runs a most insidious course.

The **symptoms** are salivation, fetor of the breath, enlargement and tenderness of the submaxillary lymphatic glands, the ordinary constitutional features of the infection, and the presence of the characteristic patches of false membrane upon the mucous surface. The membrane remains from three

to six or more days, and then exfoliates or ulcerates away, leaving a denuded base. Hemorrhage takes place frequently; when due to mechanical irritation, it is of little moment, but occurring spontaneously is an evidence of grave cachexia even when trifling in amount, and when profuse may be the direct cause of a fatal termination.

The **diagnosis** of the primary form can only be positively established by culture and the discovery of the Klebs-Loeffler bacillus; the secondary can readily be distinguished as an extension from tonsillar diphtheria.

Treatment consists in removal of the false membrane, if this can be accomplished without traumatism; the free and continuous employment of antiseptic washes, the early administration of antitoxin and of the remedies of known efficacy in diphtheria, especially bichloride of mercury. Great care must be taken to maintain the patient's strength by strychnine, alcoholic stimulants, and nutritious, easily digested food.

SYPHILITIC STOMATITIS.

Syphilis may indirectly produce stomatitis; first, by causing certain specific lesions, which give rise to disease of the mucous membrane generally, and secondly, by bringing about a greater susceptibility to the ordinary causes of oral disorders.

The primary specific lesion is not often found in the mouth in infancy or childhood, but it may be produced by infection from a syphilitic nipple, and appears upon the tongue, lip, or tonsil; the character of the sore does not differ from the initial lesion in the adult.

The features of the inherited disease are much more frequently present, and appear as fissures, papules, mucous patches, and ulcers.

Syphilitic fissures are the most common, and are found chiefly at the corners of the mouth, or upon one or other

lip. They consist of tissue infiltrations which have been split in two by the movements of the lips, the fissures usually being in such a position as to form a continuation of the commissure of the mouth and to leave one part of the infiltration nearer the lower, the other nearer the upper lip. They may be single or so numerous as to cause disfigurement and considerable pain on motion of the lips; they run a very chronic course, healing with great difficulty and leaving permanent and distorting cicatrices. Papules arise at the angles of the mouth and upon the free margin of the lips. These elevations have moist surfaces, and show a tendency to break down in the centre or to split into fissures, and are painless when they do not involve the mucous membrane. Mucous patches may develop from fissures or papules, and are most frequently seen about the lips and upon the tongue. They are whitish in color, slightly raised above the surface of the mucous membrane, do not extend deeply into the tissues, have rounded borders, and vary in size from one-eighth to one-half of an inch in diameter. Syphilitic ulcers are found upon the tongue, their position depending upon some mechanical irritation, as from a sharp tooth.

In hereditary syphilis the milk teeth are apt to be cut early and are prone to rapid decay, but show no other abnormality. The two upper, central incisors of the permanent set, however, are quite characteristically affected in many cases. The alteration termed "Hutchinson's teeth" consists in dwarfing of the teeth in both length and width and notching of the centre of the free edge. The teeth, in addition to being smaller than normal, often taper regularly from the base to the edge, are rounded and peg-like in shape, incline either toward or away from each other, and do not meet the teeth on either side; the notch is single, shallow, and crescentic in shape; in its centre the enamel is deficient, and in this position there may be discoloration.

Syphilitic lesions of the mouth, being merely local manifestations of a general condition, require the usual vigorous constitutional treatment. Locally, strict cleanliness must be enforced. Fissures and ulcers must be encouraged to heal by the application of nitrate of silver; indurations and papules should be freely anointed with a mercurial ointment; and mucous patches should be dusted with a powder composed of equal parts of calomel and subnitrate of bismuth, or washed with a weak solution of bichloride of mercury.

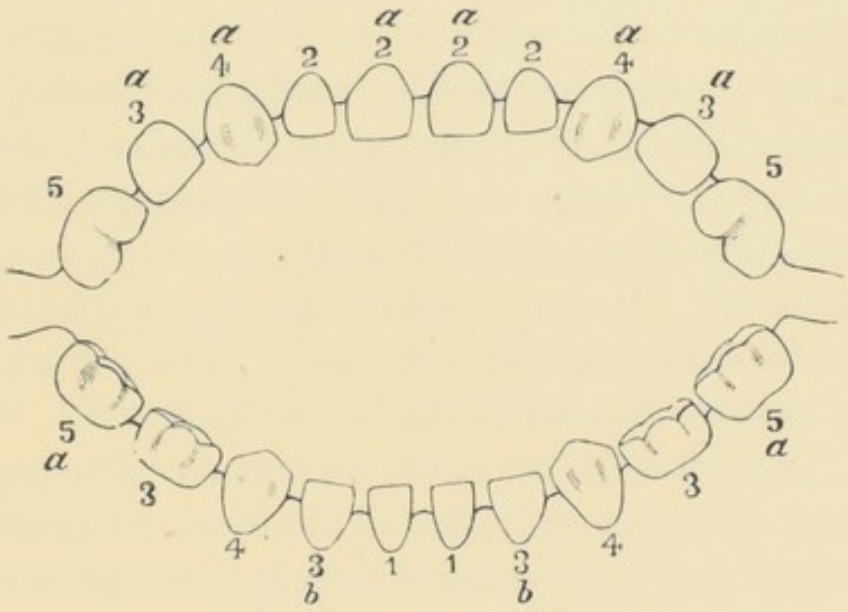


FIG. 7.—DIAGRAM SHOWING ERUPTION OF MILK TEETH.

1, 1. Between the fourth and seventh months. Pause of three to nine weeks. 2, 2, 2, 2. Between the eighth and tenth months. Pause of six to twelve weeks. 3, 3, 3, 3, 3, 3. Between the twelfth and fifteenth months. Pause until the eighteenth month. 4, 4, 4, 4. Between the eighteenth and twenty-fourth months. Pause of two to three months. 5, 5, 5, 5. Between the twentieth and thirtieth months.

DENTITION.

ERUPTION OF THE TEMPORARY TEETH.

Normally the twenty milk teeth are cut in groups, each effort being succeeded by a pause or period of rest. The accompanying diagram and table show the grouping, the date of eruption, and the duration of the pauses. The numbers, 1 to 5, indicate the groups to which the individual teeth belong

and their order of appearance, and the letters, *a* and *b*, the precedence of eruption in the different groups.

The dates given above show the time within which the different teeth naturally may be expected. In regard to the period given for the eruption of the lower central incisors, I would state that the fourth month, although an early, is not a very rare time for their appearance. For example, in the past winter alone, I have seen five cases in which these teeth pierced the gum at this age.

Often the teeth appear without the production of any symptoms. Sometimes the edges of the gums lose their sharpness and become swollen, rounded, and reddened as the teeth approach the surface. At the same time the saliva is increased in quantity, and the mouth is unnaturally warm and the seat of abnormal sensations, evidenced by the tendency to bite upon any object that comes to hand—in other words, there is a condition of mild catarrhal stomatitis. The consequent discomfort, though, is not sufficient to interfere with the child's appetite, good humor, or sleep, and when, after a few days, the margin of the tooth is free, all the local symptoms vanish.

Abnormal dentition is manifested by departures from the laws of development already stated. The standard rules may be departed from in three ways:

1. The appearance of the teeth may be premature. Children may be born with one or more of their teeth already cut. These are usually imperfect, and soon fall out, to be replaced at the proper age by well-formed milk teeth. Sometimes, however, they remain permanently, as in a few cases that have come under my own observation. Natal teeth are always incisors. Instances of the lower central incisors being cut in the third month are not uncommon. Girls are more apt than boys to cut their teeth early, and, as an early dentition is likely to be an easy one, the occurrence is to be looked upon as fortunate.

2. Dentition may be delayed. This deviation is more frequently seen and of more consequence than the first. Bottle-fed babies, as a class, are more tardy in cutting their teeth than those reared at the breast. With such, though healthy in every respect, a delay of one or two months is a common and not at all a serious event. On the contrary, whatever the method of feeding, if no teeth have appeared by the end of a year, it may be assumed that the child's general nutrition is faulty, or that rachitis is present. Delay does not necessarily imply difficulty in cutting the teeth, though the two conditions are often associated.

3. The teeth may appear out of their regular order. Bottle-fed infants are most likely to show this irregularity, which is of some importance as an indication of general feebleness. In other instances, however, it is merely a family peculiarity, and, as such, bears no special significance.

ERUPTION OF THE PERMANENT TEETH.

The permanent teeth are cut in the following order :

1. Four first molars, five to six years.
2. Four central incisors, six to eight years.
3. Four lateral incisors, seven to nine years.
4. Four first bicuspids, nine to ten years.
5. Four second bicuspids, ten to twelve years.
6. Four canines, eleven to thirteen years.
7. Four second molars, twelve to fourteen years.
8. Four posterior molars, or "wisdom teeth," seventeen to twenty-one years.

Of the twenty-eight teeth cut between the fifth and the fifteenth years, the first and seventh sets are developed *de novo*. The other sets take the place of corresponding milk teeth, and appear in very much the same order, the lower central incisors appearing before the upper, the upper lateral incisors before the lower, the upper bicuspids before the lower, etc.

Figure 8 will aid in explaining the process.

As these teeth approach the surface, absorption begins in the alveoli and at the roots of the deciduous teeth, and this continues until the latter are loosened and readily extracted, or if this be not done, until little is left but their crowns.

When the first and second molars approach the surface, the gums, just as in primary dentition, may become red, swollen, rounded, and tender. The salivary secretion is increased, the mouth is hot, the patient complains of aching in the gum, and, on account of tenderness, refuses food requiring mastication.

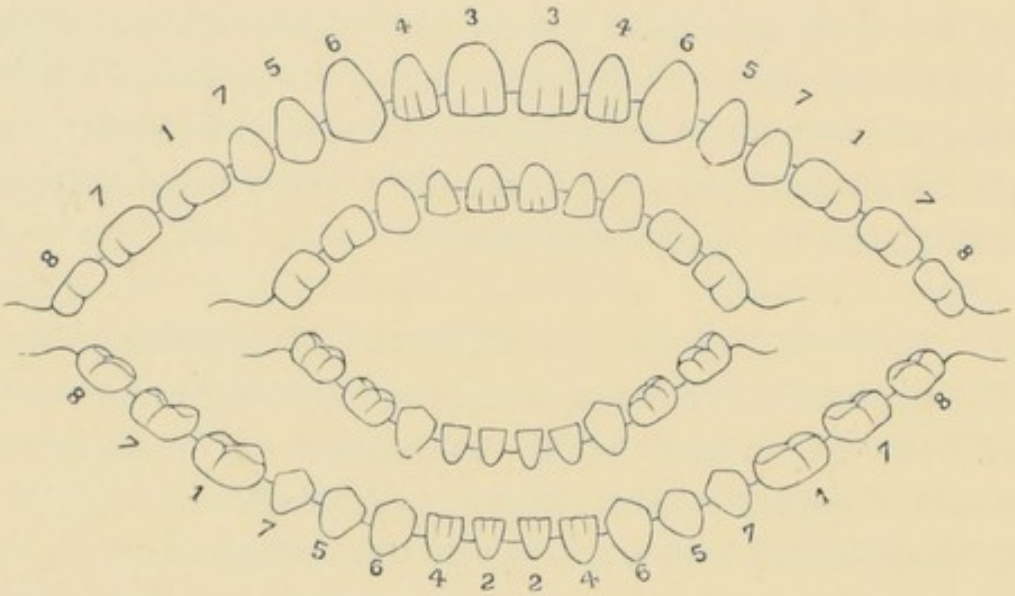


FIG. 8.—DIAGRAM SHOWING RELATION BETWEEN THE PERMANENT AND TEMPORARY TEETH.

The figures 1, 2, 3, etc., indicate the groups of teeth and the order of their appearance.

With the other sets there is a gradual loosening of the superimposed temporary teeth, pain on mastication, redness and tumefaction of the gum, and augmented flow of saliva. As there is no impairment of the general health, these trifling symptoms must be regarded merely as manifestations of the progress of a physiological process.

Many diseases occurring in infancy were formerly attributed to dentition, but as pediatrics has been more carefully studied and better understood, one disorder after another has been

relegated to its proper etiological class, and teething is now regarded as a purely physiological process, unproductive of symptoms. All that can be said is that the interval between the fourth and thirtieth months of an infant's life—the period of primary dentition—is an era of great and widely extended physical progress. The teeth are advancing; the follicular apparatus of the stomach and intestinal canal is undergoing development in preparation for the digestion and absorption of mixed food; the cerebro-spinal system is rapidly growing and functionally very active, and the organs and tissues of the

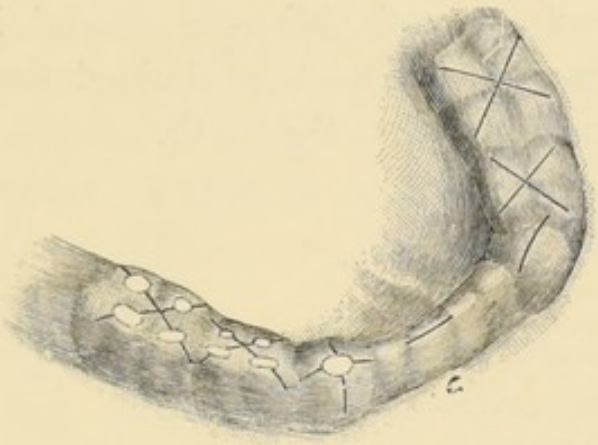


FIG. 9.—DIAGRAM OF LINES OF INCISION IN LANCING THE GUMS.*
The above diagram plainly shows the lines of incision over the different teeth before eruption and after partial eruption.

whole body are in a state of active change. This period of normal transition must also be one in which there is great susceptibility to abnormal change, or disease, provided there be a causal influence at work. Such an influence usually originates outside of the body, as when there is exposure to cold or to contagion.

With the recent and more correct understanding of the process of dentition, gum lancing has been less and less indiscriminately practised. The operation, however, must not

* From "Diseases Incident to First Dentition." James W. White, M.D., D.D.S.

be absolutely condemned, for in certain well-selected cases, in which the gum over an advancing tooth is swollen and tense, and in which there is severe local pain, free incision gives prompt and lasting relief. Such incision, if carefully made with a clean blade, is free from direct danger; in the formerly almost universal use of the lancet in every affection of teething infants, the risk lay in too great reliance upon the operation, to the neglect of proper dietetic and medicinal treatment.

In lancing the gums the form of incision is important. As shown in figure 9, it must be linear in the case of the incisors and canines, and obliquely crucial in that of the molar teeth; the tissues must be divided until the edge of the lancet distinctly touches the tooth.

CHAPTER II.

AFFECTIONS OF THE THROAT.

SIMPLE PHARYNGITIS.

Catarrh of the mucous membrane covering the soft palate, tonsils, and pharynx—simple or erythematous pharyngitis—is a common occurrence in children who have reached the third or fourth year, though it is rarely met with before that age. It may be either primary or secondary in origin.

The **anatomical lesion** is hyperæmia of the affected mucous membrane. This is red, swollen, softened, granular, and at times œdematous.

Etiology.—The primary form is most prevalent during the winter and spring. Impaired health, from neglect, bad food, or insufficient clothing, predisposes to an attack; while sudden changes in temperature and exposure to wet and cold are the chief excitants. One attack is often followed by others. The disease is not contagious, but many cases often occur simultaneously. Secondary pharyngitis, which will not be studied here, constantly accompanies scarlet fever and measles, and often complicates bronchitis and pneumonia.

Symptoms.—An attack of simple pharyngitis of ordinary gravity begins with fretfulness and lassitude; the child refuses food, and may vomit once or twice. Fever quickly follows, preceded by rigors, or, in children nearing the age of puberty, by a single distinct chill. This fever is quite out of proportion to the local symptoms. The temperature in the course of a few hours rises to 102° or 104° F., and often higher; the pulse runs up to 130 or 140 beats per minute; the

respiration is correspondingly rapid, though easy; the face is flushed and the skin dry. The voice becomes thick and husky, and there is a teasing unproductive, hoarse cough, which may assume a brazen character toward evening. Older patients may complain of dryness and fulness of the throat, of a sensation leading to frequent efforts at deglutition, or of difficulty and pain in swallowing food; while infants manifest the latter conditions by refusing the breast or bottle. An entire absence of these subjective symptoms, however, is common.

On inspection, the mucous surface of the soft palate, uvula, tonsils, and pharynx presents a reddened, tumefied, dry, granular appearance, and may be partially covered with flakes of whitish mucus or muco-pus. The tonsils are somewhat swollen, and at times the uvula is elongated and œdematous. The lymph glands about the angles of the jaw are slightly enlarged and tender to the touch.

On the second day the fever abates, the temperature often falling to the normal line, but there is an elevation on each succeeding evening until the end of the fourth or fifth day, when the attack begins to subside. In the mean time the local symptoms increase. Throughout, the child is peevish and restless, sleep is disturbed, the tongue is heavily coated, and there is loss of appetite, increased thirst, and a tendency to constipation.

In exceptional cases the disease is much more grave in type. These severe attacks begin with vomiting, excessive restlessness or drowsiness, occasionally convulsions, and always high fever, with a temperature reaching 106° or even more, and a rapid and bounding pulse. The affected mucous membrane becomes intensely red and covered with a muco-purulent secretion. All the ordinary symptoms are intensified, and, in addition, there may be mild delirium and a flushing of the entire cutaneous surface, suggesting the scarlatinal rash.

These attacks vary in duration from three to eight days, and, notwithstanding the alarming character of the symptoms, usually terminate in recovery.

Diagnosis.—It is quite possible to overlook the presence of pharyngitis on account of the frequent absence of symptoms calling attention to the throat. Thus the sudden onset of high fever, with rapid pulse and respiration and dry cough, would, in the absence of difficult deglutition and pain in the throat, suggest an attack of croupous pneumonia. If, under the same conditions, the pharyngitis be ushered in by vomiting, the fever might readily be referred to a digestive disorder. Such errors are to be avoided only by making a rule to inspect carefully the throat in each doubtful case. A grave case, again, may in the beginning be taken for one of scarlet fever, the resemblance being increased by the uniform flushing of the surface. Distinction is to be found in the different course of the two diseases, and the non-appearance of certain characteristic symptoms of the exanthem.

Care must be taken not to confound the white or yellowish-white patches of mucus or muco-pus adhering to the inflamed surface with diphtheritic membrane. The former can be wiped away easily, leaving the mucous membrane intact.

Treatment.—If the case be seen on the first day, it is possible greatly to reduce the severity of the attack by giving the child a hot mustard foot-bath,* putting him to bed in a properly warmed room, and by cautiously administering aconite, with some saline laxative, as a small teaspoonful of magnesia in a wineglassful of strong lemonade. Under such circumstances, tincture of aconite root may be given to a child of four years, in doses of a drop, every fifteen minutes until four drops have been taken, and subsequently the same dose every

* The ordinary strength of such a bath for a child of three or four years is one tablespoonful of mustard-flour in two gallons of water.

hour until an effect is produced on the pulse, or the heat and dryness of the skin are lessened.

When the fever has been reduced in this way, or should the case not be seen until the second day, the following may be ordered :

℞. Potassii chloratis, ... gr. xxiv
Syrupi, ... f℥ss
Aquæ, ... q. s. ad f℥iij. M.
SIG.—One teaspoonful every three hours in water, for a child of four years.

If the fever returns as evening approaches, this mixture should be discontinued, and another foot-bath and a few doses of aconite given ; or some simple diaphoretic may prove sufficient, as one teaspoonful of liquor potassii citratis, at intervals of two hours during the night.

Throughout the attack the diet should consist of milk and farinaceous articles prepared with milk, with a little meat broth as the fever subsides. A daily evacuation of the bowels must be secured, and the child must be kept in bed.

Local treatment must not be neglected. If the child be able, he should gargle the throat every hour with a solution of chlorate of potassium, ten grains to the fluidounce. If too young to do this, the same solution should be applied to the throat at short intervals with a mop of absorbent cotton. Painting the throat daily with a solution of nitrate of silver (gr. v to f℥j) hastens the cure. At the same time, it is well to redden the skin of the neck with some such liniment as :

℞. Ol. terebinthinæ, ... f℥j
Ol. olivæ, ... f℥iij. M.
SIG.—Apply twice daily.

Grave cases require no alteration of this plan. It is well, if there be great restlessness, to repeat the foot-bath, or even to give several full warm baths of ten minutes' duration. If there be intense inflammation of the pharynx, the neck should be

enveloped in a poultice. Clogging of the throat by tenacious mucus may demand an emetic.

When convalescence begins, the diet must be more liberal, and restoration to perfect health is hastened by administering a bitter tonic, as tincture of nux vomica, or compound tincture of gentian, in appropriate doses, three times daily.

SUPERFICIAL CATARRH OF THE TONSILS.

In this affection there is a simple hyperæmia of the mucous membrane covering the tonsils, accompanied by moderate swelling of the glands. It is produced by the same causes, and usually occurs as an element, merely, of general pharyngitis. In the exceptional cases in which it exists in an isolated form, the tonsils will be found reddened and moderately swollen, and several yellowish-white points, due to retained follicular secretion, will be seen on their surfaces. The local subjective and the general symptoms are the same as those of pharyngitis, and they yield to the same measures of treatment.

ACUTE FOLLICULAR TONSILLITIS.

This condition, in the great majority of instances, is due to an infection; but there are other cases in which it is purely catarrhal or produced by auto-intoxication in certain types of disordered digestion; it must, therefore, be studied under two heads: viz., (*a*) Infectious Follicular Tonsillitis, and (*b*) Simple Follicular Tonsillitis.

(*a*) INFECTIOUS FOLLICULAR TONSILLITIS.

This form is also called "croupous tonsillitis," "pseudo-diphtheria," and most frequently "diphtheritic sore throat." The latter is both incorrect and misleading, as this affection has no connection with true diphtheria, the Klebs-Loeffler

bacillus being uniformly absent from the culture of the tonsillar exudate.

Etiology.—The disease may occur at any period of childhood, but is very rare during the first, and uncommon until after the second year of life. Isolated cases of this disease may be encountered at any season of the year, but more or less extended epidemics arise during the late autumn, winter, and early spring months. Children who are physically depressed by improper feeding and unsanitary surroundings, and those who are acutely debilitated by exposure to cold and wet in winter or to excessive heat in summer, or who are overfatigued, are more prone to attack. The direct cause, however, is local infection by one or other species of streptococci or staphylococci.

Symptoms.—The affection is characterized by moderate enlargement with marked congestion of the tonsils and by an exudate which appears upon the reddened mucous membrane in the form of patches or puncta. They are from one to two lines in diameter, and are situated around the openings of the follicles, which they appear to extend into and line. The false membrane is closely attached to the underlying membrane, extends but little above its surface, and is white, thin, and translucent. Several puncta may run together, forming large patches, but the composite nature of these can be readily discovered by wiping away the loose muco-purulent matter which accumulates over and about them. Together with the tonsils, the chain of muco-lymphoid glands behind the posterior pillars of the fauces, and the glands of the pharynx generally, may be the seat of pseudo-membranous deposits, but the mucous membrane generally remains free.

The typical alterations in the condition of the throat are preceded by several days of depression, loss of appetite, and general malaise. The actual attack is ushered in by rigors, followed by a rapid rise of temperature to 102° or even 105°

F., and by considerable increase in the frequency of the pulse. There is headache, pain in the back and limbs, anorexia, increased thirst, a furred tongue, and sluggish bowels. The throat is painful, especially in swallowing, and there is moderate enlargement and tenderness of the submaxillary lymphatic glands. Transient albuminuria is sometimes noted. After a period varying from two to four days, the fever abates, the pulse becomes more normal, the pain in the back and legs disappears, that in the throat subsides, and the exudate clears away from the tonsils leaving the mucous membrane intact but reddened. The attack is followed by considerable depression and general feebleness; the swelling and tenderness of the cervical lymph glands may remain for a fortnight or more, and at times suppuration takes place, though this is fortunately an unusual sequel.

Diagnosis.—Infectious tonsillitis is most apt to be confounded with true diphtheria; in fact, it is often classed with this disease by a group of practitioners outside the circle of the regular profession, who are fond of impressing their patients, and, by magnifying trifles, apparently work rapid and marvelous cures of dangerous diseases. It is true that in certain instances the resemblance between the two conditions is very close, and that a diagnosis can only be absolutely established by a culture of the membrane and the discovery, by microscopic examination, of the presence or absence of the Klebs-Loeffler bacillus. In the majority of cases, however, a reasonably certain opinion can be based upon the gross appearances of the exudate in the throat and the general symptoms.

The diphtheritic false membrane may appear first at the orifices of the follicles of the tonsils, but so far from remaining limited to these positions and to the submucous glands of the throat, it rapidly extends—within twenty-four hours—to the pillars of the fauces, the velum, or the walls of the pharynx.

Again, the diphtheritic membrane is deposited in large plaques, which are thick, considerably elevated above the surface of the mucous membrane, gray or dirty yellow in color, and evidently necrotic. The exudate of tonsillitis, on the other hand, appears in puncta, is thin, translucent, white, looks clean, and shows no indication of undergoing a necrotic change. In the latter disease, too, the general symptoms develop more rapidly and are more sthenic; the pain in the throat is greater and the course is much more quickly run, the symptoms often abating markedly at the end of twenty-four hours, and disappearing entirely in from two to four days.

The **prognosis** is almost uniformly favorable, the worst sequel being suppuration of one or more of the cervical lymphatic glands, which may require surgical interference and may prove dangerous.

Treatment.—The child must be confined to bed and placed upon a diet of milk and broths, given in small quantities—four to six ounces—at intervals of two hours during the day, and once or twice at night if there be much weakness.

The medicinal treatment should be inaugurated with a course of calomel, gr. $\frac{1}{12}$ with gr. j of bicarbonate of sodium every two hours for six doses, for a child of four years. Two hours after this course is finished, chlorate of potassium and tincture of the chloride of iron should be administered, as in the following prescription:

℞. Potass. chloratis, ... gr. xxiv
Tr. ferri chloridi, ... ♏ xxxvj
Syr. zingiberis, ... f ℥ ss
Aquæ, ... q. s. ad f ℥ iij. M.
Sig.—One teaspoonful every two hours.

If there be decided depression, 3 drops of tincture of nux vomica or gr. ss–j of sulphate of quinine may be ordered every fourth hour, and moderate alcoholic stimulation is sometimes required.

High fever is best treated by hot mustard foot baths and small repeated doses of tincture of aconite.

Locally, the throat should be thoroughly sprayed twice daily with peroxide of hydrogen, pure, unless too great pain is produced, when it may be diluted one-third or one-half. In addition, a gargle or spray of chlorate of potassium—gr. x to f℥j—should be used every two hours. The surface of the neck over the swollen cervical glands must be well rubbed with warm camphorated oil at intervals of four or six hours.

When the throat becomes clean and convalescence is established, the diet should be slowly increased up to the standard for the age of the patient, the local treatment discontinued, and the potash and iron mixture replaced by a tonic, as:

℞. Tr. nucis vomicæ, ... ♏ xxx
Acid. nitro-muriat. dil., ... ♏ xxxvj
Elix. cinchonæ calisayæ, ... q. s. ad f℥ iij. M.
SIG.—One teaspoonful three times daily after food.

As marked general debility often follows an attack of infectious tonsillitis, the patient must not be allowed to leave his bed and be up and about too early, and exposure as well as overfatigue must be carefully guarded against.

(*b*) SIMPLE FOLLICULAR TONSILLITIS.

In this disease there is, in addition to superficial hyperæmia, a catarrh of the lacunæ or follicles of the tonsils. According to the extent of the disease, several or all of the follicles become filled with a yellowish-white, curd-like material, consisting of epithelium and pus. When thin, this flows away; but, when thick, it is removed with difficulty, collects and distends the lacunæ, and may undergo desiccation, or even become calcified. The parenchyma of the tonsils becomes hyperæmic, and there is an infiltration of serum and a proliferation of the gland cells.

Etiology.—The affection is a common one after the fifth year. It is most apt to be met with in the winter and spring, but it may occur at any season. Exposure to wet and cold is usually considered to be the exciting cause, but an attack may quite as frequently be traced to overeating, associated with excitement and fatigue. One attack predisposes to others, and I have seen many patients who are invariably affected after gorging themselves with rich food, pastry, or candy. A combination of all of these causes—so well afforded by that worst of institutions, a child's party—invariably produces a crop of cases.

Symptoms.—When due to overeating, the attack usually sets in on the day succeeding the indulgence. It begins with headache and lassitude; the tongue becomes frosted; there is thirst, anorexia, and nausea, often followed by vomiting. Toward the evening of the first day the face becomes flushed, the skin hot and dry, and the pulse rapid. The bowels are sluggish, and the urine is scanty, high-colored, and lateritious. On the morning of the second day the fever disappears, but it may return in the afternoon, and this course is sometimes maintained for three or four days, when convalescence is established. In the mean time the anorexia and constipation continue, the patient sleeps badly, but the strength is quickly recovered after the attack terminates.

When the affection is due to exposure alone, there is less headache, and no nausea or vomiting.

Whatever the cause, the local symptoms are the same. They consist of a sensation of dryness and heat in the throat, repeated efforts to clear the throat, difficult and painful deglutition, increased salivation, a nasal intonation of the voice, and a heavy, offensive breath. On inspection, a catarrhal condition of the palatine arches and pharynx is observed. The tonsils are enlarged, sometimes sufficiently so as almost to meet one another; their enveloping mucous membrane is red-

dened and swollen, and their surface is dotted with yellowish-white points, corresponding in number, shape, and size with the follicles involved. On pressing the tonsils, ill-smelling masses of varying size and consistency may be pressed out. These are also expelled by hawking, or are forced out in deglutition and swallowed with the food. In whichever way removed, they leave the orifices of the follicles more widely open and gaping than in health. There is some tenderness on pressure beneath and behind the angles of the jaw.

The **diagnosis** is easily made from the appearance of the tonsils, and from the fact that gentle pressure with the finger will force out one or more masses of retained secretion—a pathognomonic sign. There is no doubt that these cases are by some classed as diphtheritic, though none but the most inexperienced could confound with diphtheritic membrane the numerous yellowish-white points, of irregular shape and size, depressed below or projecting beyond the well-defined lips of the follicles, and which, as already stated, often can be expelled by pressure on the tonsils. Again, the difference between this affection and the punctated exudate of infectious follicular tonsillitis must strike any careful observer.

The **prognosis** is always favorable, except that one attack predisposes to others, which may lead to chronic hypertrophy of the tonsils.

Treatment.—If the attack be traced to overeating, the administration of an emetic would naturally suggest itself as a preliminary. This, however, is rarely necessary, as the initial vomiting empties the stomach sufficiently. Usually, the first steps are to place the child's feet in a hot mustard bath, then put him to bed, and give, according to the age, one or two grains of calomel at once, or in broken doses if there be much nausea. If, on the first night, the fever be high, tincture of aconite should be resorted to; if more moderate, an effervescing draught, like the following, will suffice:

℞. Acidi citrici, ... ʒiss
Aquæ, ... fʒiij. M.
SIG.—Solution No. 1.

℞. Potassii bicarbonatis, ... ʒj
Aquæ, ... fʒiij. M.
SIG.—Solution No. 2.

A teaspoonful of each solution is to be poured into a tablespoon or glass and taken while effervescing.

This draught has the advantage of checking nausea at the same time that it reduces fever.

The food must be restricted to small quantities of milk and lime water (3 to 1), or weak broths in case milk disagrees. On the second day it is only necessary to look carefully after the diet, to allow nothing but milk and broths, keep the patient in bed, and give during the day the following:

℞. Pepsini (Fairchild's),
Sodii bicarbonatis, ... āā ʒj.
M. et ft. chart. No. xij.
SIG.—One powder every three hours for a child of six years.

The effervescing mixture may still be used in the early night if the fever be high enough to require it.

Such measures should be continued until convalescence is established, care being taken to keep the bowels regular with calomel in broken doses. Then the diet may be gradually increased and a bitter tonic given.

If the cause be exposure to wet and cold, the general treatment must be the same as for pharyngitis.

Rheumatic and lithæmic children are very prone to this form of tonsillitis. Under these circumstances salol or salophen, in appropriate doses, should be added to the treatment.

The local treatment embraces counter-irritation of the skin of the neck; touching the tonsils once daily with a solution of nitrate of silver, gr. v to fʒj; and frequent gargling with:

℞. Potassii chloratis, ... gr. lxxx
Acid. carbolici, ... gr. ij
Glycerini, ... f℥j
Aquæ, ... q. s. ad f℥viij. M.
Sig.—Use as a gargle every hour.

PERITONSILLAR ABSCESS OR SUPPURATIVE TONSILLITIS.

Quinsy is a comparatively rare disease in childhood and is scarcely ever met with before the twelfth year. When it does occur, some family predisposition can generally be traced, the most common predisposing element being the rheumatic diathesis. Fatigue and exposure are the exciting causes. The direct cause of the suppuration is, as in all instances, infection by specific pathogenic micro-organisms, entering from some source either external or internal. It is most frequent during spring and autumn. One attack predisposes to others. It may arise as a primary affection or as a complication of scarlatinous, variolous, or pseudo-membranous anginas. One or both tonsils may be affected.

Morbid Anatomy.—At first there is intense hyperæmia with serous infiltration of the cellular tissue, and the tonsils sometimes become swollen to more than double their size. The inflammation may now undergo resolution. Otherwise an infiltration of small cells takes place, into and between the follicles, into the inter-lacunar connective tissue, and in the capsule. Retrogression is still possible, or, failing this, a new formation of reticulated substance takes place, resulting in permanent hypertrophy—a frequent termination of repeated attacks in children. If the inflammation be very intense, an abscess forms, but suppuration is not the usual result of tonsillitis occurring before puberty. With these conditions there is always associated general pharyngitis and often simple follicular tonsillitis.

Symptoms.—The disease begins with rigors or a distinct chill, followed by sneezing, epistaxis, headache, pain along the Eustachian tube, loss of appetite, and fever, with languor and muscular prostration during the day, and mild delirium at night. Soon the patient complains of dryness and burning in the throat, difficulty and pain in deglutition, and the voice becomes nasal. If the throat be inspected, the mucous membrane of the soft palate and pharynx is seen to be red and swollen, and one or both tonsils are reddened and enlarged, often presenting several whitish-yellow points of retained follicular secretion. If one tonsil only be affected, the œdematous uvula will be pushed to the opposite side—an important sign.

The symptoms gradually increase in severity. The temperature ranges from 99° or 100° F., in the morning, to 102° or 104° in the evening, and the pulse from 110 to 120; but the respiration, though snoring, is little increased in frequency. Pain grows worse and deglutition becomes more difficult; the voice assumes a peculiar, thick, nasal tone; the breath has a heavy odor; the salivary secretion is increased and dribbles from the mouth; the tongue is heavily furred, and the bowels are sluggish. The child's face wears an apathetic expression, is red or dusky in hue, and there is dulness of hearing. Talking is painful, and so also is any movement of the jaw. On this account it is difficult to obtain a view of the throat; but if such be had, the tonsils, when both are affected, are seen to be intensely congested, and so much swollen that they meet; or, when only one gland is involved, it often extends beyond the median line. The day is divided between the listless inaction of prostration and the uneasy tossing of discomfort; and the night, between the restlessness of fever and the wandering of delirium. What little sleep is obtained is interrupted by snoring.

The crisis usually occurs on the fifth day, although it may

be postponed until the eighth. If the tonsillitis ends in resolution, the fever rapidly subsides, disappearing entirely in twelve hours; the local symptoms simultaneously abate and convalescence is rapid. When the inflammation ends in the formation of new tissue and hypertrophy of the glands, the acute manifestations give place to a train of symptoms to be described in the following section. Finally, if suppuration take place, there is a chill, followed by high fever. The abscess soon points toward the mucous surface of the gland, and, unless opened by lancing, is broken by an effort at deglutition or in an examination of the throat. The quantity of pus discharged is ordinarily small, and is swallowed, as a rule. After the opening of the abscess, the child passes at once from a condition of great distress to one of comparative comfort, and strength and health are soon regained.

The **diagnosis** of quinsy is unattended with difficulty, and the prognosis, so far as life is concerned, is always good, though the danger of chronic hypertrophy must not be forgotten.

Treatment.—If the patient can be seen when the peculiar tone of the voice, the pain in the line of the Eustachian tubes, and the deflection of the uvula indicate the beginning of tonsillitis, it is possible to abort, or, at least, greatly reduce the intensity of the inflammation. For this purpose he must be put to bed, and properly proportioned doses of tincture of aconite must be administered every half hour until an effect is produced on the temperature and pulse, while small bits of ice must be swallowed at intervals of ten minutes. If there be a rheumatic tendency, salicylate of sodium, salol, or salophen should be administered in full doses for the age, in place of, or in conjunction with, the aconite. At the same time it is well to apply a sinapism to the side of the neck corresponding to the affected gland. Since the introduction of cocaine I have often succeeded in aborting tonsillitis by thoroughly mopping the affected parts three times daily with a

four per cent. solution of this drug. Even in cases where this favorable result was not obtained, the cocaine so far allayed pain as to permit liquid food to be swallowed with ease. This is an invaluable aid in the treatment of severe quinsy occurring in feeble children.

When the case is not seen till later, the indications are to encourage resolution or hasten suppuration, and to maintain the strength. To fulfil the first, the neck should be enveloped in a poultice, the throat should be repeatedly gargled with warm water, and steam from an atomizer should be constantly inhaled. The strength is to be kept up by administering all the concentrated liquid food that it is possible for the patient to swallow, and by using suppositories of quinine. The latter may be ordered in this way :

℞. Quininæ bisulphatis, ... gr. xviij
Ol. theobromæ, ... ʒiij.
M. et ft. supposit. No. xij.
Sig.—Use every four hours for a child six years of age.

On account of the difficulty in swallowing, it is well to avoid ordering any medicine by the mouth except a diaphoretic, such as the solution of the citrate of potassium, and an occasional dose of some saline laxative. When there is much restlessness or delirium at night, it is well to give bromide of potassium, in ten-grain doses, by the mouth or rectum.

If an abscess forms, a somewhat rough pressure of the finger against the involved tonsil will hasten its rupture, but incision is a better method of treatment and often lessens the duration of suffering by twenty-four hours or more.

After the crisis is past, the diet must be increased and a tonic ordered, as :

℞. Tr. ferri chloridi, ... fʒj
Quininæ sulphatis, ... gr. xij
Syrupi zingiberis, ... fʒj
Aquæ, ... q. s. ad fʒiij. M.
Sig.—One teaspoonful, in water, three times daily for a child six years old.

The subsidence of the tonsils to their normal size is hastened by painting them twice daily with :

℞. Acidi tannici, ... ℥j.
Glycerini, ... f℥j. M.

For prevention, gargles of cold water and astringents, applications of the glycerole of tannin, and measures to maintain a high standard of health, and especially to counteract any rheumatic tendency, should be employed.

HYPERTROPHY OF THE TONSILS.

Chronic enlargement of the tonsils is slow in its development, and must be considerable in degree before giving rise to definite symptoms. Consequently, the disease is rarely recognized before the third or fourth year of life, although its commencement in early infancy is quite possible. It is common between the seventh and twelfth years.

Etiology.—The predisposing cause of tonsillar hypertrophy is a peculiar constitutional tendency recently termed "lymphatism." This condition has for its local manifestations enlargement of the faucial tonsils, of the naso-pharyngeal tonsil, or "adenoids," and of the muco-lymphoid glands of the pharynx and of the base of the tongue. This diathesis is not identical with scrofula, though it seems to be allied to, and is often associated with, it. Exposure to cold and dampness and repeated tonsillar inflammation are the ordinary exciting causes. As the symptoms are aggravated by any passing angina, more cases demand treatment during the winter and spring than at other seasons.

Symptoms.—The first to attract attention is loud snoring during sleep, due to pressure upon the velum, and obstruction to the passage of air through the posterior nares. At the same time there is a decided nasal twang to the voice. Ex-

amination shows marked projection of both tonsils, or, more rarely, of one only; the follicular orifices are widely open and very distinct, and several of them may present the yellowish-white points of retained secretion. The investing mucous membrane is pale, as a rule, but it may be traversed by arborescent blood-vessels. Such a degree of hypertrophy and the accompanying symptoms sometimes disappear spontaneously with the development of the mouth and vocal organs attendant upon puberty.

When the glands are so much enlarged that they touch in the mid-line of the throat, there are added to the other symptoms mouth-breathing, a constant hacking cough with labored respiration, and difficulty of hearing, due partially to pressure upon the orifices of the Eustachian tubes, and partly to a state of habitual congestion kept up in the surrounding parts. The dyspnœa is much worse at night, and the little patient often starts from sleep in a state of terror. It may be so grave as to threaten life and necessitate tracheotomy.

When enlargement—so great as to decidedly obstruct the passage of air through the nose and give rise to constant mouth-breathing—has existed from an early age, noticeable anatomical changes take place. The nostrils become extremely small and compressed, while the superior dental arch retains the narrowness of infancy, not allowing room for the teeth, which, in consequence, overlap one another. The palate, also, becomes unusually high and arched. The face is dull, almost idiotic in expression. Furthermore, the obstacle to the free entrance of air prevents the lungs being readily filled in inspiration, so that a partial vacuum is formed between them and the chest-wall, to fill which the external air-pressure forces in the yielding parietes. The effect of external pressure is most marked where the resistance is least, namely, at the base of the thorax, and a constant and long-continued repetition of this leads to the production of a gutter of variable depth

and three or four inches in width, extending laterally from the lower part of the sternum, and to a projection forward of this bone. Any tendency to pulmonary phthisis is increased by this deformity, and if tuberculous disease be present, the impediment to the entrance of air and the constant irritation of the air passages maintain a condition most unfavorable to its arrest. Mastication and deglutition are impeded in proportion to the extent of hypertrophy, and with the disturbed sleep and especially the imperfect oxygenation of the blood resulting from the mouth-breathing, lead to great impairment of nutrition and general development.

Treatment.—Moderate enlargement of the tonsils in a weakly child will sometimes disappear when puberty is passed, or as health is regained under a course of tonics. The best tonic is syrup of the iodide of iron, in doses of ten drops three times daily for a child of eight years of age. It is well to paint the tonsils once every day with one of the following astringents :

℞. Tr. ferri chloridi, ... f℥j
Glycerini, ... q. s. ad f℥j. M.

℞. Liq. iodi comp., ... f℥ij
Glycerini, ... q. s. ad f℥j. M.

When there is marked hypertrophy, good results are obtained in suitable cases by the careful use of the electro-cautery. Children of six or eight years readily submit to this treatment provided thorough cocaine anæsthesia be produced before each application of the heated wire. A gargle containing tannic acid must also be used four times daily, as :

℞. Acidi tannici, ... ℥ss
Glycerini, ... f℥ss
Aquæ, ... q. s. ad f℥viij. M.

Syrup of the iodide of iron should be given three times

daily, care being taken not to administer it at the time that the gargle is used. Cod-liver oil is also serviceable.

Together with this treatment enough nutritious food must be given to keep up the strength. This can be done with readiness, since, in spite of the size of the tonsils, there is usually no pain, and little difficulty in swallowing.

Excision, however, is the best and most rapidly successful procedure when there is excessive enlargement, and is a necessity if, at any time, there is dangerous interference with respiration. Constant or frequent cough, or the presence of any other symptom suggestive of phthisis, also demands an immediate operation. Tonsillotomy is free from danger; in fact, it may be classed as one of the safest even of minor operations.

If, after removal of a portion of the tonsils or their reduction by treatment, the chest is slow to regain its natural form, the use of light dumb-bells and carefully regulated gymnastics are of much service. Dupuytren's method of reducing the sternal prominence by placing the child's back against a wall, and pressing it firmly backward with the palm of the hand during each act of expiration, is efficient, notwithstanding its apparent roughness.

NASO-PHARYNGEAL ADENOID HYPERTROPHY.

At the vault of the pharynx there is situated a composite gland closely resembling in structure the faucial tonsils and called the "third" or "pharyngeal tonsil." This, in health, is of small size, but it readily undergoes hypertrophy, and then interferes markedly with the general health and development of the child.

Etiology.—The condition of constitution already described as "lymphatism" predisposes to hypertrophy of this as well as other muco-lymphoid glands, so also does inherited syph-

ilis and tuberculosis; but enlargement of the third tonsil frequently occurs in children who are otherwise strong and healthy. The exciting causes are those of ordinary catarrh: exposure to cold and dampness and to rapid and extreme atmospheric changes.

Symptoms.—Adenoid growths present two classes of symptoms, one due to an associated naso-pharyngeal catarrh, the other to mechanical obstruction.

Catarrhal symptoms are most prominent in infancy, producing a persistent mucous or muco-purulent and sometimes bloody discharge from the nose. This discharge is rarely present during the warm, dry months of summer, but in winter is continuous, or is produced or aggravated by exposure to cold or dampness. Frequent attacks of otitis also occur, and the voice is apt to be thick and hoarse. With the catarrh the infant shows evidences of obstruction of the naso-pharynx by difficulty in blowing the nose, a nasal voice, and mouth-breathing. The latter feature may be constant, but is usually noticed only during sleep, when the inspiration becomes labored and is noisy or even stertorous. The difficulty in breathing is most marked when the patient lies upon the back or approximates this posture, so there is much turning about in bed and restless, uneasy sleep, in the unconscious endeavor to find some position in which breathing can be carried on with ease.

In older children nasal catarrh may be present or is readily produced by exposure, but the obstructive features are always more accentuated. The plugging of the posterior nares leads to constant oral breathing, and the habitually open mouth, by altering the normal adaptation of certain of the muscles of the face, causes changes in the shape of the soft and developing facial bones, and gives rise to a characteristic physiognomy. The lower jaw hangs down and lengthens the face, the nose is pinched or the nostrils distended, the corners of the mouth

and eyes have a drawn appearance, and the general expression is vacant and stupid or almost idiotic. From alteration in air pressure the hard palate becomes pointed or "high-arched"; the upper jaw, in turn, is diminished in transverse diameter and pointed in front, and the teeth, especially the incisors, are crowded into irregular groups or rotated on their axes. The forcing upward of the palatine arch produces deflection of the septum of the nose, which aids the original growth in obstructing nasal respiration and encourages the development of hypertrophic rhinitis.

When the adenoid hypertrophy begins early in life, and especially in rachitic cases, the mouth-breathing changes the shape of the chest walls, producing pigeon-breast with prominence of the sternum and deep lateral gutters, or decided depression of the lower third of the sternum.

Impairment of hearing due to obstruction of the orifices of the Eustachian tubes is another common result of pressure.

These symptoms are associated with general languor, restless sleep, a thick, hoarse voice, headache, mental depression or sluggishness, inability to fix the attention or to learn, and, when the disease is of long standing, with anæmia and the indications of malnutrition. Finally, the hypertrophy may be the reflex cause of various neuroses, as chorea, incontinence of urine, asthma, spasm of the glottis, and even epileptiform convulsions.

Diagnosis.—An absolutely certain opinion can only be based upon a digital exploration and the discovery of a soft, velvety, irregular mass in the vault of the pharynx. Without this, however, it is usually possible to make a diagnosis from the expression of the face, the mental sluggishness, impaired hearing, thick voice, the mouth-breathing, disturbed sleep, the anæmia and depraved nutrition, and the history of a chronic nasal catarrh which is little affected by treatment.

Deafness and hoarseness must not direct attention from the

naso-pharynx to the ears or larynx as the seat of disease; and it is well to remember that the manifestations of obstructive pressure do not depend solely upon the extent of hypertrophy, since a small growth in a narrow pharynx is competent to cause marked symptoms.

Prognosis.—Adenoid growths always improve and give rise to less decided symptoms in the warm, dry atmosphere of the summer months, though they have no tendency to spontaneous recovery. Their normal course is to increase in size up to a certain point, and then remain stationary until puberty, when they atrophy partially, or, in the case of the smaller growths, completely; but they leave their imprint in the deformed face and chest and in the sluggish intellect. In addition, the arrest of development resulting from long-continued anæmia and poor nutrition is a handicap during the remainder of the patient's life.

Adenoid subjects readily contract diphtheria when exposed, and in them any intercurrent disease—as diphtheria, scarlet fever, measles, or whooping-cough—is more prone to result seriously on account of the enfeebled general health.

Treatment.—The medical man can do little in these cases beyond maintaining the patient's strength by tonics and well-selected, nutritious foods. His office, after making the diagnosis, is to insist upon removal of the growth and to place the case in competent surgical hands.

RETROPHARYNGEAL ABSCESS.

This form of abscess is not limited to any period of childhood, but is of infrequent occurrence. It may be due to traumatism, or to caries of the cervical vertebræ, though, as a rule, it depends upon suppurative inflammation of the lymphatic glands embedded in the posterior wall of the pharynx; the direct cause of the inflammation being infection by the

pus-producing micro-organisms. This infection is usually secondary to an inflammatory process in the superficial and associated muco-lymphoid glands of the fauces and naso-pharynx. Thus the abscess may follow follicular tonsillitis, peritonsillar abscess, or the various types of tonsillitis and pharyngitis that attend the exanthemata; occasionally the source of infection may be rhinitis, or, yet more infrequently, a suppurative otitis. In its initial stage the disease is a lymph-adenitis, and the inflammation may either terminate in resolution or proceed to completion in the formation of an abscess.

The **symptoms** are deep-seated pain, difficulty in swallowing and after a time in breathing. On lying down the respiratory embarrassment is increased, sometimes to such an extent as to threaten suffocation. There is, also, great stiffness of the neck, retraction and immobility of the head, and a diffuse swelling of the lateral cervical surfaces, often greater on one side than the other. If now the finger be carried over the root of the tongue, and down toward the pharynx, a firm or fluctuating swelling will be felt, more or less filling the pharyngeal canal, and projecting over the opening of the glottis. On inspecting the throat, the swelling can usually be seen, occupying one or other side or the middle of the pharynx, and pressing forward the uvula and soft palate. The investing mucous membrane may be normal or congested. Sometimes the mouth cannot be sufficiently opened to permit of inspection, and at others the abscess is seated so low in the pharynx that no tumor can be seen; when so seated, a comparatively small abscess may threaten suffocation.

Duparcque enumerates three symptoms indicating the formation of an abscess behind the œsophagus: viz., severe pain, produced even by moderate pressure on the larynx and upper part of the trachea; the entire suspension of respiration by such pressure; and displacement of the larynx forward and to the right.

Fever and cerebral manifestations may or may not be present, and initial symptoms are far from being uniform, so that, unless an examination of the throat be made, the disease may be overlooked in its early stages. Ordinarily, however, the diagnosis can be made without difficulty.

Diagnosis.—Without care, the disease may be confounded with œdema of the glottis, and with true or false croup. In the first affection, inspection of the throat shows that the swelling is seated in the larynx and not in the pharynx. In diphtheritic laryngitis some false membrane can usually be discovered on the tonsils or half arches; in spasmodic laryngitis the appearances of simple pharyngitis alone are present if the throat shares at all in the catarrh, and in both forms of croup the voice is altered, being extinct or hoarse, a symptom entirely absent in retropharyngeal abscess.

Prognosis.—Recovery is the usual outcome of the disease, the abscess discharging spontaneously; under these circumstances the course is run in from five to fifteen days. In some cases, however, a prompt diagnosis and the evacuation of the abscess by puncture are required to avert death by suffocation, or to prevent burrowing of the pus into the œsophagus, larynx, mediastinum, or the pleural cavity.

The prognosis is very grave when the disease accompanies cervical caries. Suffocation from the sudden, spontaneous discharge of pus is an exceptional event.

The **treatment** is simple. As soon as the abscess has formed, it must, when within easy reach, be punctured, as near the median line of the pharynx as possible, the blade of the bistoury having been carefully wrapped with adhesive plaster to within a fourth of an inch of its point. If the abscess be situated low down, a trocar and cannula is the safer instrument to employ.

Intubation should be performed when the puncture is unproductive and not followed by relief of the dyspnœa; but if

this operation be mechanically impossible or prove ineffectual, tracheotomy will be required.

For several days after the incision, occasional pressure must be made by the finger on the tumor, to insure thorough evacuation of the pus. At the same time a general tonic and supporting treatment is necessary.

CHAPTER III.

AFFECTIONS OF THE STOMACH AND INTESTINES.

ACUTE GASTRIC CATARRH.

This is one of the most common ills of childhood, since, in addition to arising idiopathically, it attends every disease in which there is pyrexia, as well as many of those that are apyretic.

The **idiopathic form** may occur at any age, but is infrequent in breast-fed infants. Its origin under such circumstances is always traceable to some abnormal condition of the mother's milk. The ordinary predisposing causes are general feebleness of constitution, exposure, and imperfect hygiene. Exposure is also an excitant, but the chief of this class of causes is the administration of food that is either bad in quality or excessive in quantity.

The **anatomical lesion** is hyperæmia of the mucous membrane of the stomach, producing an increased secretion of mucus, and a diminished flow of gastric juice.

Symptoms.—An attack of what the nurse calls "indigestion" comes on in infants after a bottle of changed milk or a "taste" of some unusual food has been given; in older children after a mixed and indigestible meal, particularly when this has been attended by exposure and excitement. The child, after a few hours, becomes listless, has a hot, dry skin, loses appetite, is thirsty, sleeps restlessly, and, if old enough, complains of headache, abdominal discomfort, and nausea. Then there is vomiting of sour-smelling, curdled milk, or of whatever food is in the stomach in a more or less imperfectly digested state.

The first act of emesis is easy, but if repeated, as is often the case, there is painful retching, and nothing is expelled save a little bile-stained mucus. Soon the tongue becomes covered, except at the very tip and edges, which are red, with a thick white or yellowish-white fur, through which the fungiform papillæ protrude as bright scarlet points. The breath has a heavy or sour odor. There is some fever, the temperature ranging from one to three degrees above normal, and the pulse counting 110 or 120 per minute. There is moderate tenderness on pressure in the epigastric region. The bowels are confined, and the urine is lessened in quantity and lateritious. These symptoms continue from twenty-four to forty-eight hours.

The attack sometimes terminates suddenly, with several loose fæcal evacuations. In other cases the fever gradually subsides, the nausea and thirst diminish, the tongue cleans, and the appetite slowly returns, convalescence extending over a period of two or three days.

The **diagnosis** is readily established by the history of the causation, the character of the vomit, the state of the tongue, the moderate fever, the epigastric tenderness, and the course of the attack.

The **prognosis** is always favorable so far as recovery is concerned, but it must be remembered that one attack always increases the susceptibility to another.

Treatment.—Complete rest, on the nurse's lap for infants, and in bed for older children, is essential. During the first twelve or twenty-four hours there is no inclination for food, and if any be forced, it is quickly rejected. Consequently it is better to avoid any attempt at ordinary feeding until the stomach becomes settled. Thirst is to be relieved by cool water, or carbonic-acid or Vichy water, and the only nourishment to be allowed is albumin water or weak barley water given in doses of two to four fluidounces every two hours.

Such measures are also useful to allay nausea and vomiting; but if these symptoms are at all obstinate, a mustard sinapism, just strong enough to redden the skin, should be applied to the epigastrium, and the following prescription ordered:

℞. Liquor. calcis,
Aquæ cinnamomi, ... āā f ℥ ij. M.
Sig.—One to two teaspoonfuls, according to the age, at intervals of fifteen to thirty minutes, as necessary.

Or, if the tongue be heavily coated and the breath foul, gr. $\frac{1}{12}$ or $\frac{1}{6}$ of calomel with gr. j of bicarbonate of sodium every hour for six doses. Frequently repeated small doses of the effervescing citrate of potassium, or of the effervescing draught already mentioned (page 222), are efficient. A good plan, too, is to divide the contents of each package of a Seidlitz powder into a number of equal parts, about twelve for a child of three years; dissolve a portion from each in a small tablespoonful of water, pour them together, and administer in a state of effervescence. This may be repeated, at first, every half-hour, later at longer intervals; rarely more than six or eight doses are required to check the vomiting. This and the calomel course have the additional advantage of acting gently on the bowels.

In those exceptional cases in which, after an unsuitable meal, there is headache, fever, epigastric discomfort, and nausea without vomiting, it is necessary, as a preliminary measure, to induce emesis by draughts of warm water or a sufficient dose of syrup or wine of ipecacuanha.

When vomiting has ceased and nausea disappeared, the patient must begin to take food. At first one ounce of sound milk diluted with half an ounce, or even an ounce, of lime water or barley water may be given every two hours; and the quantity increased and the dilution lessened as the stomach regains its functional powers. Weak mutton, veal, or chicken broth, free from grease, and diluted with one-half or an equal

quantity of barley water, sometimes suits when milk cannot be retained.

While attention is paid to the diet, care must be taken to secure a free evacuation of the bowels by a mercurial followed by a saline laxative. Beyond this, all that is required is to administer properly proportioned doses of bicarbonate of sodium and pepsin before each meal, for three or four days, and to gradually increase the diet to its normal standard as healthy digestion is restored.

CHRONIC GASTRIC CATARRH.

This affection presents so many points of dissimilarity, according to the age of the patient, that it is desirable to study it under two heads, namely, chronic gastric catarrh in infants, and chronic gastric catarrh in children who have passed the period of first dentition. Further, since chronic catarrh of the stomach is always attended by imperfect gastric digestion, and since food imperfectly digested in the stomach is unfitted for intestinal digestion, and must act as an irritant and lead to intestinal catarrh, it is impossible to absolutely isolate the two conditions in a clinical description. This is so markedly the case in older children that it seems best to defer the study of the second division of the subject to a later section, headed "chronic gastro-intestinal catarrh," and at present to consider only—

CHRONIC GASTRIC CATARRH IN INFANTS.

This dangerous affection, sometimes termed "chronic vomiting," is of common occurrence.

Morbid Anatomy.—In the earlier stages there is a simple hyperæmia of the gastric mucosa, but a long continuance of this condition thickens and loosens the membrane, changes its color to ashen-grey, and leads to an excessive formation of tenacious mucus, while greatly lessening the secretion of

efficient gastric juice. Coincident enlargement of the gastric glands also gives an appearance of roughness to the surface of the mucous membrane.

Etiology.—The period of life between the third and seventh months furnishes by far the greatest number of cases. Sex and season are not influential. Infants fed entirely at the healthy breast are very rarely affected.

The predisposing causes belong to the class of influences that lower the readily depressed vitality of early infancy; for instance, overcrowding, filth, want of sunlight and fresh air in dwelling-rooms, insufficient clothing, and too early weaning.

The one great exciting cause is the administration of unsuitable food. Sometimes the breast milk departs so much from its normal quality that it acts as an irritant upon the delicate mucous membrane and produces catarrh; or it may flow so freely that the child swallows more than he can digest, and the surplus, having undergone chemical change in the stomach, produces a like result. But the harm commonly arises from the use, in artificial feeding, of food that is either, by its nature, unsuited to the feeble digestive ability of infancy, or which, though good in itself, is rendered hurtful by being kept in unclean vessels, and given from foul or badly constructed bottles.

Of the first, or essentially bad articles of diet, the farinaceous foods are the most harmful, because, for the digestion of starch, both saliva and pancreatic juice are required, and these secretions are absent until the fourth month, and not fully established for some time later. Further, when subjected to the action of a ferment in the presence of heat and moisture—conditions existing in the stomach—these substances readily undergo fermentation resulting in the formation of acid which acts as an irritant to the susceptible mucous membrane. Consequently, such a diet used, as it too often is, to the exclusion of milk, must be a very active cause of gastric catarrh. The

habit of allowing or encouraging infants to bolt bits of table-food and drink tea is quite as injurious; perhaps, though, this indiscretion is more apt to produce chronic diarrhœa than chronic vomiting.

Perfectly pure milk will be quickly changed and rendered irritating and unfit for use by being poured, when delivered by the milk-man, into pitchers or cans not properly cleansed from the remains of the supply of the day before. The smallest quantity of sour, bacteria-laden milk is sufficient to rapidly produce a like change in several pints of the fresh fluid when mixed with it. The same is true of unclean bottles and tips to which the dregs of former meals adhere in the form of small white curds. In these the change begins as soon as the fresh milk is added, and advances far before the child finishes the meal.

A knowledge of the etiological factors explains why by far the greatest sufferers are foundlings, foster-children, children born to poverty, and those belonging to women who engage themselves as wet-nurses, or are obliged to earn their living by working away from home.

Symptoms.—The first symptom is vomiting, occurring at irregular intervals, and resulting in the expulsion of curdled, sour-smelling milk, or whatever food is in the stomach, stained yellow or green by bile. The characters of the vomit, however, soon change, the bile disappearing and only a clear, watery fluid, containing fragments of food, being ejected. In addition, there are eructations of sour or even fetid gas. The surface of the body is normal in temperature or cool, the skin is harsh and sallow, and an eruption of strophulus may cover the trunk and arms. The lips are red and dry, the tongue is coated with a thick, dry, yellow fur, with dull red fungiform papillæ protruding at intervals; the mouth is parched, thirst is increased, and milk or water is taken greedily, only to be quickly vomited again. The bowels are constipated, and

when an evacuation does occur, it is attended by great straining, and the feces appear in small, round, hard, light-colored lumps, often enveloped in mucus; sometimes moderate diarrhœa alternates. The abdomen is distended and tympanitic, and there is great tenderness over the epigastrium. Flesh is rapidly lost, the anterior fontanelle becomes sunken, the child is very fretful, has an aged and anxious expression of face, and a deep furrow may be noticed passing downward from the alæ of the nose to encircle the mouth, giving to the lips the appearance of projecting.

This condition continues, with occasional brief periods of improvement, for several months. Then the vomiting becomes more constant, occurring both after food and in the intervals of feeding. It is excited by any disturbance; such a trifling act as wiping the mouth, for example, being sufficient to bring on an attack. The stomach seems now to have lost its power to even begin the digestion of the blandest food, for if milk be given, it is vomited uncurdled and in the same state as when swallowed. Emaciation progresses very rapidly. The skin, dry and inelastic, hangs in loose folds from the limbs, and is apparently too large for the wasted body. It has a muddy color, and exhales an offensive, sour odor. The face is pinched, the eyes are sunken, though bright, with pearly sclerotics; the nose is sharp and the cheeks are hollow. The infant lies with the knees drawn up against the abdomen, and to this position they are at once returned when straightened out; often the legs are moved about uneasily, indicating abdominal pain. There is little sleep either by day or night. Fretfulness is constant, with an occasional breaking out into loud, painful cries, or, as weakness increases, into low wailings. The tongue is dry and heavily coated, the bowels continue constipated, and, toward the end, the abdomen becomes retracted. The pulse grows weak and frequent in proportion to the failure in general strength, and the temperature

falls below normal; the thermometer, placed in the rectum, often registering but 97° F. The breath is sour, and the scantily secreted saliva, perspiration, and urine are all very acid. As death draws nearer, the surface is perceptibly cool to the touch, the hands and feet become blue, patches of thrush appear upon the inside of the lips and cheeks, the little patient lies utterly exhausted, dozing or half unconscious, and for several days before the fatal termination the only evidences of life are the gentle rise and fall of the chest in breathing and the occasional expression of pain that flits across the face.

Sometimes, in the last few weeks of the attack, certain of the symptoms become exaggerated, and may suggest cerebral involvement. In this condition there is deep depression of the fontanelle, dilated pupils, transient flushing of the face, great languor, heaviness of the head, drowsiness, semi-stupor, and even coma with stertorous breathing. Indications of pain and fever are, however, absent. The sunken fontanelle shows a deficiency in the amount of blood in the brain, but, as suggested by Parrot, there may be, in addition to this source of the symptoms, some toxic element analogous to that of uræmia. Thrombosis of the cerebral sinuses and intracranial hemorrhages are also occasionally found after death, but their connection with the ante-mortem phenomena is by no means uniform.

When the disease terminates favorably, the vomiting becomes less in amount, some little of the food being retained; it also begins to occur at longer and longer intervals, and finally stops entirely, though there is great liability to a return on the slightest indiscretion. Afterward all the other symptoms disappear except the constipation, which is apt to be obstinate.

Diagnosis.—The protracted course, the frequent and obstinate vomiting of sour liquid, and the excessive emaciation, mark the disease with sufficient distinctness. The association

of vomiting and constipation, and the development of the cerebral features, are suggestive of tuberculous meningitis. This disease is to be excluded by the depressed condition of the fontanelle, the regularity of the pulse, the tympanitic abdomen, and the apyrexia.

Prognosis.—Chronic vomiting is a dangerous affection; still, with careful feeding and judicious management many patients recover, and become stout and robust. The course, in unfavorable cases, is prolonged, extending from two to four or even six months.

Treatment.—The first and most essential step in the successful management is a careful regulation of the diet. There are two ends to be attained: first, to give the stomach as much rest as possible; and second, if a sour odor of the breath and body indicates that fermentation is going on in the viscus, to stop this process by withholding fermentable materials.

In cases of moderate severity, where the vomiting has followed premature weaning, with a substitution of farinaceous food for the natural, a return to the breast is indicated. Or, if this be impracticable, the food must consist exclusively of sterile milk guarded with lime water or diluted with barley water. For a child of three months a good proportion is one part cream, two parts milk, and three parts lime water or barley water, with sugar of milk and a little salt. Of either of these mixtures two fluidounces may be given every two hours, though the only guide to the proper quantity is the power of retention; and if one measure be rejected, less must be given at the next feeding, until the proper amount is ascertained. Subsequently, it may be increased as the stomach becomes retentive.

In more severe and long-standing cases, attended by symptoms of acid fermentation, it is still advisable, with young infants, to try a return to the breast. In doing this, the fact that the mere act of sucking is sometimes sufficient to excite

vomiting must be remembered. So, before discarding the mother's milk as a food, an effort should be made to administer it with a spoon, after pumping it from the breast. It may then be retained and digested. However, the majority of patients in this stage of the disease can digest neither breast milk nor any of the ordinary preparations of cows' milk, and time and even life may be saved by adopting at once an unfermentable diet, as a mixture of—

Fresh cream, ... f ℥ ss
Whey, ... f ℥ j
Barley water, ... f ℥ j;

Or—

Weak veal broth (half a pound to the pint).
Thin barley water; in equal quantities.

Either food is best given cold and in small quantities at short intervals. One teaspoonful at a time is enough in bad cases; but when the amount is so small, the dose must be repeated every ten or fifteen minutes. As improvement occurs, the amount of food and the length of the intervals should both be increased. It is important always to forbid the use of a bottle and to feed with a spoon. A careful observance of these details is frequently rewarded by a rapid cessation of the vomiting. After the stomach has been retentive for forty-eight hours an effort may be made to return to a milk diet and the bottle. The change may be begun with a very dilute milk mixture, and even this should be partially predigested at first.

For a patient three months old make each bottle of food as follows:

Cream, ... 1 tablespoonful (f ℥ ss)
Milk, ... 3 tablespoonfuls (f ℥ iss)
Water, ... 5 tablespoonfuls (f ℥ iiss)
Peptogenic milk-powder, ... 1 level teaspoonful.

After mixing, heat cautiously over a flame for six minutes, stirring constantly with a spoon, and tasting often, so that it shall not become too hot to be sipped—115° F. Cool to 98° F. before administering.

Feed every two to two and a half hours from 5 A. M. to 10 P. M.

In case each bottle cannot be prepared separately—by far the better way—the whole quantity for each day may be prepared in the morning, as follows:

Cream,	8 tablespoonfuls (f℥iv)
Milk,	24 tablespoonfuls (f℥xij)
Water,	40 tablespoonfuls (f℥xx).
Peptogenic milk-powder,	8 level teaspoonfuls.

Heat slowly, so as to bring to a full boil at the end of ten minutes; fill eight graduated nursing bottles to the five-ounce mark, cork with cotton, and place in nursery refrigerator; heat to 98° F. at time of administration.

This food is to be given at first in portions of two fluid-ounces, and this quantity gradually increased until double the quantity at a feeding is borne with ease. Then, to return to an unpeptonized diet, gradually reduce the time of heating; finally replace the milk-powder by sugar of milk and salt, and carefully increase the proportion of milk until a food properly modified for the age is attained. For example:

Milk,	f℥ij
Cream,	f℥ss
Milk sugar,	℥j
Salt,	a pinch
Water,	f℥iss;

given from a perfectly clean bottle, every two and a half hours. The substitution of lime water or barley water for water is advisable in case of slow digestion with colic.

The importance of preparing each meal separately, and immediately before it is served, must not be overlooked.

The second necessary step is to attend to the clothing and hygiene. A light, long-sleeved, woolen shirt, drawers of the same material, and thick worsted stockings, must be worn; the latter especially should be insisted on, as it is essential to keep the feet warm. In addition it is well to envelop the abdomen with a flannel binder. The clothing must be changed at reasonable intervals. Should it become soiled by vomit, it must be taken off at once and carried out of the room. The

frequency of such accidents can be much lessened by placing a towel under the child's chin and over his chest, to receive the vomited matter. This, too, when soiled, is to be removed immediately and replaced by another, perfectly dry and fresh. The sick-room must be light and well ventilated, and no articles of body or bed clothing moistened with vomited matter should be allowed to remain in it a moment; the proper temperature is 68° F.

If the feet remain cold in spite of stockings, they should be rubbed from time to time with the dry hand, or with some stimulating liniment—oil of turpentine, f℥ij, and olive oil, f℥ij; if this does not warm them, the legs, as far as the knees, may be put in a hot mustard foot-bath for five minutes. Hot flaxseed poultices made light and dashed with mustard, will, when worn over the belly, relieve pain and fretfulness; the same result follows repeated applications of the stimulating liniment. To promote free action of the skin, the whole body should be sponged with warm water twice a day, and afterward anointed with warm olive oil, which must be gently rubbed into the surface with the pulps of the fingers. If there be great prostration, a full bath of 100° F., with or without mustard, may be resorted to, the body being immersed from one to three minutes. Under such circumstances, it may also be necessary to envelop the legs in cloths wrung out of hot mustard water, and to keep bottles or rubber bags filled with hot water in close contact with the body in order to encourage reaction and maintain a normal temperature.

The ordinary medicines for relieving gastric irritability are of little avail in checking the vomiting in chronic catarrh of the stomach. The remedy that seems to possess most power to accomplish this is liquor potassii arsenitis. The proper dose for a child of three months is half a drop, three times daily, administered simply in a teaspoonful of water or combined with an alkali and aromatic, as:

℞. Liquor potassii arsenitis, ... ♏xij
Sodii bicarbonatis, ... gr. xxiv
Aquæ menthæ pip., ... q. s. ad f℥iij. M.
Sig.—One t aspoonful in a little water, three times daily.

Tincture of nux vomica is also very useful; it may be administered in half-drop doses three times daily, combined with bicarbonate of sodium and an aromatic, as in the prescription just given.

When Fowler's solution and nux vomica fail, there are several other drugs that may be tried. These are wine of ipecacuanha in drop doses every three hours, calomel one-twelfth of a grain every four hours, and salicylate of sodium half a grain every two hours.

While these medicines are being administered, the bowels should, in case of constipation, be regularly evacuated by laxative enemata.

Prostration demands stimulants. The best is old whiskey, which may be given in ten-drop doses every two hours; but the guide for the dose, as well as for the proper time to commence administration, is the condition of the fontanelle.

When convalescence begins half a drop of tincture of nux vomica, or fifteen drops of the ferrated elixir of cinchona, may be prescribed, and the tonic effects of fresh air and sunlight must be utilized by taking the child out of doors when the weather permits.

ULCER OF THE STOMACH AND HÆMATEMESIS.

This disease is not very uncommon in new-born infants, but is decidedly rare afterward. It may occur as a single, minute, round ulcer, with a perforating tendency, as in adults, or as numerous small scattered erosions which stud the surface of the mucous membrane and assume the appearance of ulcerated

follicles. The perforating ulcer has been ascribed to all the various causes which are held to be potent in producing the gastric ulcer of adult life, and it is probable that for children after they are weaned the pathology of the two may be the same ; but, for newborn infants, circulatory disturbances which ensue somewhat suddenly at birth, the sudden arrest of the placental stream, the gradual development of the pulmonary circulation, associated as it often is with partial atelectasis, so potently predispose to venous stagnation in the abdominal viscera as to give much ground for the belief that congestion, and even ecchymosis, are at the root of the ulceration.

The scattered ulceration has been found under such varied clinical conditions that it is impossible to attach any definite meaning to it, although one may suppose with reason that it is the result of some chronic catarrh.

Vomiting of blood and melæna are the only indications which point to the existence of an ulcer of the stomach in the infant. A healthy child who within a few hours of its birth begins to vomit blood and to pass pitchy matter per anum, may have a gastric ulcer. More than this we cannot say, for the same symptoms may certainly be present without any ulcer. In the few cases in which a gastric ulcer is present in older children, the symptoms, if definite, should be as in adults—epigastric pain and vomiting. The follicular ulcer cannot be diagnosed, and has always been found accidentally upon the post-mortem table.

Tuberculous ulceration of the stomach is occasionally met with, but it has no symptoms apart from those of tabes mesenterica. Hemorrhage from the stomach, without ulceration, may take place during the first few days of life and is one of the most frequent forms of "hemorrhagic disease" in the newborn. In older children bleeding sometimes occurs without fixed gastric lesion, and may be a symptom of several constitutional diseases : namely, purpura, scurvy, hæmophilia,

and at times malaria. If blood leaking from the infant's nose or pharynx be swallowed, it is usually vomited; so also if sucked from a fissured or ulcerated nipple during the act of nursing: this spurious hæmatemesis must not be confounded with the true form.

In some cases of gastric hemorrhage there is no hæmatemesis, and the diagnosis must be established by the general symptoms, which are those well known to attend internal hemorrhage; usually, however, there is both vomiting of blood and its expulsion with the stools. Vomited blood is bright red in color if expelled soon after the bleeding has occurred, dark brown and resembling coffee grounds if it has remained long in the viscus. Blood that has passed from the stomach into the intestines is voided with the fæces as a black, tarry material.

Spurious hemorrhage can be distinguished by the absence of alteration in the child's general health and by a careful examination of the patient's nose and pharynx and the nurse's nipple.

Hæmoptysis has its own characteristic features readily establishing its presence or absence.

The bleeding in many cases of gastric ulcer is so quickly fatal that no treatment is available. In less rapid cases, and in hæmatemesis, favorable results are sometimes secured by keeping the stomach at rest, nothing being allowed by the mouth but small bits of ice and sips of water. Nourishment must be given by enema, and the rectum also utilized for medicinal treatment, which consists in the administration of opium in small but sufficient doses to maintain quiet. Stimulants may also be given by this channel, or whiskey and strychnia may be introduced hypodermatically if necessary. When the bleeding is checked, gastric feeding may be cautiously begun, and bismuth subcarbonate or silver nitrate may be administered in appropriate doses.

SOFTENING OF THE STOMACH (GASTRO-MALACIA).

This condition has received a great deal of attention, and some of the most distinguished writers upon the diseases of children have credited it with being a distinct disease, but, to my mind, with insufficient reason. Of symptoms it has none which is in any way characteristic, and the appearances found after death are identical with those of post-mortem solution. Whether this, as well as other changes which are cadaveric in their nature, may not at times commence during the last hours of life may perhaps be an open question, but that the change is, in all cases, essentially what has been described as post-mortem solution there is no doubt.

Goodhart has twice found evidence of a gastric solution of the lung, which had gone on during the life of the patient. Into the appearances of the parts it is needless to enter further than to say that they showed a distinctly peculiar broncho-pneumonia, and that in each case there had been a moribund condition associated with vomiting for some days before death. Now, it is obvious that such a condition has no right to the position of a disease; it would never have occurred had the circulation of the patient been at its proper tension. It was the result of an ebbing life, not a disease, which caused death. So it is with the gastro-malacia of children. It is the result of exhausting disease of any kind, and is virtually, if not literally, a post-mortem change.

CHRONIC GASTRO-INTESTINAL CATARRH.

This disease is common in children who have passed the first dentition, and bears to them somewhat the same relation that chronic vomiting does to infants. Among the latter it is very uncommon, perhaps because the anatomical position and

greater irritability of the stomach in the early months of life favor the rapid expulsion of improper or partially digested food, and the irritating products of gastric fermentation, which would otherwise, as in older children, pass through the pylorus and induce catarrh of the intestinal mucous membrane. The disease is met with in two forms, differing merely in the degree of catarrh. For convenience, they may be considered separately; as, habitual indigestion, in which the catarrh is moderate in degree; and mucous disease, in which it is intense.

HABITUAL INDIGESTION.

In the rare cases of this disease where death has resulted from an intercurrent affection, post-mortem examination has revealed the gastro-intestinal mucous membrane finely injected, reddened in patches, flabby, swollen, and covered with a layer of tenacious mucus of variable thickness. In the majority of cases, though, it is probable that the catarrh does not extend beyond the grade that would leave no gross change after death.

Etiology.—The predisposing agencies are deficient functional activity of the stomach, either existing simply as a factor of a weak constitution, or resulting from previous disease or ill-directed hand-feeding. Residence in large cities, and in close, damp houses; too little outdoor exercise, and too much confinement and pushing at school, belong to this class of causes. They all act by lowering the capacity to digest, and the best food imperfectly digested undergoes chemical changes rendering it irritant and capable of transforming the normal hyperæmia of digestion into the congestion of catarrh. Fewer cases are met with in summer than in winter, because children live more out of doors, and the functions of the skin are more active, keeping a larger quantity of blood at the surface—a great safeguard against catarrh. Season, then, may be added to the predisposing influences.

The prime exciting cause is unsuitable food. As a rule, especially with children of the poorer classes, among whom the disease is very rife, the fault lies in the food being too strong. These children are allowed to sit at table and partake of whatever the elders eat, such as meat two or three times a day, with potatoes, bread and butter and tea, none too well prepared or of too good quality. This coarse food, of itself irritating to the delicate lining of the stomach, is also very difficult to digest. The child may have force enough to maintain a fair degree of health against this odds for a while, and some even win in the race, but for most, the time of trouble surely and soon comes. Some portions of the food begin to escape, more or less completely, the solvent action of the gastric juice. The starches and fats, influenced by the heat of the parts and the organic matter or bacteria present, undergo fermentation, and are converted into acids, with the liberation of carbonic acid gas; the albuminoids become partially decomposed and acrid. These not only irritate the mucous lining of the stomach, but, passing into the intestine, act upon its mucous membrane, and cause the same catarrhal lesions there.

At first an attack of vomiting and purging, by cleaning out the alimentary canal, puts an end to the catarrh, and the patient is free from symptoms so long as the resulting anorexia restricts his appetite. But a return to the old diet is quickly followed by a relapse, culminating in another natural effort at relief; and so the attacks recur, growing more and more frequent and easily induced, until what was originally an acute and passing indigestion becomes chronic.

As soon as the catarrh is established and the interior of the canal is covered with tenacious mucus, the disease begins to react upon and increase itself. For, whatever food is taken is soon enveloped by mucus, and this coating prevents the free access of the gastric and intestinal juices, which are solvents and antiferments. Mucus, too, is in itself a powerful ferment,

and increases the formation of irritating substances; further, by covering the interior of the alimentary canal, it prevents the absorption of what little food is digested, leading to malnutrition, with a deterioration in the quality of the gastric juice and succus entericus, and leaving more material for chemical change. Thus there is a direct and an indirect reaction.

Well-to-do children are spared a coarse diet and, in consequence, do not suffer so severely. In them bad food takes the form of rich dishes, pastry, sweets, and so forth.

Exposure to wet and cold has some excitant influence, though, without the aid of bad diet, it is scarcely sufficient to induce an attack.

Symptoms.—When the disease is fully developed, the patient has a spare, delicate appearance, the face wears a languid expression and is pale; the pallor at intervals increasing very much, or again giving place to flushing of one or both cheeks. The hair is crisp and lustreless. The conjunctivæ are sometimes natural, but more often slightly yellow. The skin is cool, dry and rough to the touch, and somewhat sallow in hue. The pulse is weak, but otherwise unaltered. The mucous membrane of the mouth is less pink than normal; the breath has a heavy, disagreeable odor; the tongue is pale, broad, and flabby, frequently indented by the teeth, and covered with a thin, white frosting, which grows thicker, and more yellowish toward the posterior part of the dorsum. Through this coating the enlarged fungiform papillæ project, and are redder than the rest of the mucous membrane, but not so highly colored as in acute gastric catarrh. Moderate hypertrophy of the tonsils can frequently be observed, and, as a rule, the cervical lymphatic glands are slightly enlarged.

The appetite is variable and perverted, the desire being for highly seasoned food. After eating, eructations of flatus occur, and small quantities of partially digested food, mixed

with thin mucus and intensely sour, are from time to time regurgitated from the stomach. Tympanites is a constant symptom, and when the child is stripped the distended abdomen contrasts markedly with the spare trunk and limbs. Pain is uniformly present. It may be constant or paroxysmal, severe and colicky, or only amounting to discomfort, and either general or confined to certain parts of the abdomen. Usually it is paroxysmal, beginning from two to three hours after meals; if constant, it is subject to exacerbations at these periods. Generally, too, it is only moderately severe, and is confined to the left or right hypochondriac region; the reason for this limitation being, that in both positions, but especially in the first, the colon makes a sharp turn, where the gases, liberated by fermentation, become lodged. On account of the mucus covering the fæcal masses as well as the interior of the bowel, bringing two slippery surfaces together, the peristaltic contractions are less efficacious, and constipation results. Intervals of two, three, or even nine days elapse between the movements, which are attended by considerable straining, and result in the expulsion of a small number of dark, hard lumps enveloped in mucus.

The urine, at times, is scanty and high-colored; at others, overabundant and light-colored. The diminution is apt to attend exacerbations of abdominal pain.

During the day the child is listless, disinclined to play, and easily tired, while at night he tosses about the bed in a dreamy sleep.

To the above symptoms catarrh of the nasal and bronchial mucous membranes is often added.

It is usual for the even course of the disease to be broken by vomiting and diarrhœa. In such attacks there may be slight fever, the tongue becomes more heavily coated, the appetite fails and thirst is increased. The vomited matter at first is composed of acid, partially digested food, mixed with stringy

mucus; afterward, if there be much retching, of more or less bile-stained mucus alone. The purging, primarily, unloads the bowel of a large quantity of lumpy fæces, apparently the collection of several days; afterward, the stools are made up of mucus and liquid fæces. Such attacks last one or two days, and are followed by a brief period of improvement.

The **diagnosis** is easy.

The **prognosis** is favorable, though when left to itself the disease runs a protracted course, improving in summer to return in winter. By the general debility that it produces, it opens the way to intercurrent affections, or the development of hereditary tendencies, and renders both more fatal.

MUCOUS DISEASE.

This form of chronic gastro-intestinal catarrh occurs much less frequently than the other. It consists of a mucous flux from the whole internal surface of the alimentary canal, which interferes mechanically with the digestion and absorption of food, and so impedes nutrition as to suggest the presence of tubercles. The lesions are identical in kind with those of habitual indigestion, but are much greater in degree.

Etiology.—The affection usually arises between the fourth and twelfth years, and has the same predisposing and exciting causes as the milder form. It is also a frequent sequel of pertussis.

During the course of whooping-cough the gastro-intestinal mucous membrane is always in a catarrhal state. Much of the tenacious mucus expelled at the end of each paroxysm comes from the stomach. When vomiting occurs, most of the matter ejected is mucus, and the stools contain a quantity of the same substance. As the cough subsides, the secondary catarrh usually disappears, but after severe attacks, and in feeble children, it may continue, and pass into mucous disease.

Symptoms.—As might be expected from what has already been said in regard to lesions and causation, the symptoms, in the main, are those of habitual indigestion greatly magnified, and to these are added certain well-defined nervous manifestations.

The child is emaciated and muscularly weak. His face is uniformly pale, though subject to great changes in color, and at times a circumscribed crimson flush appears on one or both cheeks; at others, there is so much pallor, especially about the lips, that fainting seems imminent, and, indeed, it does sometimes occur. The eyes are surrounded by bluish circles, which deepen when the face pales. The conjunctivæ are muddy, and there is occasional squinting. The skin is markedly sallow, dry and rough to the touch and, by light friction, numerous fine scales of dead epidermis can be removed, and the hair has a lustreless, faded appearance. The cervical lymphatics are noticeably swollen, though painless.

The oral mucous membrane is pale. The tongue, besides being flabby and indented by the teeth, presents an appearance characteristic of the disease. The dorsum, with the exception of an oval space in the centre, is covered with a light gray coating, scarcely thick enough to obscure the natural pale-pink color, and shows clearly the slightly redder fungiform papillæ. The oval bare spot, about as large as a cent, is still deeper red, and shines as though varnished. This glossy look, in very severe cases, extends over the whole dorsum, and is due to an excessive secretion from the mucous glands of the mouth. Such a tongue does not lose the natural velvety appearance arising from the fungiform papillæ. (See *a*, Plate II.)

Chronic hypertrophy of the tonsils, with plugging of the follicles by retained secretion, is common, and in part accounts for the disagreeable odor of the breath.

The appetite in the beginning fails, then becomes capricious,

and, finally, almost insatiable. The increased desire for food is due partly to a morbid craving, excited by the irritation of the fermenting contents of the stomach and intestines, and partly to the demand of the tissues generally for more nutriment than is supplied by the imperfect digestion and impeded absorption. Eating is followed by a sensation of drowsiness, and by eructations of flatus and acid liquid.

Tympanitic distention of the belly is always marked, and the child complains of pain in this portion of the body. The pain may be general, amounting to little more than a sensation of soreness, but more frequently it is limited to the left hypochondrium, and is stitch-like in character. Either variety may be constant, or present only after meals; in the former case there is a temporary increase of discomfort after eating. In some instances paroxysms of severe pain in the neighborhood of the umbilicus occur early in the morning, and occasionally after meals. These are unattended by nausea, purging, or doubling of the body to secure relief, as in colic, but while they last the pallor of the face is extreme.

Constipation is the usual condition of the bowels. Evacuations take place at intervals of several days, with much straining, and at times rectal prolapse; they are scanty, and composed of small, hard, dark-colored lumps with a large proportion of mucus, and often contain intestinal parasites or their ova. Sometimes the constipation lasts for a week or more at a time, to be followed by a number of free evacuations in quick succession, relieving the bowel of the accumulated fæces; then comes another period of confinement, another relief, and so on.

By day, the patient suffers from headache; is languid, ill tempered, and disinclined for study or play. At night, he is restless; grinds his teeth; starts from sleep in terror caused by frightful dreams, and often screams or talks incoherently, and for a time is seemingly unconscious of his surroundings.

Somnambulism and nocturnal incontinence of urine are quite common. Stammering is another nervous symptom occasionally encountered.

There is no alteration in the temperature ; the pulse is feeble, and there is frequently a slight, dry, hacking cough, entirely independent of pulmonary disease. The urine is diminished during the continuance of severe pain, but is voided in excessive quantities at the termination of the paroxysms.

At intervals of two or three weeks violent vomiting and purging occur. During these attacks, which last from one to three days, a large quantity of mucus is rejected ; there is slight fever, and the tongue is changed in appearance, and for the second time assumes a characteristic aspect. It becomes less flabby, more pointed, and covered with a thick, white, feathery fur, except along the sides, where there are several smooth, bright-red, glazed patches of variable size and shape, with irregular, indented edges. A few red fungiform papillæ show through the coating. Sometimes the whole dorsum is clean, red, and glazed, as if denuded of epithelium. (See *b*, Plate II.) Temporary improvement follows the clearing-out process, but soon the symptoms return, and slowly grow worse, to culminate in another attack.

The course of the disease is very chronic, extending over months. There is no regular progression, though the tendency is for the symptoms to grow more and more severe as time elapses.

Diagnosis.—Tuberculosis is the condition most likely to be confounded with the disease in question, and the mistake is especially apt to be made when a dry, hacking cough is present. The appearance of the symptoms after whooping-cough ; the state of the tongue ; the mucous stools ; the condition and color of the skin ; the absence of pyrexia except during the attacks of vomiting and purging ; the periodicity of these attacks ; the diurnal drowsiness and nocturnal terrors,

and the irregularity in the course are the distinguishing features.

Prognosis.—Mucous disease is not in itself mortal, and is perfectly amenable to treatment. It is, nevertheless, dangerous from its power to reduce the general nutrition, thus opening the way for more serious intercurrent affections.

As the plan of managing both forms of chronic gastro-intestinal catarrh is the same, it is unnecessary to divide the subject of—

Treatment.—Since the exciting cause is perfectly well known and removable, relief may be confidently promised, provided it be possible to regulate the diet. There are two rules to be insisted upon : first, to stop the supply of all those articles of food that readily undergo fermentation ; and, second, to allow only a moderate quantity of food at a time, so as not to overdistend the stomach, while the meals are increased to four a day, to insure the ingestion of a proper amount of nourishment.

All farinaceous substances must be excluded from the dietary save stale or toasted bread, and this, even, must be restricted in amount. Potatoes, peas, beans, turnips, carrots, parsnips, fruit, cakes, pastry, sweetmeats, and butter are all in the proscribed list.

Of permissible articles, milk, eggs, and lean meat are the chief, though poultry, game, fresh fish, raw oysters, cauliflower tops, spinach, asparagus, lettuce, and celery can be used without ill effect.

With such food to select from, it is easy to write out a suitable diet list and make changes sufficiently often to avoid cloying the appetite by monotony. In writing such lists, it is best to fix the hour, as well as the ingredients, of each meal. For example :

Breakfast, at 7 A. M.—One or two tumblerfuls of milk

guarded by lime water* (f℥ij to f℥vj), the yelk of a soft-boiled egg, and a single thin slice of stale, unbuttered bread.

Luncheon, at 11 A. M.—A cup (f℥iv) of beef-, chicken-, or mutton-broth, entirely free from fat,† and a thin slice of dry toast.

Dinner, at 2.30 P. M.—Broiled mutton chop, entirely free from fat, one or two, according to the size; a large spoonful of well-boiled spinach, and a slice of stale, dry bread.

Supper, at 7 P. M.—One or two tumblerfuls of milk guarded by lime water, and a slice of dry toast.

Filtered water must constitute the drink, though, if the child will take it, half a tumblerful of Vichy at luncheon and dinner can be recommended.

Should failing appetite demand a change, another menu must be made, as:

Breakfast.—Milk, a bit of boiled fresh fish, and a thin slice of unbuttered toast.

Luncheon.—The soft parts of six or eight small oysters, seasoned with salt alone, and a Boston cracker.

Dinner.—A bit of the breast of a roasted or boiled fowl, a moderate portion of well-boiled cauliflower tops, and a slice of stale, dry bread.

Supper.—Milk and dry bread.

Further variety can be had by substituting a thin slice of cold roast mutton or beef for the egg or fish at breakfast; at dinner, by running the changes on roast mutton, broiled beef-steak, roast beef, plainly cooked game, and such vegetables as stewed celery, boiled asparagus tops, spinach, and cauliflower;

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* The lime water is added both for the purpose of retarding coagulation and for its effect upon the mucus in the alimentary canal.

† The fat can be completely removed by allowing the broth to stand for a few minutes after it is made, and picking off the globules of oil as they rise to the surface with a fragment of blotting-paper.

by using different sorts of meat broths, and by changing the manner of cooking the eggs.

When, in mucous disease, there is great debility, stimulants are indicated. They should be given well diluted and with the meals. Whiskey and old dry sherry are the best. Of the first, one or two teaspoonfuls in a fourth of a tumbler of water may be given with lunch and dinner; of the second, one or two tablespoonfuls with twice as much water at the same meals.

Next to regulating the diet it is important to maintain the activity of the skin. This is to be accomplished by baths, inunctions, and proper clothing. Each morning the patient, being in a warm room, and standing in enough hot water to cover the feet, should be sponged with water at a temperature of 70° F., then thoroughly rubbed down with a coarse towel, and the whole body anointed with warm olive oil, which ought to be gently rubbed into the skin with the finger pulps. At bedtime a full bath of 100°, of five minutes' duration, must be given, and the inunction repeated, after careful drying with friction. In severe cases, where the skin is very dry and rough, the first warm bath should contain a heaped teaspoonful of soda, and with this and soap the whole surface must be thoroughly scrubbed.

Woolen underclothing, to cover completely the trunk and limbs, and woolen stockings are to be insisted upon. The weight may be changed with the weather, but not the material. This not only keeps the skin warm, full of blood, and functionally active, but it also maintains the heat of the whole body and saves force. Children dressed for beauty with four or five inches of bare leg, nine times out of ten suffer from chronic indigestion or bronchitis. First, because chilling of the surface drives the blood toward the interior and puts the mucous membranes in the most favorable condition for catarrh; secondly, because so much force is consumed in

maintaining the normal temperature, in the face of constant chilling, that other functions, notably the digestive, must suffer. Parents would appreciate this better if they could be persuaded to try the experiment of sitting, for an hour or so, even in a warm room, in the same degree of nakedness that they inflict on their children, who are less robust and less able to resist cold.

Exercise in the open air on suitable days in winter, and an almost complete outdoor life in summer, hastens recovery. The sleeping and living rooms should be large, light, dry, well ventilated, and properly warmed.

Medicinal treatment is of minor importance, but by no means to be neglected. The indications to be fulfilled are to check the secretion of mucus; to neutralize the acids formed by fermentation of the food; to restore the mucous membrane to a normal condition, thereby improving secretion, digestion, and appetite, and to secure regular action of the bowels and the expulsion of collected mucus and fæces. These accomplished, strength and health return, though it may be necessary to call in the aid of tonics.

Alkalies are the best remedies to check the secretion of mucus, and to liquefy it so that it may more readily be removed. They are also most efficient in neutralizing the acid products of fermentation. Simple bitters, too, have some power in lessening the formation of mucus, and considerable influence in arresting fermentation; at the same time they give tone to the mucous membrane and stimulate digestion. Laxatives keep the bowels clear. Of the first class, bicarbonate of sodium, phosphate of sodium, and chloride of ammonium; of the second, gentian, calumba, nux vomica; and of the third, senna or aloës, are to be preferred in treating this disease.

In habitual indigestion a combination like the following will be all that is required:

℞. Sodii bicarbonatis, ... ʒij
Ext. sennæ fluid., ... fʒiij
Inf. gentianæ comp., ... q. s. ad fʒiij. M.
Sig.—Two teaspoonfuls three times daily before eating, at the age of seven years.*

Should there be yellowness of the conjunctivæ and marked sallowness of the skin, indicating a slight degree of catarrhal jaundice, it is well, at first, to substitute equal doses of chloride of ammonium for the bicarbonate of sodium in this prescription.

In mucous disease a similar prescription, with minute doses of iodide of potassium to increase the salivary secretion, may be ordered before meals, as:

℞. Potassii iodidi, ... gr. vj
Sodii bicarbonatis, ... ʒj
Ext. sennæ fld., ... fʒiij
Inf. calumbæ, ... q. s. ad fʒiij. M.
Sig.—Two teaspoonfuls three times daily before eating.

After food, it is well to order from ten to twenty drops of tincture of myrrh in a little water, for its powerful tonic action on the intestinal mucous membrane.

Aloës is valuable not alone as a laxative, but in arresting the mucous flux and bracing the mucous membrane. It can be administered in the form of tincture of aloës and myrrh, in doses of twenty drops, three times daily after eating. Or, if the child be able to swallow a pill, it may be combined thus:

℞. Pulv. ipecacuanhæ, ... gr. j
Pil. aloës et myrrhæ, ... gr. xij
Ext. gentianæ, ... gr. vj
Ext. taraxaci, ... gr. xij.
M. et ft. pil. No. xij.
Sig.—One pill three times daily an hour after eating.

When there is much debility, iron is demanded; and if the

* All of the subjoined prescriptions are proportioned for children of this age.

proper form be selected, it may be given in spite of a coated tongue, the usual contraindication. A good formula is :

℞. Ferri sulphatis exsiccati, ... gr. xij
Tr. aloës et myrrhæ, ... f℥iv
Syr. rhei aromat., ... q. s. ad f℥iij. M.
SIG.—One teaspoonful three times daily after meals.

From this prescription there is an astringent action, by the iron and rhubarb, which tends to check the formation of mucus ; a laxative action, by the aloës and rhubarb, keeping the bowels clear of mucus and fæces ; while the myrrh is a direct tonic to the relaxed mucous membrane.

If, as the tongue cleans, the improvement under this plan comes to a stand, it is advisable to change to an acid treatment. There are several useful prescriptions, for instance :

℞. Tr. nucis vom., ... ♏xxxvj
Essence of pepsin (Fairchild's), ... f℥vj
Acidi muriatici dil., ... f℥ij
Elix. aromat., ... q. s ad f℥iij. M.
SIG.—One teaspoonful three times daily after eating.

Or an acid may be combined with a bitter :

℞. Acidi nitro-muriat. dil., ... f℥j
Inf. gentianæ comp., ... q. s. ad f℥iij. M.
SIG.—One teaspoonful three times daily after meals.

Or—

℞. Quininæ sulphatis, ... gr. xij
Acidi muriatici dil., ... f℥ij
Aquæ cinnamomi, ... q. s. ad f℥iij. M.
SIG.—One teaspoonful three times daily after meals.

All of these prescriptions must be well diluted and taken through a glass tube.

During the periodical attacks of vomiting and diarrhœa, so apt to occur in both forms of the disease, the child must be put to bed, restricted to a diet of milk and meat broths, given a course of calomel in minute doses,—gr. $\frac{1}{24}$ to $\frac{1}{12}$ with gr. j of bicarbonate of sodium every hour for six doses,—and then the following prescription :

℞. Pepsini (Fairchild's), ... ℥ss
Sodii bicarbonatis, ... gr. xxxvj
Pulv. aromatici, ... gr. xij.
M. et ft. chart. No. xij.
SIG.—One powder four times daily.

The diarrhœa must not be interfered with unless it become excessive, when it may be held under control by adding five grains of subcarbonate of bismuth to each of the alkaline powders.

After the tongue becomes normal and the active symptoms have disappeared, the general strength must be built up by a course of tonics. The best are tincture of nux vomica, ferrated elixir of cinchona, and bitter wine of iron. In order to prevent a relapse, a mixed diet must be avoided for at least two months after convalescence is fully established, and to confirm the cure, change of air, by a trip to the sea-shore or mountains, is advisable.

Both habitual indigestion and mucous disease are occasionally attended by a troublesome symptom that demands brief consideration. This is a peculiar cough, which is dry, paroxysmal, and unattended by lesions of the throat or lungs. The paroxysms are due to reflex causes; they commence in the early evening, and may, by their repetition, prevent sleep for half the night. On the following day the patient is as well as usual, or coughs only at long intervals, but about bedtime the trouble begins again. So the symptom continues for weeks at a time, unless its true nature as a "stomach cough" be recognized and it is properly treated. The paroxysms suggest those of pertussis, though they may be distinguished by the absence of whooping, and of the characteristic expulsion of tenacious mucus at the end of the kinks. Questioning often reveals the fact that the cough is worse after a rich and heavy supper.

If proper clothing be worn, the diet carefully regulated, and alkalies prescribed, as for an ordinary case of chronic gastro-intestinal catarrh, improvement is rapid, for in this way the cause is removed. Ordinary cough mixtures do more harm than good, from their tendency to derange digestion; still, the fatiguing cough must be relieved. This can be done by letting the child wear a small bean-shaped belladonna plaster over the larynx, and administering a dose of one of the following mixtures every two hours, beginning at four o'clock in the afternoon:

℞. Pulv. aluminis, ... gr. xlviij
Potassii bromidi, ... ʒij
Syrupi zingiberis,
Aquæ, ... aa f ℥iss. M.
Sig.—Dose, one teaspoonful.

Or—

℞. Ext. belladonnæ, ... gr. ss–j
Pulv. aluminis, ... gr. xlviij
Syrupi zingiberis,
Aquæ, ... aa f ℥iss. M.
Sig.—Dose, one teaspoonful.

ACUTE INTESTINAL CATARRH (SIMPLE DIARRHŒA).

The condition intended to be indicated by this title is usually called simple or non-inflammatory diarrhœa, and classed as a functional disease. But from its etiology, and from the fact that in certain patients and under certain circumstances it so readily lapses into entero-colitis, it is more than probable that it depends upon a distinct, though passing lesion—a hyperæmia or catarrh of the intestinal mucous membrane. This is difficult to demonstrate, partly because the opportunity for post-mortem inspection is rare in simple diarrhœa, and also on account of the well-recognized rapidity with which the appre-

ciable manifestations of mild forms of catarrh disappear after death. Nevertheless, even those authors who advocate the functional character of the affection, state that in some instances of death, in feeble children or from intercurrent disease, autopsy shows injection, swelling, and relaxation of the mucous membrane, and tumefaction of the intestinal glands.

Etiology.—Constitutional feebleness and unfavorable hygienic surroundings, especially residence in crowded, damp, and filthy houses and quarters of cities, increase the liability to attacks of diarrhœa. Many more cases occur in summer than at other seasons of the year. Children of either sex, or of any age, may be affected, though the younger the patient, the more serious the disease.

In infancy there are numerous exciting causes. Overfeeding, even with healthy breast milk or well-prepared cows' milk, is one. Ordinarily in such cases vomiting is so easy that the child gets rid of the surplus and no harm is done; but if this does not happen, the excess remains undigested, undergoes change, acts as an irritant to the intestinal mucous membrane, and causes diarrhœa. Another cause is food of bad quality: either poor and cholesterin-laden breast milk, or unsound bacteria-laden cows' milk and farinaceous preparations. Here the action is the same as in overfeeding, though more rapid and violent; this is especially true of the farinaceæ, on account of their readiness to undergo acid fermentation. Again, exposure to cold and wet, by chilling the surface and determining the blood to the interior of the body and mucous membranes, may lead to an intestinal catarrh, in the same way that it does, more frequently, to a bronchial catarrh. Hyperæmia, too, of the mucous membrane of the alimentary tract is attended by a diminution in the secretion of digestive solvents and an increased production of the mucus—two conditions most favorable to incomplete digestion and fermentation of the food with the formation of irritant products. These, as already

seen, are quite capable, in themselves, of causing looseness of the bowels, and must greatly add to the ill effects of exposure. High atmospheric temperature is much more influential than low, particularly when associated with excessive moisture. Such conditions are powerful depressants to the vital forces; the digestion shares in the general weakness, and much of the food is left to ferment and become irritant, and carelessly kept food is more apt to become changed and to be rendered injurious by bacterial influences.

During childhood the chief exciting cause is still the use of unsuitable food.

It is almost unnecessary to call attention to the lesson taught by this study of the etiology. There is, on the one hand, the presence of an irritant as a constant factor; on the other, a mucous membrane naturally delicate and functionally very active. The conclusion is inevitable, that the ordinary effect must follow, and hyperæmia or catarrh be produced.

Symptoms.—In infants the attack may begin suddenly, or be preceded for twenty-four hours or more by peevishness, languor, faded cheeks, slight abdominal pain, indicated by moaning or fits of crying, and restless, disturbed sleep.

Next, the bowels become disturbed. The movements number from four to eight in twenty-four hours, and usually occur only while food is being taken—from six in the morning to ten o'clock at night. At first they differ from the normal merely in being more liquid and copious, and having a more offensive odor. As the disease progresses they undergo various changes. Sometimes they are composed of a yellowish liquid containing white or yellowish flakes resembling curdled milk. At others, distinct white lumps of undigested curd are mixed with the liquid. Still again, green flakes may appear in a stool having the characters of the first; and, finally, the whole may be of a deep green color, and contain small masses of mucus. In exceptional cases a small amount of bright-colored

blood may be seen in the evacuations. Often the movements are preceded, for a short time, by pain, but this disappears as soon as the act is accomplished. Occasionally, if the stools be acid, considerable tenesmus attends their expulsion, and it is under such circumstances that blood is most likely to be voided.

The tongue is lightly coated; there is anorexia, increased thirst, and occasionally nausea and vomiting. The abdomen is natural in shape, and is soft and painless on palpation. The urine is somewhat lessened in quantity, and high-colored. There is no pyrexia, and the pulse is but slightly increased in frequency.

The evil effect of several days' continuance of diarrhœa upon the general condition of the child is shown by the pallor of the face, the sunken eyes, the loss of weight, and the flabbiness of the muscles. Under proper management the attack terminates in from four to seven days, and strength is soon restored.

Simple diarrhœa is more uncommon in older children and much milder in its manifestation. There is slight furring of the tongue, loss of appetite, and abdominal pain of a colicky nature, with more or less frequent evacuations of light yellow, offensive, semi-solid or liquid fæcal matter, at times containing masses of partially digested food. The patient is weak and disinclined to exert himself. These attacks last for three or four days, and are followed by little constitutional depression.

Diagnosis.—There is no difficulty in distinguishing the disease. The only conditions for which it could possibly be mistaken are tuberculous diarrhœa and entero-colitis. The former is excluded by the history and course of the case and by lack of evidence of tuberculosis of other portions of the body; the latter, by the apyrexia and the non-existence of symptoms indicating intestinal inflammation.

Prognosis.—The result of even the more serious attacks in infants is, in the great majority of cases, favorable; never-

theless, it must not be forgotten that an acute catarrhal diarrhœa, when it occurs in a weak, ill-fed, and badly cared-for child during hot weather, has a tendency to run into entero-colitis, and thus prove fatal. An infant, too, may be so debilitated by previous illness as to be carried off by an attack of ordinary severity.

Treatment.—Before entering into the details of the management of this disease, it is necessary to draw attention to the conservative nature of the diarrhœa. The frequent, loose, and copious stools clear the intestines of irritant matter, and remove the cause of further trouble. Consequently, it is never advisable, early in the course, to completely arrest the evacuations, although at the same time they must be kept well in hand, lest the attack pass into entero-colitis.

As in other digestive disorders, the most essential step is to attend to the feeding. With infants nursed at a healthy breast it is enough to see that they are not fed too frequently, and to lessen the quantity taken by shortening each act of sucking. If, from any cause, the breast milk be unsuitable, the babe must be weaned and carefully fed by bottle. In hand-fed babies it is necessary, first, to insist upon the use of the old-fashioned bottle and tip, and to see that they are kept absolutely clean. Next, to banish all farinaceous preparations, used purely as foods, from the diet. This does not preclude the employment of small quantities of barley water or rice water for the purpose of breaking up the milk curd. Thirdly, to direct that the daily supply of milk—the only food to be allowed—must come from one reliable dairy; be received fresh in the morning, and kept in separate, perfectly clean vessels, and, if possible, in an especial refrigerator. And, finally, to give careful, written orders as to the manner of preparing the milk food, and to make a rule that each bottle shall be mixed separately and only immediately before it is required. In hot weather, and especially in cities, it is advisable to

Pasteurize the whole supply of milk immediately after it is received in the morning, but this does not affect the principle of the separate preparation of each portion.

As guides to the manner of modifying the milk, two formulæ may be given; they are proportioned for children of four to six months.

Unskimmed milk,	f℥iiss
Cream,	f℥ss
Lime water,	f℥ij
Sugar of milk,	℥j.

Mix these in a clean bottle, and warm by standing in hot water. Five to six bottles to be taken during the day.

Or—

Unskimmed milk,	f℥iiss
Cream,	f℥ss
Rice water,*	f℥ij
Sugar of milk,	℥j.

Mix and treat as before.

The quantity is to be reduced and the dilution increased in proportion to the youth of the infant, and the reverse as age increases. Sometimes in children of one or two months a cream and whey mixture suits better, as:

Fresh cream,	f℥ss
Whey,	f℥iss
Hot water,	f℥iss
Sugar of milk,	℥j.

If the simple milk mixtures be imperfectly digested and the casein appears as curds in the fæces, partial predigestion with peptogenic milk powder must be resorted to.

When there is thirst, cool water should be given with moderate freedom.

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* *Rice water*.—Put two teaspoonfuls of washed rice in a saucepan with a pint of water; boil slowly down to two thirds of a pint; strain.

The sleeping room should be airy, well ventilated, and, in hot weather, the coolest the house affords. Soiled diapers, or the vessel containing a stool, must not be left about. In summer the patient should pass the mornings and evenings in the open air, and the hot mid-day in a cool room. A day's excursion on a steamboat, or to the country, if the journey be short, is very beneficial, while a trip to the sea-shore works wonders; a single day passed in salt air often removing every trace of the disease. Even in winter, if an attack occurs, the child, well wrapped up, should be taken out for an hour at noon on warm, sunny, still days.

The daily bath must be continued, and in hot weather a bath morning and evening is none too much. Woolen drawers and shirts of the lightest texture must be worn in summer, and if the diarrhœa prove at all obstinate, the abdomen must be enveloped in a light flannel bandage.

When these measures are carefully carried out in mild cases, medicines are often unnecessary. In those more severe, it is well to assist nature and begin the treatment with a laxative. Pain, green stools, and the presence of blood always indicate this course. The best laxative is castor oil. This not only efficiently clears away the irritating contents of the intestines, but has a secondary, soothing action upon the mucous membrane. For a child of six months, the dose is a teaspoonful, with five drops of camphorated tincture of opium to prevent griping.

After this has operated, a teaspoonful of chalk mixture every two hours will complete the cure in some instances. A more efficient prescription, however, is:

℞. Sodii bicarbonatis, ... ℥ss
Syrupi rhei aromat., ... f℥ss
Aquæ menthæ pip., ... q. s. ad f℥iij. M.
Sig.—Teaspoonful every two hours.

The great value of rhubarb depends upon its combined

laxative and astringent action, precisely what is required in simple diarrhœa.

Should the stools still fail to become less frequent and more natural in color and consistence, resort must be made to astringents. A very good formula is :

℞. Syr. rhei aromat., ... f℥j
Bismuth. subcarb. (Squibb), ... gr. lxxij
Syrupi, ... f℥ss
Misturæ cretæ, ... q. s. ad f℥iij. M.
SIG.—Teaspoonful every two hours.

The value of calomel in certain cases where the evacuations obstinately remain green and acrid must not be overlooked. It must be employed in small doses, and combined with an alkali, thus :

℞. Hydrargyri chloridi mitis, ... gr. j
Cretæ præparatæ, ... gr. xxiv.
M. et ft. chart. No. xij.
SIG.—One powder every two hours.

Its good effect should be noted in twenty-four hours ; then it must be discontinued, and one of the other prescriptions given.

When the stools become normal, tincture of nux vomica and essence of pepsin must be ordered for a week or more until the digestion is put upon a sound footing.

In older children the treatment is very simple. All that is required is a bland diet, perhaps a dose of castor oil, and some mild astringent mixture. For example, let the patient take for breakfast—a soft-boiled egg, milk guarded with lime-water, and stale, dry bread ; for dinner—some meat broth, free from fat, with stale, dry bread, and rice-and-milk pudding ; and for supper—milk, and stale, dry bread. The bismuth mixture already given, increased in dose proportionately to the age, is very serviceable. As with infants, a course of essence of pepsin, or pepsin with muriatic acid and tincture of nux vomica or other bitter tonic, should terminate the treatment.

CHRONIC INTESTINAL CATARRH.

Chronic entero-colitis, or chronic diarrhœa, as this condition is frequently termed, is a common and fatal disease in infants. When it occurs after the completion of the first dentition, it is less dangerous to life, though it runs a protracted course and interferes greatly with nutrition.

Morbid Anatomy.—As with other catarrhs, the absence of appreciable lesions is quite possible; but usually the mucous membrane of the colon is studded with minute, dark spots—the shaven-beard appearance—which the microscope shows to depend upon rings of vascular injection around the orifices of the follicles. In some instances there is deep congestion, limited principally to the summits of the longitudinal plicæ, while in others ulcers are also found. These ulcers are shallow, and either elongated and narrow, when they occupy the summits of the plicæ, or small and circular, when they are seated between the folds. They are best seen by looking obliquely at the surface of the gut. Together with the ulcers there are numerous pearl-like projections, surrounded by narrow rings of congestion. These are enlarged solitary glands, and it is to their suppuration that the round ulcers are due. The whole mucous membrane is softened and thickened, unless the disease has been of very long duration, when it becomes extremely thin. The mesenteric glands are swollen and may even be caseous. In exceptional cases, the lower portion of the ileum presents the same changes as the large intestine.

Etiology.—Entero-colitis, or a series of attacks of simple diarrhœa, may establish chronic diarrhœa; but the disease frequently arises insidiously from the constant action of the great exciting cause—improper food. This cause is most operative in hand-fed infants, and at the time of weaning, but it affects nurslings who are supplied with poor breast milk or allowed to eat bits of table food, and also older children.

Exposure to wet and cold is another excitant; so, too, are various acute diseases, notably measles, croupous pneumonia, and typhoid and scarlet fevers.

The predisposing agencies are bad hygienic surroundings, particularly overcrowding. With regard to age, the period of greatest liability, as well as greatest fatality, is from birth to the end of the second year; afterward it grows less common as age advances. In our climate the greater number of cases originate in early spring and autumn, when the weather is most changeable; and late winter, when it is cold and damp.

Symptoms.—The first indication of the disease is an alteration in the character of the stools. These assume the color and consistence of putty, and, according to the composition of the food, consist of curd and farinaceous matter, with semi-solid fæces, and, at times, mucus and streaks of blood. They are voided with much pain and straining, but are little, if at all, increased in frequency. Their odor is offensive and sour. The face is pale and listless in expression, though the child is sufficiently lively, takes his food well, and has no fever.

These symptoms continue with trifling change for two or more months, the patient gradually becoming thinner, paler, and more languid. Then for the first time diarrhœa, sufficiently marked to arrest the nurse's attention, sets in. The evacuations now have a putrid odor, but vary considerably in other characters from day to day. They may be thin, liquid and brownish like dirty water; or clay-colored, of the consistence of thin mud; or watery, with particles of grass-green matter; and, finally, they may be slimy and contain whitish masses of undigested curd or particles of other food. The number of movements varies from ten to thirty in twenty-four hours; their frequency depending upon the amount of food taken and, to some degree, upon the weather, being greater on moist, cold days than on warm, dry ones. They are preceded by pain, indicated by crying or uneasy movements of

the legs, and are attended with straining, sometimes sufficient to cause prolapse of the rectum.

The tongue is usually natural, though at times the tip and edges are too vividly red and the fungiform papillæ too prominent. The appetite is normal, or even increased; nevertheless wasting is continuous. The skin grows pale, dry, and harsh, and assumes a peculiar earthy tinge, which is deepest over the abdomen. The eyes are sunken and surrounded by dark circles; the lips are bloodless and thin; the nasal lines of Jadelot are marked, and the fontanelle is depressed. The abdomen may be soft and flaccid, but oftener is distended with flatus, and then is the seat of pain, manifested by moaning and twitching of the corners of the mouth. Palpation is painless unless there be ulceration; in the latter case there is tenderness, and the contact of the hand causes borborygmus. The skin on the internal aspect of the thighs and the nates is reddened by intertrigo, due to the irritant action of the fæces and urine. Prostration is so great that the child lies perfectly passive; the pulse is feeble and frequent; the temperature is not elevated, but, on the contrary, the hands and feet often feel cold, and have a bluish color.

The urine is diminished in quantity and retained for long periods.

With occasional brief intervals of improvement the condition gradually grows worse. The stools become more watery; look like chopped spinach floating in brown, putrid water, and may contain mucus and pus with blood, in brownish-yellow masses. Abdominal distention, tenderness, and gurgling, the signs of intestinal ulceration, are present. The appetite is capricious or lost. The face becomes thin and pinched; the forehead is wrinkled; the hair dry and lustreless, and the whole expression that of a puny, weak, old man. General wasting progresses until the body seems to consist of little more than the bones, which stand out prominently, with the

muddy, harsh, flaccid skin hanging from them in folds. To this emaciation the distended belly stands in marked contrast. The fontanelle, at this stage, is deeply depressed; the pulse feeble; the breathing superficial, and the temperature subnormal, being sometimes as low as 97.5° F. in the rectum.

As the end approaches, the nasal lines increase in depth; the lips are red, fissured, and encrusted with scales; the tongue dry, red, and rasp-like from enlarged fungiform papillæ, and the whole oral mucous membrane is covered with aphthæ or thrush patches. A fetid odor hangs about the body. The feet and hands are cold, purple, and œdematous. The little sufferer lies quiet, with half-shut, lustreless eyes; from time to time an expression of pain flits over his face, but he is too weak to cry. Finally, there is no evidence of living, save the slow rise and fall of the chest as the breath comes and goes, and gradually this ceases, so gently that it is difficult to decide upon the exact moment at which life passes away. It is not uncommon for the discharges from the bowels to stop entirely for several days before the fatal termination. This circumstance alone has no favorable significance.

Death may result from exhaustion, or several complications may arise and hasten this event. These are serous effusions, hypostatic pneumonia, exanthemata, convulsions, and thrombosis of the cerebral sinuses.

Serous effusion may take place into the pleuræ, peritoneum, and pericardium, but usually occurs in the form of œdema of the feet, hands, and, at times, the face. It is due to the impoverished condition of the blood and want of tonicity in the vascular walls.

Hypostatic pneumonia, due to the constant dorsal decubitus, is a common cause of death.

The exanthemata are very prone to attack the subjects of chronic diarrhœa, probably on account of the attendant prostration reducing the power of resisting contagion.

Convulsions are only dangerous in the early stages of the attack; later, the nervous irritability is so blunted that this complication is rare.

Thrombosis of the sinuses of the brain depends upon the withdrawal of the liquid elements from the blood by the diarrhœa. Water is then absorbed from the brain, lessening its bulk. The resulting vacuum, together with atmospheric pressure from without, leads to depression of the fontanelle, and even overlapping of the cranial bones in young subjects. If this be insufficient to compensate, the cerebral sinuses and blood-vessels become engorged with blood, and as the naturally sluggish current in the sinuses is rendered more slow by concentration of the blood and feebleness of the heart, the conditions for clotting are most favorable. At the autopsy, the clot is usually found in the longitudinal sinus, completely obliterating the channel; it is laminated, whitish, and adherent to the walls of the sinus, which are free from signs of inflammation. The veins that enter the sinus are distended with blood. The symptoms preceding death from this complication are difficult respiration, stupor, dilatation of the pupils and strabismus, spasm of the posterior cervical muscles, fulness of the jugular veins, and unilateral facial paralysis.

When the case tends to recovery, the evacuations become more solid and natural in odor and color; the latter change being caused by the reappearance of bile. The semi-stupor disappears, and the child grows very irritable, often crying out and shedding tears—a most favorable omen. The flesh, also, begins to return, the buttocks being the first part of the body to show the improvement. Diarrhœa is, after a time, succeeded by a constipated condition of the bowels. Convalescence is protracted.

Children over two years of age, when affected with chronic diarrhœa, are pale, thin, languid, and readily fatigued. Irritability of temper, night terrors, and nocturnal incontinence of

urine are common. The tongue is red at the tip and edges, with prominent papillæ, and perhaps light frosting. The appetite may be normal, craving, or capricious. The stools vary in number from three to twelve in twenty-four hours; in the former case they are semi-solid, light-colored, and mixed with minute masses of green or colorless mucus; in the latter, they consist of dark liquid, containing lumps of clay-colored fæces; this variation bears some relation to the state of the weather. The evacuations are always fetid in odor, and the act of defecation is attended by pain and straining. The abdomen is distended by flatus. Feebleness of the pulse is proportionate to the general weakness; respiration is unaltered, and there is no pyrexia.

In some instances the stools are limited to four or five a day, and are composed almost completely of undigested food and mucus. One evacuation occurs in the morning, soon after rising; the others during or immediately after meals. They are preceded by griping pain and by so urgent a desire that the patient has difficulty in waiting for the chamber or reaching the closet. The condition undoubtedly depends upon great irritability of the intestine and exaggerated peristalsis.

Diagnosis.—The diarrhœa of chronic catarrh is to be distinguished from that of tuberculosis of the intestines, the only condition with which it is likely to be confounded. Should it begin soon after birth or at weaning, if there be a history of bad feeding or exposure, and if there be no constant elevation of temperature, the affection is probably catarrhal. A temporary rise in temperature may be caused by some passing irritation, and is of no diagnostic importance.

Tuberculous diarrhœa, on the contrary, occurs after the third year, and is attended by pyrexia and enlargement of the mesenteric glands. On pressure there is tenderness and gurgling in the right iliac fossa, and tension of the abdominal wall

over this region. There is also evidence of tuberculosis of the lungs. The evacuations, too, are distinctive; they are intensely fetid, brown and liquid, when passed, but, on standing, deposit a dark sediment, composed of flocculent matter, with small, black clots of blood, and little masses of mucus, and pus. The presence, therefore, of these features or their absence, while the symptoms of catarrhal diarrhœa are observed, will determine the nature of the affection in children who have passed the age of infancy.

Prognosis.—Chronic intestinal catarrh is fraught with great danger when it attacks children under the age of two years. It is particularly fatal when it follows an acute disease; when it occurs in syphilitic, rachitic, or feeble subjects, and when it is complicated by measles or other exanthem. Unfavorable symptoms are dryness and roughness of the tongue; thrush; anasarca; features indicating intestinal ulceration; great depression of the fontanelle, and extreme emaciation. Favorable symptoms are normal progression of dentition; the reappearance of tears; intermissions in the diarrhœa, and improvement in the character of the stools and general symptoms.

Treatment.—As the disease is produced by overcrowding, neglect, exposure, and unsuitable food, the initial measures of treatment must be the regulation of the hygiene, clothing, and diet.

The sleeping-room must be kept at a uniform temperature —between 64° and 68° F.; it must be dry, well ventilated, and, if possible, heated in cold weather by an open wood-fire, and occupied by no one but the patient and nurse. During the day the patient must be moved to another room, being wrapped in a blanket if cold halls have to be passed. This room should be large, well ventilated, dry, and kept at the same temperature as the first. After the removal, the windows of the sleeping-room should be opened, and the bed and its linen thoroughly aired and freshened. Soiled diapers or

chambers containing stools are to be removed at once, and no cooking is to be done in either room. The child's person must be kept clean, and it is especially important to sponge the perineum and nates with warm water after each movement of the bowels; and, if there be any redness of the skin, to anoint the parts with oxide of zinc ointment, or powder them. It may be impossible to carry out this plan among poor patients, but it can be approximated by keeping the baby clean, out of the kitchen, and away from the door-step.

As to clothing, the body must be clad in woolen from the neck to the toes, and, as an additional protection, a broad flannel abdominal belt must be worn. So clothed, the patient may be taken into the open air on dry days, during the early stages of the attack. Soiled garments are to be replaced at once by fresh ones, and diapers must be washed when soiled, not simply dried and used over again.

The diet should vary with the age of the patient; the great principle being to maintain the general nutrition with the least amount of irritation of the intestinal mucous membrane.

Infants partly nursed and partly bottle-fed do best when restricted to the breast, provided the latter be healthy. If the diarrhœa does not improve under the change, both the intervals and the time of nursing must be shortened.

If the infant be hand-fed, every precaution must be taken to insure purity of food and perfect cleanliness of the feeding apparatus. The latter must consist of a simple bottle and tip, unless the amount to be given be very small, when a teaspoon can be used. The quantity of food and intervals of feeding always depend upon the degree of diarrhœa; thus, in very severe cases, not more than a teaspoonful every fifteen minutes can be allowed. The quality depends upon the age.

For an infant under six months, cows' milk and lime-water, in the proportion of one part to two or three, and sweetened

with sugar of milk, may be tried. If this undergoes acid fermentation, fresh whey and veal- or chicken-broth, with equal quantities of barley water, may be substituted. At the age of six months, a good scale of diet when milk cannot be taken is :

First meal, 7 A. M.—Veal-broth (½ lb. of veal to a pint of water) and barley water equal parts, 6–8 tablespoonfuls (f℥iij–iv).

Second meal, 10 A. M.—Cream, one tablespoonful (f℥ss); whey (freshly prepared), 12 tablespoonfuls (f℥vj); sugar of milk, 1 teaspoonful (f℥j).

Third meal, 1 P. M.—Same as first, with chicken-broth in place of veal-broth.

Fourth meal, 5 P. M.—Same as second.

Fifth meal, 10 P. M.—Same as first.

If feeble, one meal at 4 A. M., same as second.

After a week or more of improvement, milk may be resumed gradually, in the beginning at the first meal only ; then at the first and last, and so on. Partial peptonization is an important intermediary in the resumption of milk feeding.

Should these foods disagree, they must be discontinued and the child fed upon raw-beef juice. This is prepared by chopping a piece of sirloin steak, free from fat or tendon, into small bits, and, after slightly warming, pressing out the juice with a lemon squeezer. One or two teaspoonfuls, with a little salt, is to be given every two hours ; and, at the same time, to keep the blood-vessels full, the patient must take from 12 to 24 fluidounces of pure water, barley water, or white-of-egg water each twenty-four hours ; these being given in small doses at short intervals.

If there be much prostration, the yolk of a raw egg, well beaten with ten drops of brandy, a teaspoonful of cinnamon water, and a little white sugar, may be administered once or

twice a day, together with the whey, broth, or raw-beef juice feeding.

For a child over twelve months old, if milk can be taken, the following diet is suitable:

First meal, 7 A. M.—Six ounces of milk and barley water, equal parts; one teaspoonful of sugar of milk.

Second meal, 10 A. M.—Four ounces of veal-broth with two ounces of barley water.

Third meal, 2 P. M.—The yolk of a raw egg, beaten up well with twenty drops of brandy, a teaspoonful of cinnamon water and a little white sugar.

Fourth meal, 6 P. M.—Same as second, or four ounces of fresh whey with a tablespoonful of cream, and one teaspoonful of sugar of milk.

Fifth meal, 10 P. M.—Same as first.

It is most important to remember that if the evacuations be very frequent and watery, there can be no set meals, but the food must be given by the teaspoonful at intervals of ten or fifteen minutes. Also, that between set meals and these minimum quantities, there is a wide range in the amounts and intervals, according to the grade of the symptoms.

From older children it is necessary to withhold potatoes and farinaceous vegetables generally; fruits, sugar, sweetmeats, pastry, hot bread or cakes, butter, and all made and highly seasoned dishes; at the same time the bulk of each meal must be somewhat restricted. A good diet is:

For breakfast, at 7.30 A. M.—One or two tumblerfuls of milk warmed, and diluted by the addition of a fourth part of hot water; the yolk of a soft-boiled egg, salted, and a slice of thin, dry toast.

For luncheon, at 12 M.—The soft parts of eight raw oysters, flavored with lemon juice, and a Boston cracker. Or in summer a small teacupful of junket, with a cracker.

For dinner, at 3 P. M.—A bit of the breast of chicken cut

up very fine, or a tender piece of roast beef or beef-steak treated in the same way; with a tablespoonful of well-boiled spinach, asparagus tops, cauliflower tops, or stewed celery, and a thin slice of dry, stale bread.

For supper, at 7 P. M.—A glass of milk, warmed as at breakfast, and a slice of well-made cream toast.

An important rule in all cases is to watch the diet carefully until all danger of a relapse has passed.

Baths and external applications are useful. Infants who are not much prostrated should be placed in a hot bath (95°–100° F.) every evening for three minutes, then quickly dried, anointed over the whole body with warm olive oil, wrapped in a blanket, and put to bed. If there be much prostration, the bath must contain mustard, one teaspoonful to the gallon, and the child kept in until the supporting arms of the nurse begin to tingle.

When intestinal ulceration is suspected, the belly should be enveloped in a light flaxseed poultice, or, what answers as well, a layer of carded cotton covered with oiled silk.

Medicines are to be selected according to the stage of the attack. Early, while the stools are little increased in number, but putty-like and of sour odor, the bowels must be gently acted on by:

℞. Hydrarg. chloridi mit., ... gr. ss
Sodii bicarbonatis, ... gr. vj
Pulv. rhei, ... gr. j.
M. et ft. chart. No. vj.
SIG.—One powder every hour until all are taken, for an infant of three to six months.

Afterward—on the succeeding day, usually—the following may be administered:

℞. Bismuth. subcarb., ... ℥iss
Essence of pepsin (Fairchild's), ... f℥ij
Elix. aromat., ... f℥j
Aquæ, ... q. s. ad f℥iij. M.
SIG.—Teaspoonful every two hours.

When the stools become frequent and green, the mixture of aromatic syrup of rhubarb, bismuth, and chalk, already given (page 275), is very useful, or :

℞. Beta-naphtol bismuth., ... gr. vj
Bismuth. subcarb., ... gr. xxx
Pulv. rhei, ... gr. j.
M. et ft. chart. No. xij.
SIG.—One powder every two to four hours.

If tenesmus be marked, the lower bowel should be washed out with a pint of normal saline solution at a temperature of 98° F. once or twice daily. In very severe cases it is sometimes necessary to follow these flushings by a sedative enema, as :

℞. Tr. opii, ... gtt iij
Potass. bicarb., ... gr. iij
Mucilag. amyli, ... f℥ss. M.
SIG.—To be injected into rectum.

This may be repeated every six or twelve hours, according to the necessity, taking care that the child—and all children are very susceptible—does not get too much opium.

Should the diarrhœa still continue, and the stools become watery and very fetid, more powerful astringents are required ; for example :

℞. Acid. sulphurici aromat., ... ♏xxiv
Liquor. morphinæ sulph., ... f℥ij
Elix. curaçoæ, ... f℥ss
Aquæ, ... q. s. ad f℥iij. M.
SIG.—One teaspoonful every three hours.

Or—

℞. Argenti nitratis, ... gr. ss
Syr. acaciæ, ... f℥ss
Aquæ, ... q. s. ad f℥iij. M.
SIG.—One teaspoonful every three hours, midway between feedings, if possible.

Nitrate of silver is most valuable when the stools contain mucus and blood, and aphthæ or thrush are present.

While administering remedies to arrest the diarrhœa, it is well to keep up the patient's general strength by tincture of nux vomica in doses of gtt. j–ij every six hours. Prostration and depression of the fontanelle demand stimulants. Ten drops of whiskey in water every two hours is about the average dose, but it may be given oftener and in larger quantities as circumstances require.

As soon as the stools become normal in character and frequency, the child must be ordered tonics, as :

℞. Tr. nucis vom., ... ♏xxiv
Acid. nitro-muriat. dil., ... ♏xij
Elix. cinchon. cal., ... f℥j
Elix. aromat., ... q. s. ad f℥iij. M.
Sig.—Teaspoonful three times daily.

Or—

℞. Ferri et ammonii citratis, ... gr. xij
Tr. gentianæ comp., ... f℥j
Spt. lavandulæ comp., ... f℥ij
Syrupi limonis, ... q. s. ad f℥iij. M.
Sig.—One teaspoonful three times daily.

For the constipation of convalescence very small doses of castor oil—twenty drops—may be ordered once or twice daily, but it is best not to interfere unless the bowels have been indolent for twenty-four or forty-eight hours.

With older children the medicinal treatment is more simple. Ordinarily the following prescription will suffice :

℞. Syr. rhei aromat., ... f℥iv
Bismuth. subcarb., ... ℥ij
Syr. acaciæ, ... f℥ij
Mist. cretæ, ... q. s. ad f℥vj. M.
Sig.—Two teaspoonfuls every two hours.

With this, tincture of nux vomica and essence of pepsin should be given three times daily after food.

The lienteric form of diarrhœa should not be treated by

astringents, but by digestants, as pepsin and pancreatin, and by nux vomica followed by arsenic. For instance, until the stools become less frequent and urgent and the griping pain diminishes, a good prescription is :

℞. Tr. opii deodorat.,
Tr. nucis vomicæ, ... āā ♏xlviij
Aq. menthæ pip., ... q. s. ad f℥iij. M.
SIG.—One teaspoonful before each meal, at the age of six years.

Afterward :

℞. Liq. potassii arsenitis, ... f℥j
Inf. gentianæ comp., ... q. s. ad f℥iij. M.
SIG.—One teaspoonful after each meal.

Washing out the intestine is also a useful method of treatment.

During convalescence from chronic diarrhœa, older children do well upon the same tonics as infants, the doses being proportionately increased.

ENTERO-COLITIS.

(*Summer Diarrhœa—Febrile Diarrhœa.*)

Entero-colitis, or inflammatory diarrhœa, is the scourge of our large cities during the summer months, when it brings death to hundreds of children, especially among the overcrowded, ill-fed poor. To it is due the popular dread of that period of an infant's life termed "the second summer," and justly, for among those unfortunates who are obliged to pass this time in crowded houses, and narrow, filthy streets, the instances of complete escape are very rare.

Morbid Anatomy.—The anatomical lesions consist in inflammatory hyperæmia of the intestinal mucous membrane. This may be distributed over the whole tract, but commonly

it is limited to the ileum and colon, and is most intense in the neighborhood of the ileo-cæcal valve and the sigmoid flexure. The mucous membrane is reddened, swollen, and softened. Redness is either general or in the form of arborescent patches about the follicles; while swelling and softening are proportionate to the degree of congestion. The former is sometimes so great at the lower end of the ileum as almost to occlude the valve; to this has been attributed the vomiting which, in the absence of gastric lesions, is otherwise difficult to explain. The isolated glands are enlarged, and more opaque than normal, having the appearance of grains of white sand scattered over the mucous surface, and the Peyer's patches are tumefied and projecting, with punctated surfaces. On the peritoneal aspect, the gut, in positions corresponding to the inflamed glands, presents areas of arborescent injection. There is moderate enlargement of the mesenteric glands.

From this condition it is but a step to the state of ulceration seen in chronic intestinal catarrh—a not infrequent result of entero-colitis.

The stomach, as already hinted, is usually normal in appearance; occasionally its mucous membrane is reddened and thickened, and it is quite possible that this viscus is often the seat of a catarrh so moderate in degree as to leave no evidences after death, though sufficient to give rise to vomiting during life.

Etiology.—Season, age, and locality of residence are important predisposing factors. Only isolated cases occur in the winter months, and these are met with among the poor, with whom it is a habit, for convenience in watching, to keep infants in the living room, which is also the kitchen; this is heated by the cooking stove, and is either intensely hot when the room-door is closed, or too cold when it is left open, in the frequent excursions of the older members of the family to the yard or street. There is, therefore, a constant exposure to

sudden and marked changes in temperature. At the same time the air of such a room is contaminated by cooking, by re-breathing, and by the exhalations from soiled clothing and dirty bodies. In other words, under these circumstances there is a combination of unsanitary influences tending to reduce the vitality and lessen the resisting power of the infant. About the middle of May or June, according to the character of the individual season, cases become more common, and as the summer heats are established, in July, August, and the first half of September, the number is augmented to the proportions of an epidemic. Late in September or in October, according, again, to the season, there is a marked diminution, and this increases as winter approaches. During the summer the number of cases and deaths varies with the range of the thermometer; several successive days with a temperature above 90° F. being attended by a great increase, while a similar period with a temperature below 80° is followed by a decided decrease. Hot, damp weather is the most productive, and of all months August is the most fatal, both on this account and because a high temperature is maintained during the night. These atmospheric conditions predispose to entero-colitis by sapping nerve energy and opening the way for the action of the chief exciting cause: namely, unsound, bacteria-laden food. At the same time they encourage the very changes in the food which render it disease producing.

Infants between the ages of six and eighteen months are by far the commonest sufferers. From the eighteenth month to the end of the second year, about one-fourth as many cases occur, and the third period of greatest frequency is from birth to the sixth month. Children over three years are not often attacked. Here, again, the questions of vital resistance, the manner of feeding, and the character of the food enter intimately into the causation.

Residence in large cities and at a distance from the source

of milk supply is an important etiological condition; the vast majority of cases occur where the streets are narrow and more than ordinarily filthy, and where the houses are overcrowded and dirty, and the people poor, ill-fed, unclean, and careless as to the condition of the cows' milk used in artificial feeding. There are other factors at work here besides the elevated temperature, since in the open country immediately surrounding affected cities, where the thermometer ranges nearly as high, the disease is of exceptional occurrence. These factors are an atmosphere polluted by poisonous gases and containing countless bacteria, the result of decomposing organic substances; and the use of impure, bacteria-laden, artificial food.

As already indicated, the most potent exciting cause is bad food. Infants hand-fed from birth are the most frequent sufferers; next, those who are weaned early. In both, cows' milk, modified in some way, is the usual substitute for the maternal breast, and it is to injurious changes taking place in this fluid, through the influence of various forms of bacteria, that one must look for the origin of the majority of cases of entero-colitis. These changes are encouraged by high atmospheric temperature, and while they may occur in milk most carefully guarded at the dairy and in the nursery, are more rapid and intense if the handling be careless. Hence the prevalence of the disease during the summer months and among the city poor, who draw their supply from a distance, cannot afford the outlay for originally good, clean milk, or for ice to preserve it, and often lack the time to secure, or overlook the necessity of, clean receiving vessels and feeding apparatus.

The disease may also be produced by the employment of farinaceous preparations in excess, and by "tastes" of table-food. Nursing infants are more exempt, but even with them too frequent and continuous feeding, or breast milk

of abnormal quality, when the predisposing conditions are favorable, often produces entero-colitis.

Symptoms.—For one or two days prior to the actual attack the infant is restless and fretful; his sleep is disturbed by moaning or fits of crying; he is paler than usual, and his head and, perhaps, the palms of his hands feel hot. He also ceases to empty his bottles; after feeding, eructations of very sour-smelling material are apt to occur, and the stools are somewhat more numerous and softer than usual.

Next, vomiting and diarrhœa set in. The former occurs after feeding, and, in bad cases, is so obstinate that nothing is retained. The matter rejected consists of sour, acid, and curdled milk, or other food imperfectly digested.

The stools range from six to twenty or more in twenty-four hours, and vary in character from day to day, and even from hour to hour. At first, they are semi-solid, homogeneous, yellow in color and neutral in reaction; then they become more liquid and green, though still homogeneous and neutral, and then the reaction becomes acid without change in the other characters. Often they are semi-fluid, heterogeneous, green with little masses of yellow fæces, and neutral; or semi-fluid, heterogeneous and green, with fragments of yellowish-white casein, and acid; or watery, with floating flakes of white, yellow, or green matter, and acid. Mucus and blood may be mixed with any of these stools; the first in stringy masses; the second, in bright red streaks or merely tingeing the mucus. In severe cases the passages become watery and so colorless as hardly to stain the diapers. The odor at first is fæcal, then sour, and finally offensive. The act of defecation is preceded by pain, manifested by the expression of the face, by crying, and by twisting of the trunk and drawing up of the legs. Sometimes there is tenesmus and slight prolapse of the rectum; it is under these circumstances that blood appears in the stools.

The tongue is dry, red at the tip and edges, and covered in the centre with a light white coating; thirst is increased. The abdomen is distended by flatus, and, at times, there is tenderness on pressure.

With these features there is pyrexia, rarely exceeding 103° F., and continuous for the first three or four days, afterward remittent; the head is especially hot, and the palms of the hands are dry and burning to the touch. The pulse is weak and frequent, beating 120, or even 140, times per minute. The urine is reduced in quantity and passed at long intervals; sometimes only two or three times a day.

As the diarrhœa continues the face becomes pale; the eyes are surrounded by dark circles; the nasal lines appear; the fontanelle, if still membranous, is depressed; the fat disappears from the body; the muscles grow soft and flabby; the buttocks and inner surfaces of the thighs are reddened by the acid stools and concentrated urine, and there is great feebleness and languor. In grave attacks these changes take place in an incredibly short space of time, twenty-four hours being ample to reduce an active, robust infant to a mere shadow of himself.

If death approach, the patient, in some cases, grows fretful; has a dry, burning skin; rolls the head from side to side; vomits incessantly; has strabismus and indolent pupils, and may have convulsions, which are more frequently unilateral than general. In others, there is drowsiness, an apathetic refusal of food, cessation of vomiting and diarrhœa, and coolness of the extremities. This difference depends upon the acuteness of the attack, for upon this rests the preservation or loss of nervous irritability.

The great diminution of the urinary excretion suggests the possibility of the fatal termination being, in some instances, due to uræmic poisoning.

When the attack tends to recovery, the vomiting stops; the motions are less numerous and more fæcal; the temperature

falls; the pulse becomes slower and the skin cooler and more moist; the urine is excreted freely; the eyes grow bright; the child again shows interest in his surroundings; takes his food better, and rapidly regains flesh and strength.

Diagnosis.—The pyrexia, the vomiting, and the frequency and character of the stools, taken in conjunction with the early age of the patient; the season and locality of occurrence; and the almost epidemic prevalence of the disease, make its distinction an easy matter. The portion of the intestinal canal chiefly involved is not so readily determined, though the presence of mucus and blood in the evacuations points to the colon as the seat of inflammation; their absence, by inference, to the small intestine. It is important to differentiate this disease from cholera infantum or "acute milk infection," which is an infinitely more serious disease. Cholera infantum is sudden in its onset, characterized by a high temperature, from 105° F. to 108° F.; uncontrollable vomiting; frequent and profuse serous evacuations; embarrassed respiration; frequent and irregular pulse; marked involvement of the nervous system, and rapid collapse. Often a case will pass in the course of twenty-four hours from blooming health into a condition of almost ante-mortem decomposition. We do not see these changes in entero-colitis.

Prognosis.—Inflammatory diarrhœa ranks among the most dangerous of the affections of infancy, both from its inherent nature and its tendency to run into chronic entero-colitis. Nevertheless, under appropriate management, a large proportion of cases recover. The outlook is most discouraging when the infant's lot has been cast in poverty; when it has been hand-fed from or soon after birth; and when it has had the bad fortune to be born in the late winter or spring, so that weaning and the necessity for artificial feeding come in the summer—"second summer."

The unfavorable features are high fever, very frequent and

watery evacuations, rapid collapse, cerebral symptoms, and convulsions.

An attack may prove fatal in four or five days, or it may be protracted for two weeks. The latter is about the duration of severe cases that terminate in recovery. One attack predisposes to another, an important point to remember in the treatment by change of climate.

Treatment.—People with means avoid the dangers of summer diarrhœa by taking their children to the country, sea-shore, or mountains, where the air is uncontaminated, the heat less intense, and the milk pure. Such escape is not open to the children of the poor; nevertheless, much may be done to preserve their health by keeping them during the day in the fresh air of public parks; by bathing in cool water; by proper, cleanly clothing; by Pasteurization and careful handling of milk and cleanliness of feeding apparatus, and by attention to the cleanliness of beds and sleeping rooms. This the parents can, and in many cases will do; and if, with these precautions, they would insist upon decently clean streets, entero-colitis would become a far less common disease.

When an attack occurs during the hot months, the patient, if possible, must be sent at once from the city to the sea-side or country. The locality selected should be near at hand, or the journey will be too fatiguing; still, it is important to fix upon a place affording a decided change of air and a lower temperature. From Philadelphia the infant may be taken to Atlantic City, Cape May, Point Pleasant, Avon, or any of the many resorts on the Jersey coast, kept there for two or three weeks and then removed to the New Hampshire hills for the remainder of the summer. A long stay is essential, since a return to town in hot weather is almost certain to be followed by a relapse.

If circumstances render it impossible to carry out this most potent of all prescriptions, fresh air must be secured by taking

the child to the public squares in the cool of the morning and evening, or by spending the day in the Park, or, better still, by a morning and evening trip on one of the river steamboats. The heat of the day must be spent in as cool a room as can be had. It is of great moment to let the little sufferer rest in bed and not on the hot lap or shoulder, and when out, to wheel him in a coach rather than carry him. Many a stout mother has hastened her infant's death by too fond and constant nursing.

The clothing must be as thin as possible, provided, always, that woolen be worn next the skin.

Twice or three times a day, in very hot weather, the whole surface of the body should be sponged with water at a temperature of 80° F., and dried with gentle rubbing. The bracing effect of these baths is greatly increased by the addition of rock salt, or concentrated sea-water if the purse can afford it. These cool spongings must be supplanted by full warm baths when there is much prostration.

In regulating the diet, it must be remembered that the presence of fever, with increased thirst, leads the child to take more liquid food than is needed or can be digested; consequently, it is necessary to specify the quantity as well as the quality of the food. Infants at the breast are to be suckled only at intervals of two or three hours, according to their age, and taken away before they have completely satisfied themselves.

Hand-fed babies are to be similarly restricted. As cows' milk must constitute the bulk of their food, it is important to see that it is obtained fresh every day from a reliable dealer, promptly Pasteurized, and administered from an absolutely clean bottle fitted with a simple tip. For example:

Milk,	f℥iij
Cream,	f℥ss
Lime water,	f℥iiss
Sugar of milk,	℥j.

Mix in a clean tin-cup, pour into bottle, adjust tip, and warm by plunging into hot water.

This food may be given every three hours to a child ten or twelve months old. The quantity is less and the dilution greater than for a healthy infant of the same age, because enfeebled digestion demands a proportionate reduction in the amount and strength of the food.

When preparations of milk are vomited or passed undigested from the bowels, a whey mixture can be resorted to :

Whey, ... 4 tablespoonfuls (f℥ij)
Barley water, ... 4 tablespoonfuls (f℥ij)
Milk sugar, ... 1 teaspoonful (℥j).
For one portion, to be given every two hours.

Cool filtered water should be allowed, in moderation, and at short intervals, to relieve the thirst.

If vomiting be persistent, all food must be stopped for from twelve to twenty-four hours, and the thirst quenched by barley water or Vichy water,—cool, and in small quantities. If the child be at the breast, as soon as vomiting is checked it can gradually be brought back to its accustomed diet, care being taken that too much food be not given.

In bottle-fed children under two years, when the attack is at all severe, it saves time, and often life, to begin the treatment by *withholding milk entirely ;* whey, chicken- and mutton-broth, Mellin's food with barley gruel, and the juice expressed from raw beefsteak or roast beef should constitute the "no-milk diet." For instance :

Barley jelly, ... 1 teaspoonful
Water, ... 8 tablespoonfuls (f℥iv).
Mix and add half the white of a fresh egg.
For one portion, to be given every two hours.

Or :

Veal-broth (½ lb. of meat to a pint of water),
Barley water, ... of each, 4 tablespoonfuls (f℥ij).
For one portion, to be given every two hours.

Or:

Raw-beef juice, ... 1–2 teaspoonfuls (f℥j–ij).
Every two hours.

While on raw-beef juice the patient must take from 12 to 24 fluidounces of pure water, barley water, or white-of-egg water each twenty-four hours; these must be given in small doses at short intervals.

Resume milk-feeding gradually after using any of these preparations. Partially peptonized milk food is the best intermediate diet. Make each bottle of food as follows:

Cream, ... 1 tablespoonful (f℥ss)
Milk, ... 5 tablespoonfuls (f℥iiss)
Water, ... 4 tablespoonfuls (f℥ij)
Peptogenic milk powder, ... 1 level teaspoonful.

After mixing, heat cautiously over a flame for six minutes, stirring constantly with a spoon, and tasting often, so that it shall not become too hot to be sipped—115° F. Cool to 98° F. before administering.

Feed every two and a half hours from 5 A.M. to 10 P.M.

In case each bottle cannot be prepared separately,—by far the better way,—the whole quantity for each day may be prepared in the morning as follows:

Cream, ... 8 tablespoonfuls (f℥iv)
Milk, ... 40 tablespoonfuls (f℥xx)
Water, ... 32 tablespoonfuls (f℥xvj)
Peptogenic milk powder, ... 8 level teaspoonfuls.

Heat slowly, so as to bring to a full boil at the end of ten minutes; fill eight graduated nursing bottles to the five-oz. mark, cork with cotton, and place in nursery refrigerator; heat to 98° F. at time of administration. A mixture stronger than 2 parts of milk to 1 part of water is difficult to predigest without curdling, especially if the milk be of more than ordinarily good quality.

To return to unpeptonized diet, gradually reduce the time of heating, and finally replace the milk powder by sugar of milk and salt.

The indications for medical treatment may be grouped under four heads: (1) To clear out the bowels; (2) to stop decom-

position; (3) to restore healthy action in the alimentary tract; (4) to treat the consecutive lesions.

1. The bowels should be emptied as completely as possible, as the first step in the treatment, and for precisely the same reasons that the surgeon cleanses a wound thoroughly before applying antiseptic dressing. This rule holds good not only where there is a history of antecedent constipation, or the evidence of the presence of indigestible food in the alimentary tract, but in every case in which there are altered secretions undergoing putrefactive changes. The only instances in which the process of cleansing should not be undertaken, because unnecessary, are those where, after two or three fæcal or semi-fæcal evacuations, the discharges consist of almost pure serum, large in amount, alkaline in reaction, and odorless.

To sweep out the intestinal canal nothing compares in efficacy with castor oil. Should the stomach be very irritable, however, it will be necessary to substitute enemata. These should consist of normal saline solution at a temperature of 98° F., and to be efficient must be copious enough to reach the cæcal valve—about one pint in a child of six months, and two pints in one of two years. The injection must be given slowly, with a fountain syringe, the abdomen meanwhile being gently manipulated.

Many mild cases can be cured, if taken at the start, by castor oil and a strict diet alone.

2 and 3. To stop decomposition and restore a healthy action in the intestines, the administration of antiseptics is necessary.

Antiseptics must be given in small doses lest the stomach reject them, and frequently, to maintain a continuous action. The best are betanaphtol bismuth, calomel, and salicylate of sodium.

Betanaphtol bismuth is a true and most reliable intestinal disinfectant. It is non-irritating to the stomach and may be administered in powder, either alone or combined with sub-

carbonate of bismuth in doses of gr. ss to iij, according to the age of the patient, repeated every two hours. It acts rapidly, and, on this account, must be carefully watched and the interval between the doses increased lest constipation, with locking of irritant intestinal contents, be produced.

Calomel may be prescribed in the following combination :

℞. Hydrargyri chloridi mit., ... gr. ss
Bismuthi subcarbonatis, ... gr. xxxvj
Pulv. aromatici, ... gr. vj.
M. et ft. chart. No. xij.
Sig.—One powder every two hours.

Salicylate of sodium is prescribed in doses of from one to three grains every two hours, according to the age, from three months to three years. An aqueous solution is tasteless, and can readily be given in the food or drink ; it has a tendency to check rather than occasion vomiting. It may also be substituted for the calomel in the above prescription.

Naphthalin is also recommended ; although possessing a strong odor, it is not disagreeable to the taste. On account of its insolubility, it is best administered rubbed up with sugar of milk. The doses should be larger than those of the salicylate of sodium—one to five grains, according to the age.

Resorcin and bichloride of mercury are also useful antiseptics. Resorcin is bitter, and though freely soluble in water, not easily administered ; the dose is one-half a grain to two grains. The bichloride is given in doses of $\frac{1}{120}$ to $\frac{1}{100}$ of a grain, but even in these minute quantities frequently causes vomiting.

Counterirritation by mustard plasters to the belly is useful. Stimulants are required when prostration sets in, and must be given in doses and at intervals adapted to the demands of the case ; and it is well from the beginning of the attack to maintain the vital forces with appropriate doses of tincture of nux vomica or strychnine.

Applications of oxide of zinc ointment, with cleanliness, cure the intertrigo of the buttocks and thighs most quickly, or, at least, keep it in check until the cause is removed.

4. The essential consecutive lesions are in the colon, and consist practically of a follicular colitis. When the condition of ulceration is reached, astringents by the mouth are useless, with the possible exception of bismuth.

Three things are valuable:

First. As careful attention to the diet as during the acute stages, and in recent cases. Deviation from dietetic rules is the most frequent cause of relapse.

Second. The continuance of antiseptics to check intestinal decomposition, and hence stop irritation.

Third. The whole large intestine should be washed out once every day, either with normal saline solution at 98° F., or with weak antiseptic or astringent solutions. Of the former, the best are benzoate or salicylate of sodium; of the latter, nitrate of silver or tannic acid.

Attention to diet and hygiene are not to be relaxed when convalescence is established, and after the measures calculated to check diarrhœa are unnecessary, digestants, as wine of pepsin, and tonics, as the ferrated elixir of cinchona, are still required, to restore health.

The exceptional cases that occur in cold weather should, of course, be treated at home in a well-ventilated and warm room; otherwise, the only alteration to be made in the general plan of management is to envelop the abdomen with light linseed poultices, or with cotton covered by oiled silk.

CHOLERA INFANTUM—ACUTE MILK INFECTION.

This affection is encountered in children artificially fed upon cows' milk variously modified, and occurs during the hot

months of summer, when toxicogenic germs are most widely distributed, and is characterized by a sudden onset, high fever, irritability of the stomach, frequent serous evacuations, changes in the respiration and pulse, marked symptoms of nerve involvement, and rapid collapse. It is a far less common disease than entero-colitis, and it is probable that the germs which produce it are less abundant than those causing the latter disease and that the poisons generated in this form are more virulent.

Morbid Anatomy.—In cases that run the ordinary course and die early, the gastro-intestinal mucous membrane is congested, thickened and softened, and the follicles and Peyer's patches are enlarged. In other words, the appearances indicate the early stage of inflammation, which passes into lesions identical with those of entero-colitis, when the patient, as sometimes happens, survives the choleraic stage and dies, subsequently, from a more protracted diarrhœa. But, in addition to inflammation, there is probably—and this is the important point—some involvement of the sympathetic nerves, leading to dilatation of the capillaries and transudation of serum into the intestine, and to alterations in the pulse, temperature, respiration, and urinary excretion. The nature of this is paralytic, so far as the intestine is concerned, and resembles in its results experimental section of the sympathetic nerves. It is due, chiefly, to the direct irritant influence of the poison-laden contents of the canal, and in part, perhaps, to the nerve exhaustion produced by high atmospheric temperature, one of the essential conditions for the development of cholera infantum. The changes in calorification and in the functions of the heart, lungs, and kidneys are most probably toxic.

Etiology.—Like entero-colitis, this is a disease of cities, finding its victims chiefly among those who live in poverty and squalor. Almost exclusively confined to hot weather, it may occur at any time between the middle of May and the end of

September, though the greater proportion of cases originate during the latter half of July, August, and the first half of September. Infants from six to twelve months are most susceptible, though it may occur at any age up to two years. It is practically confined to subjects artificially fed upon some modification of cows' milk, and while the particular toxicogenic germ or its resultant poison present in the food has not been isolated, there can be no doubt that the causal factor is a bacteria-produced toxic element existing in the milk when administered, or formed in it, after entering the intestinal canal, by the growth of bacteria. High temperature (85°–95° F. or more) sustained for several days, and especially if associated with a moist atmosphere, predisposes to attack by exhausting the infant's vital resistance; such conditions also encourage bacterial changes in impure, carelessly handled milk, and therefore augment the prevalence and increase the activity of the exciting cause.

Symptoms.—An attack usually arises in the midst of health, the onset being sudden. The infant begins to void copious stools. These at first, if there be no premonitory diarrhœa, contain more or less fæcal matter, but they soon become watery. Sometimes they are so serous as to soak away into the diaper without leaving any stain; at others, they contain a few yellow or green flocculi or little masses of mucus, and, in both instances, are odorless. Again, they are composed of yellow or brown liquid, containing a small proportion of thin, fæcal matter, and have a peculiar musty and offensive odor, which clings to the napkins and clothing, and even to the body of the child, in spite of the utmost efforts at cleanliness. The number varies from eight to thirty in twenty-four hours, and they are evacuated with considerable force.

At the same time, or soon after, the stomach becomes so irritable that everything, even to a mouthful of water, is rejected as soon as swallowed, and there is violent retching with

the expulsion of bile-stained mucus. Appetite is lost, but there is intense thirst, the patient eagerly drinking when the opportunity offers, and following the glass, as it is removed, with greedy eyes. The tongue, originally moist and lightly frosted, soon becomes dry and pasty, and protrudes from the parched lips. The abdomen is flaccid and indolent.

There is great restlessness; the temperature is elevated to 105° or even 108° F.; the pulse is small and very frequent, counting from 130 to 150 beats per minute; the breathing becomes irregular and anxious, and the urine is greatly diminished in quantity.

With these symptoms there is a marked and appalling change in appearance. Within a few hours, the infant, perhaps plump and rosy before, can scarcely be recognized; the face becomes pale and pinched; the eyes and cheeks sunken, and the eyelids and lips permanently parted from loss of muscular contractility; the fat melts from the body; the muscles grow flabby; the bones appear prominent, and the skin, often greenish or cadaverous in hue, hangs in folds.

Soon the features of collapse appear. The hands, feet, nose, and even the breath, become cool; the pulse is thready and so frequent as to be uncountable; the respiratory movements are more unequal, and there is drowsiness, apathy, and suppression of urine. As life ebbs away, the vomiting stops; the surface becomes cold and clammy, though even in this stage the rectal temperature may remain high, the thermometer ranging about 107° or 108° F.; the face is set with lines of death; the respiration is quickened and shallow; the pulse scarcely perceptible, and the patient sinks into a state of semi-coma, with bleared eyes and contracted pupils. In this condition the end may come quietly or be preceded by slight convulsions.

The course of the disease, whatever the result, is always very short. It may prove fatal in from one to three days, or

the character of the attack may change and death result later from a secondary inflammatory diarrhœa.

In case of recovery, the stools, after three or four days, gradually become less copious, frequent and watery, more fæcal and of better odor; vomiting stops; thirst diminishes; appetite returns; the urinary excretion is reestablished; the temperature and pulse fall; the respiratory movements become rhythmical; emaciation ceases, and the child, though very feeble, again notices his surroundings, and after a week or more of simple diarrhœa, regains a moderate degree of health.

Diagnosis.—The character of the stools, the extreme irritability of the stomach; disturbed respiratory rhythm; high temperature; increased thirst and rapid emaciation and collapse, distinguish this from entero-colitis, and from other forms of diarrhœa.

Asiatic cholera alone presents similar symptoms, and in case of the prevalence of this disease, bacteriological investigation of the evacuations from the bowel would be necessary to establish a diagnosis.

Prognosis.—The prospect is most discouraging, the usual outcome being death; even in seemingly favorable instances the opinion as to the result must be guarded, for though the choleriform symptoms be survived, there is danger from the succeeding diarrhœa. The disease is most fatal in children of the poor, who are badly fed and subjected to the worst hygienic influences; conversely, it is more apt to terminate in recovery in the rich, who can be treated in large, airy rooms, have proper feeding and nursing, and be removed to healthy localities.

Treatment.—Cholera infantum, being the result of the ingestion of an irritant poison, must be treated energetically and upon certain well-defined lines. The indications are:

First, to remove the toxic elements from the gastro-intes-

tinal canal and guard against their reintroduction by absolutely withholding milk or milk preparations.

Second, to counteract the depressant action of the poison upon the centres of circulation and respiration, and upon the nervous system generally.

Third, to supply to the blood the fluid drained away by the excessive purgation.

Fourth, to reduce temperature and meet special symptoms as they arise.

First. The most rapid and efficient methods of fulfilling this indication are stomach-washing, flushing of the colon, and the administration of a purgative dose—gr. ij to v—of calomel. A normal saline solution at 100° F. for cleansing the stomach, and 80° F. for irrigating the colon, should be employed; both procedures should be thorough and repeated in six hours if the vomiting and purging persist or return after being relieved; while apparently radical measures, they produce a degree of exhaustion quite insignificant when compared with that which rapidly follows the repeated vomiting and purging incident to the disease.

The calomel purge should not be administered until after the stomach has been washed; its main purpose is to clear out the small intestine, which can not be reached by irrigation, but it has, in addition, a beneficial antiseptic action. After the colon has been thoroughly cleansed, Vaughan recommends an injection of cool water containing gr. xv–xxx of tannic acid to the pint, for the purpose of neutralizing the remaining poisonous proteids.

To prevent the reintroduction of the poison, milk in every form should be strictly prohibited, and the patient, for the first twenty-four hours, be allowed only pure, cool water in small quantities at short intervals, or, at most, cool water with raw-beef juice or panopepton, in one-half to one teaspoonful doses every two hours.

Second. The effect of the poison upon the vital forces must be combated by stimulants. These include good brandy or whiskey given hypodermatically, or by the mouth in full doses, sufficiently diluted with water; together with strychnine, and morphine with atropine administered hypodermatically. At the age of twelve months sulphate of strychnine may be given at first in doses of gr. $\frac{1}{150}$ every four to six hours and increased as the intensity of prostration demands; gr. $\frac{1}{100}$ of sulphate of morphine with gr. $\frac{1}{500}$ of sulphate of atropine is the proper initial dose, and the injection may be repeated every two to four hours, the guide being the effect upon the vomiting and purging, the pulse and nervous symptoms generally, all of which these drugs tend to improve. Care must be taken not to produce narcosis, and drowsiness and coma are absolute contraindications.

Third. Fluids administered in any bulk by the mouth are expelled almost as soon as swallowed, and enemas are but little better retained, therefore the only successful way of replacing the liquid wasted by the excessive purgation is by hypodermoclysis. For this purpose a sterile normal saline solution should be employed and thrown into the subcutaneous cellular tissue of the abdomen, buttocks, or back; the quantity administered, in divided doses, should be at least eight fluidounces in each twelve hours; this solution is rapidly absorbed and causes no irritation.

Fourth. Antipyrin, phenacetin, or other antipyretic drug should never be used to reduce temperature in cholera infantum. When the fever is moderate,—102°,—an ice cap or cold-water bag to the head may be all that is necessary; when it mounts to 103° or 104°, cold water should be applied, with friction, to the surface every two hours or oftener if required to keep the temperature within bounds. If the pyrexia reaches 105° or more the patient must be immersed in a full bath, warm at first, and gradually cooled to 80° by the addi-

tion of ice; the surface must be well rubbed during the bath, which may be prolonged for ten minutes after the water has been cooled, and repeated as demanded. Cold-water enemas are useful adjutors of the baths in severe cases.

Collapse with cold extremities calls for hot mustard baths or packs, the constant application of dry heat by hot-water bags, and the subcutaneous injection of whiskey and strychnine. The clothing, diapers, and person must be kept perfectly clean; the sick-room must be as large and airy as can be commanded, and the infant must lie upon a bed, and not be constantly nursed upon the lap.

In the fortunate instances in which this plan is successful, and after the vomiting has been thoroughly controlled, the "no milk" diet suggested for entero-colitis may be attempted, but convalescence must be completely established before venturing upon any food containing milk. It is also necessary to treat the succeeding diarrhœa by the same measures as employed in entero-colitis; and, finally, to build up the general health by good food, tonics, and fresh air. If it be possible, the patient should be sent early to the sea-shore or country, as this affords by far the best chance for recovery. Failing in this, morning and evening airings in a coach, or daily steamboat excursions, must be resorted to.

INFLAMMATION OF THE COLON AND RECTUM —ILEO-COLITIS—DYSENTERY.

Dysentery is not a common disease of infancy or childhood, but it may occur in one of three forms: the catarrhal, the amœbic, and the membranous.

CATARRHAL DYSENTERY.

This form may arise at any period of childhood, but is most frequent after the first and up to the tenth year. It may be

sporadic, endemic, or epidemic, and is confined to no class, locality, or season, though it is most often encountered among the poor, in crowded unsanitary quarters of large cities, and during the hot months of summer and early autumn.

Etiology.—Subjects enfeebled by such diseases as tuberculosis, constitutional syphilis, and rickets are prone to be attacked; so also those depressed by exposure and want. However, the predisposing and exciting causes are similar to those of entero-colitis—impure food, in other words—bacteria playing an important rôle, though a specific germ has not as yet been discovered.

Morbid Anatomy.—The lesions are situated, as a rule, in the rectum and lower portion of the colon, but they may involve the whole length of the large intestine and extend into the ileum. They consist of circumscribed or general hyperæmia of the mucous membrane, which is covered with tenacious mucus, swollen, grayish, dark red, or purple in color, and sometimes the seat of punctiform hemorrhages. The solitary lymph follicles are enlarged and surrounded by areas of congestion. Ulceration may occur; in the beginning, the ulcers are superficial and round, but they soon deepen and by coalescing become irregular in outline and large—measuring half an inch or more in diameter; their edges are everted and flattened. The necrosis often extends to the muscular coat and in rare cases involves the entire intestinal wall, leading to perforative peritonitis. The mesenteric glands are enlarged, congested, and softened, and the liver is usually hyperæmic, and sometimes suppuration takes place in this viscus, with the production of multiple abscesses.

Symptoms.—The attack may be preceded by a more or less prolonged diarrhœa, or begin suddenly with, in some cases, rigors or more distinct chills. There is moderate fever, the temperature ranging from two to four degrees above normal; the pulse is increased in frequency, and has a tendency

to rapidly become small and compressible. The tongue is moist and covered with a light, white fur; there is nausea, sometimes vomiting, and a constant desire to evacuate the bowels, with pain and straining during and after the act. The stools are small in quantity and numerous, ranging from four to forty a day. At first they contain fæcal matter, but after a short time are composed entirely of mucus and blood, mixed with yellow or green flocculi and pus. The blood may appear in dark red streaks or clots, in black masses, as a substance resembling the washings of meat, or merely diffused through the mucus, giving it a uniform red color. The evacuations at first are offensive; later they become odorless or have a "fresh-meat odor." The urine is high-colored and diminished in quantity; sometimes there is suppression with vesical tenesmus.

The face wears an anxious expression; there is great restlessness, sleeplessness, muscular weakness, and rapid emaciation. The tongue becomes dry, red at the tip and edges, and covered in the centre with a brownish coating. There is anorexia, urgent thirst, and vomiting. The abdomen is distended, tympanitic, and painful on pressure, particularly over the course of the colon.

As the attack progresses, tenesmus becomes the most prominent symptom; it occurs without the passage of stools, and is often attended with prolapse of the rectum. Fever gives place to coolness of the surface; restlessness, to semi-stupor; the eyes and cheeks sink; the face becomes pinched, and death may take place quietly or be preceded by convulsions.

The duration varies from two or three days in grave cases, to about two weeks in those that result favorably.

The **diagnostic features** are fever, tenderness along the track of the large intestine, tenesmus, and the number and character of the stools.

The **prognosis** is favorable in the sporadic form and when

there is only slight elevation of temperature and moderately frequent stools. Quite the reverse, if there be high fever, great tenesmus, frequent evacuations containing much blood and pus; when there is a tendency to collapse; when there is marked restlessness, stupor, or convulsions; when the urine is suppressed, and when the disease is epidemic. Relapses frequently occur.

AMŒBIC DYSENTERY.

Amœbic or tropical dysentery, while it may occur in temperate climates, is not often encountered in this country, especially during the earlier years of life. The disease is due to a special organism, the *amœba coli*, and the usual source of infection is impure drinking-water.

Morbid Anatomy.—The lesions occupying the colon, and sometimes invading the ileum, consist, in the beginning, of small elevations, due to infiltration, in the submucosa; next, the mucous membrane covering them sloughs, leaving grayish-yellow ulcers. Councilman divides these ulcers into four varieties, representing different stages of the same process: "(1) Ulcers characterized by cellular infiltration, softening, and cavity formation in the submucosa; these have a small opening in the mucous membrane and often communicate with neighboring ulcers by passages in the submucosa. (2) Ulcers with slight undermining of the edges, representing simple excavations in the thickened submucous tissue. (3) Ulcers with smooth sides and clean bases. (4) Ulcers with extensive, adhering sloughs." The products of purulent inflammation are absent, the connective-tissue cells are proliferated, and amœbæ are found at the base of and about the ulcers, in the lymphatic spaces, and sometimes in the blood-vessels. In addition to the changes in the intestines, the liver is the seat either of scattered local necroses of the parenchyma, or of abscesses, which may be single or multiple.

Symptoms.—These may develop gradually or—the rule in severe cases—suddenly. There is moderate fever, sometimes nausea and vomiting, often tormina and tenesmus, and diarrhœa, the evacuations averaging ten or twelve daily, being grayish-yellow in color, containing mucus and blood, and showing under the microscope numerous amœbæ. The diarrhœa shows a marked tendency to intermit. There is progressive loss of strength and flesh.

Diagnosis.—The frequent exacerbations and remissions of the diarrhœa and the presence of amœbæ in the stools readily distinguish this form from catarrhal dysentery.

Prognosis.—The outlook is less favorable than that of the ordinary form of ileo-colitis; at the best, the disease runs a course of from one to three months; and recovery is slow. The beginning of convalescence is indicated by the disappearance of the amœbæ from the evacuations.

MEMBRANOUS DYSENTERY.

This, by far the most serious form of ileo-colitis, is fortunately a rare disease in children, though it may arise, infants between the sixth and twenty-fourth month being the usual subjects. It may attack the most robust, and is most frequently unassociated with the deposition of false membrane in other portions of the body.

Morbid Anatomy.—The lesions involve the colon and lower part of the ileum, and are most marked near the ileo-cæcal valve or in the sigmoid flexure and rectum. The intestinal wall is thickened and indurated; the pseudo-membrane appears in patches, grayish-green in color and often lobulated by fissures, and the uncovered mucous membrane is deep red, rough, and granular; the villi, Peyer's patches, and solitary follicles are obliterated. The membrane is composed of a fibrinous network filled with small round cells, a few red blood corpuscles, and bacteria—mainly cocci; round cells and

a fibrinous exudate may also infiltrate the mucosa and submucosa.

Symptoms.—The features closely resemble those of the severest types of ordinary dysentery, and the course is active and brief, extending over a period of from six to ten days. The onset is sudden, with sick stomach, high fever, and a number of copious liquid evacuations from the bowels. The vomiting may cease after the first day, and the temperature, originally ranging from 103° to 105°, may continue high or remit. Prostration, delirium, or stupor are decided, sometimes sufficiently so to mask the intestinal symptoms. There is severe abdominal pain and persistent tenesmus; the latter may force through the anus several inches of the rectal mucous membrane, which appears as an intensely congested mass mottled with patches of pseudo-membrane. The evacuations are like those of catarrhal dysentery, but blood is present more constantly and in greater quantity, and they contain shreds and patches of membrane.

The **diagnosis** is established by inspection of the stools and the discovery of the false membrane.

The **prognosis** is unfavorable, almost every case occurring in infancy terminating fatally. In older children there is more prospect of recovery, but this result is not attained until after a long illness and protracted convalescence.

Treatment.—Children suffering from ileo-colitis must be kept at rest in the best room—so far as sanitary conditions are concerned—that the house affords. During the acute stage the feeding must be guided by the same rules that govern entero-colitis or infectious diarrhœa; in protracted cases, weak predigested milk mixtures, broths, and beef-juice compose the dietary, and if, as is too often the case, the appetite so fails that insufficient food is taken to sustain life, nourishment must be introduced by gavage. To avoid relapse it

is necessary to guard the diet carefully long after the establishment of apparent convalescence.

Two or three times daily the body should be thoroughly sponged with water at a temperature of 95° F., and the abdomen must be kept covered with a light flaxseed poultice, over the surface of which a little mustard has been sprinkled; this must be covered with oiled silk and changed as often as it becomes cold.

Irrigation of the colon is the most useful element of treatment. A normal saline solution should be employed and introduced high up in the colon through a long rectal tube; little force must be exerted, but the quantity of solution used must be large,—four quarts,—the excess being allowed to flow away during the injection. Two irrigations daily are necessary in the beginning; later, once each day or even less frequently is sufficient. Ordinarily the solution may be used at a temperature of 98° F., though if there be severe tenesmus or a free discharge of blood it should be hot, 100° F., or ice cold. In protracted cases astringent injections are indicated; for example, tannic acid ℥ss, fluid extract of hamamelis f℥j to one pint of water. More powerful astringents, as nitrate of silver, must never be employed in the acute stage of a catarrhal attack, and their utility is doubtful even in chronic cases.

In amœbic dysentery injections of a solution of quinine, 1 : 5000 to 1 : 1000, are recommended. The patient should be placed in the knee-chest position, one-half to one pint of quinine solution should be then introduced and allowed to remain for fifteen minutes. These injections should be given three times each day.

In membranous ileo-colitis, weak nitrate of silver enemata—gr. j to f℥ij—may be of service. This quantity may be injected twice daily for three days and then a free interval of twenty-four hours allowed.

If the patient be seen early in the attack, the medicinal treatment may be begun with a laxative, as:

℞. Ol. ricini, ... f℥iv
Pulv. acaciæ, ... ℥ij
Tr. opii, ... ♏viij
Aq. menth. pip., ... q. s. ad f℥ij. M.

Sig.—One teaspoonful every three hours, at three years of age.

After this has been continued for twenty-four hours, there should be marked improvement in the evacuations. If this be not the case, it is well to order the following:

℞. Pulv. ipecac. comp., ... gr. vj
Bismuthi subcarb., ... ℥j
Pulv. aromat., ... gr. vj.
M. et ft. chart. No. xij.

Sig.—One powder every three hours.

If the castor-oil mixture can not be retained on account of gastric irritability, calomel in broken doses or a saline cathartic must be administered, to thoroughly clear out the intestines.

If the Dover's powder is badly retained, bismuth may be given by itself and the pain and tenesmus relieved by an enema of laudanum—gtt. iij–v to f℥ss of warm starch-water every four hours; or a suppository of opium and acetate of lead:

℞. Pulv. opii, ... gr. ss
Plumbi acetat., ... gr. j
Ol. theobromæ, ... ℥j.
M. et ft. supposit., No. vj.

Sig.—One to be used every four or six hours.

Cocain by suppository also acts quickly and efficiently.

To ward off prostration, it is necessary to employ stimulants, in doses and at intervals proportionate to the demands of the case. Should collapse occur, alcohol and artificial

heat to maintain the body temperature are the main resources.

When convalescence is established, it is still necessary, as already indicated, to guard the diet carefully and at the same time to build up the general health by change of air and tonics. Of the latter, the best are quinine with dilute nitro-muriatic acid, or tincture of nux vomica with compound tincture of gentian, followed by ferrated elixir of cinchona, or citrate of iron and quinine.

PROCTITIS.

Children suffer from several forms of inflammation of the rectum: viz., the catarrhal, the membranous, or the ulcerative; it is to the first alone that attention need be specially directed.

A severe grade of acute catarrhal inflammation of the mucous membrane of the rectum and lower portion of the colon is of frequent occurrence during the earlier months of infancy, and produces symptoms which, without careful analysis and local inspection, are misleading and prone to suggest misdirected and unavailing treatment.

Etiology.—Catarrhal proctitis is most apt to exist as an isolated affection in early life, and is more common in artificially fed infants, though it often attacks those reared at the breast. It is due to direct bacterial infection, or to mechanical irritation, resulting from the employment of irritating enemata or suppositories, or from the rough or careless use of a soap stick or syringe nozle to relieve constipation. In older children it is usually associated with more or less acute catarrh of the whole intestinal tract, and is a secondary condition, induced by the irritating or infective character of the fæcal discharges.

Symptoms.—Proctitis may be suspected if, while the little

patient has a clean tongue, a fair appetite, and retentive stomach, there is restlessness, slight febrile reaction, moderately marked features of general health failure in the way of wasting, pallor, and prostration, and a history of increasingly frequent, small bowel movements that are expelled by a straining effort, which the facial expression and fretful cries show to be painful. Inspection reveals redness and excoriation of an extended area of the skin about the anus, and if the lower portion of the rectum be everted,—a feat easily accomplished by lateral pressure of the thumbs placed on either side of the anus,—the exposed mucous membrane shows intense redness and often superficial linear ulcerations. The fæcal evacuations number from ten to fifteen or twenty in twenty-four hours and are quite characteristic. Three or four times daily, at moderately regular intervals, a free, yellow, and almost normal stool is voided. The remaining passages are small, scarcely more than one or two teaspoonfuls in bulk, are composed almost entirely of greenish or dark yellow mucus, are voided with a "spurt," and their expulsion is attended by considerable straining and crying, symptoms which are almost entirely absent at the time the free actions occur.

When the general intestinal tract is uninvolved in the catarrh, the abdomen is normal in size, and soft and painless on palpation.

Diagnosis.—Proctitis is most frequently confounded with ordinary catarrhal diarrhœa due to improper feeding, and the greater number of cases that have come under my own observation have been brought to me because they obstinately resisted both the dietetic and therapeutic treatment usually successful in this disorder. The error may be avoided by noting that each day, at quite regular intervals, there are several nearly normal evacuations of the bowels; that the remainder of the evacuations are small in bulk, are composed entirely of mucus, and are spurted from the rectum with pain

and straining; and, finally, examination shows excoriation of the skin about the anus and inflammation of the mucous membrane of the rectum.

Prognosis.—The outlook is very favorable and the course is short, provided the proper measures for relief are employed.

Treatment.—This condition is most successfully and quickly righted by deep cleansing injections. Usually a solution of salt and water (℥j to Oj), warmed to a temperature of 98°, is all that is required. A fountain syringe is the best instrument to employ, and in giving the injection the reservoir should be elevated only so high that the fluid will run into the gut freely, not forcibly. Of the solution, from four ounces to a pint may be used at each washing; in other words, enough to thoroughly cleanse the rectum. These washings may with advantage be immediately followed by bland enemata, as olive oil or olive oil combined with lime water, in quantities small enough to be readily retained—two fluidrachms, for example.

In very obstinate and chronic cases it is sometimes necessary to begin the local treatment by injections of nitrate of silver. For this purpose a solution of one-half to one grain of the nitrate to each fluidounce of distilled water is sufficiently strong, and two fluidounces is the usual quantity for each injection. Before injecting the silver solution the gut should be thoroughly cleansed by a simple warm water enema, and five or ten minutes after its introduction a free re-washing with a solution of salt and water must be effected in order to completely remove or neutralize any excess of the silver salt. From one to three nitrate of silver injections, given at intervals of three or four days, usually suffice to start the reparative process, which is then readily carried to a successful issue by the simpler treatment already detailed.

To relieve the irritation of the skin around the anus it is important to forbid the use of water in cleaning the parts

after an evacuation, using in its place olive oil soaked into pledgets of absorbent cotton. Oxide of zinc ointment and the preparation known as jelly of witch-hazel are useful healing applications.

The general treatment demands only regulation of the food supply and attention to the other hygienic requirements of the infant and mother. If there be evidences of impaired gastric or intestinal function, pepsin or pancreatin are indicated; an occasional laxative dose of castor oil may be necessary, and perhaps, toward the end of the attack, a tonic.

COLIC.

Colicky pains frequently attend dysentery, constipation, and other intestinal disorders; but colic with flatulence so uniformly occurs as a functional affection in children from birth to the end of the third month, and gives so much discomfort both to the infant and its attendants, by causing fretfulness, crying, and wakefulness, that it demands separate consideration.

Etiology.—In studying the causation of this condition, it must be remembered that after birth the infant, previously nourished through the blood of its mother, begins to take food through a new channel. Hence a new habit has to be formed, in addition to the development of a secreting and absorbing apparatus hitherto inactive. It is during this transition state that food even of the best quality may be imperfectly or slowly digested and flatulence and colic result.

Food that is at all difficult to digest almost always occasions colic, and hand-fed babies are especially liable to it. Other causes are fulness of the stomach in overfeeding, or the opposite condition of emptiness after nursing at a breast that affords milk in small quantity, and, finally, inherited feeble-

ness of digestive power, and oversensitiveness of the mucous membrane to the contact of food.

Symptoms.—Soon after feeding, the infant becomes restless, kicks his legs about uneasily, twists his body, grunts, or utters a series of piercing cries. The face is congested at first, from the effort of crying, but soon becomes pale, with a tinge of blue around the lips. The belly is full and hard, the hands and feet are cold, and, in bad cases, the fontanelle is more or less depressed. After a time, varying from a few minutes to an hour, eructations of flatus or of curdled milk occur, and the symptoms disappear for a while. Such paroxysms may occur at any hour of the day, but are most frequent and severe in the evening and night.

There is usually, also, a moderate degree of constipation, or the bowels are irregular. At night the rest is broken by uneasy tossing and whimpering, and during sleep a smile or an expression of pain often flits over the face; but, in spite of the fretfulness and discomfort, the infant suffers little in general health, and increases in flesh and strength almost as rapidly as is normal.

Treatment.—When the infant is fed at a healthy breast, it is of great importance to insist upon the rule of feeding only at proper intervals, and absolutely to forbid the habit of putting the child to the breast whenever it cries. Food will be taken whenever it is offered, and the warm milk entering the stomach relieves the pain for a time, only, however, to increase it later by giving the organ more work to do, and filling it with material to undergo fermentation with the production of flatus. Consequently, it is much better to resort to one of the preparations to be hereafter given for the relief of the pain.

Should the child draw but a poor and scanty supply of milk, and the colic be due to emptiness, the breast must be supplemented by hand-feeding. Under these circumstances,

and when the whole feeding is by bottle, much may be done to prevent or relieve the attacks of pain by attention to cleanliness of the feeding apparatus; by carefully selecting the ingredients of the food; by proper modification, and by partial predigestion. A good food for a child from six to eight weeks old is:

Milk, ... f ℥ iss
Cream, ... f ℥ ss
Barley water, ... f ℥ iss
Fairchild's peptogenic milk powder, ... ʒ ⅔.
Predigest at 115° F. for four or six minutes; cool to 98° before giving.

If the case be not severe enough to demand predigestion, one grain of pancreatin and two grains of bicarbonate of sodium added to a properly modified bottle of cream, milk, barley water, and milk sugar just at the time of its administration produce good results by aiding intestinal digestion.

When the bowels are inclined to constipation, the barley water may be replaced by a gruel made of ground oatmeal (Bethlehem brand). One or two teaspoonfuls of the meal to the quantity of water necessary for each bottle is the proper proportion. In place of this, a teaspoonful of Mellin's food may be added to the requisite quantity of water.

The belly should be rubbed for five minutes twice a day with warm olive oil, and enveloped in a broad flannel binder. It is even more important to keep the feet warm, and for this purpose thick socks or long woolen stockings should be worn, and in bad cases, artificial heat must be applied by hot water bottles.

Medicines are indicated chiefly during the attacks of pain. A simple and serviceable prescription is ten drops of gin in a teaspoonful of sweetened warm water. Another is:

℞. Sodii bicarb., ... gr. xvj
Syrupi, ... f ℥ ss
Aq. menth. pip., ... q. s. ad f ℥ ij. M.
Sig.—One teaspoonful p. r. n. for a child of one month.

This is rendered more efficient by the addition of two drops of aromatic spirit of ammonia to each dose, or, in severe cases, one drop of spirit of chloroform.

Bromide of potassium and chloral are most useful; they may be combined as follows:

℞. Potassii bromidi, ... gr. xvj
Chloral., ... gr. viij
Syrupi, ... f℥ss
Aq. menthæ pip., ... q. s. ad f℥ij. M.
SIG.—One teaspoonful for a dose.

Of this preparation it is rarely necessary to give more than two or three doses, at intervals of an hour. It is well to reserve this mixture for severe attacks, and in ordinary cases, to use the gin or the soda mixture.

Should the paroxysm be so violent as to lead to depression of the fontanelle and threaten collapse, the infant must be placed in a warm bath for five minutes; after being removed and carefully dried, he must be wrapped in a blanket; a flax-seed poultice with a dash of mustard placed over the abdomen; a hot-water bottle applied to the feet; the bowels relieved by an enema of warm water, and ten drops of gin or brandy in warm water administered by the mouth. If the fontanelle still remains depressed, the stimulant must be continued in doses and at intervals proportioned to the urgency of the symptoms; at the same time the soda and ammonia mixture may be given, and a suppository containing one-half to one grain of asafœtida inserted in the rectum every fourth hour.

As a routine treatment to improve digestion, it is well to order fifteen drops of essence of pepsin (Fairchild's) three times daily.

HABITUAL CONSTIPATION.

In addition to the locking of the bowels that results from mechanical causes, as intussusception, peritoneal adhesions,

and so on, or from paralysis of the muscular coat of the intestine in certain nervous diseases, constipation of a functional character is a frequent and often an obstinate condition during childhood.

Etiology.—Before the completion of the first dentition, it is more common in hand-fed babies than those nursed at the breast, and is due to the use of milk over-rich in casein; the abuse of starchy food; an insufficient supply of water, and often to the action of popular remedies given to relieve colic. With children who have passed the first dentition, constipation arises from faulty habits, and from the employment of a diet that is either bad in quality or unsuitable from its too great sameness. In all cases inherited sluggishness of the peristaltic movements must be remembered as a possible cause.

Symptoms.—These vary greatly in degree. Thus, an infant, instead of the normal number, may have but one evacuation a day, or one, two, and even three days may intervene between the movements. The stools are scanty; composed of hard, dry, whitish lumps, and are voided with much pain and straining. Should the last symptom be severe, it is frequently attended by rectal prolapse and hemorrhage. Other features are colic, abdominal distention, diminished appetite, occasional vomiting, feverishness, fretfulness, restless sleep, and, in bad cases, convulsions.

In older children there may be one scanty passage each day, or a week at a time may elapse without relief. The stools, while lumpy and hard, are dark-colored and mixed with mucus. The abdomen is the seat of pain, and may or may not be distended with flatus; in the latter event, palpation often reveals the presence of hard masses along the course of the descending colon. The tongue is coated; the appetite capricious; there is nausea and a sensation of discomfort in the rectum, leading to frequent, though unproductive, straining efforts at defecation. There is also languor, irritability of

temper, headache, and restless sleep; a muddy complexion and general spareness of frame. In some cases the constipation seems to be due to simple want of rectal expulsive power, as the evacuations, when started by such mechanical means as a soap stick, are voided freely and appear to be completely digested and are of normal color and consistence.

Diagnosis.—There is little difficulty in establishing the existence of habitual constipation. One must be cautious, however, not to place too much reliance upon the statement that "the child's bowels are open every day," for in obstinate cases, it is not unusual for daily evacuations of thin, worm-like masses to take place whilst the bulky and hard fæces are retained.

Prognosis.—Constipation is often a very tedious condition, but proper persistent management rarely fails in regulating the action of the bowels. It may, however, prove serious in two ways: first, by leading to fæcal accumulation; second, by generating a condition of general ill health, during which the child is more exposed to the attack of acute and dangerous disease.

Treatment.—In every case the relief of the actual state of retention of fæces in the rectum and the breaking up of the costive habit are the ends to be accomplished.

For the former purpose, I prefer the use of purgative enemata and suppositories to the administration of the same class of remedies by the mouth, particularly when abdominal palpation or digital examination of the rectum shows that the retained mass is large and hard. The author's plan is to inject into the rectum, according to the age of the patient, from one to four teaspoonfuls of warm sweet oil; allow it to remain for six hours, and then use one or more clysters of normal saline solution, or of olive oil, soap, and warm water. The preliminary injections of oil soften the fæces, while the clysters—which must vary in bulk from one to six fluid-

ounces, to be adapted to the capacity of the gut—have the additional effect of distending the walls of the rectum, and thus bring about muscular contraction and expulsion of its contents. Should the mass present at the anus but be too bulky to escape, more liquid may be injected, and if this fail, it must be broken up by the finger and its passage assisted by gently supporting the perineum during the straining efforts. In severe cases little result may follow a single application of this method, though a course of one or two oil injections and purgative clysters daily for several successive days will rarely fail to empty the bowel.

When the simple injections fail to produce expulsive efforts, they may be rendered more efficient by the addition of a teaspoonful or more of castor oil or oil of turpentine. To make such an enema for a child of two years :

Take—One teaspoonful of oil of turpentine,
Two teaspoonfuls of olive oil,
The yolk of one egg.
Mix thoroughly, and add, with constant stirring, to
Four fluidounces of warm water.

Another enema which rarely fails to act quickly and efficiently is from one to two fluidrachms of pure glycerin with a fluidounce of water.

All injections must be thrown in gently, and the action of the syringe stopped as soon as pain is produced.

In infants, unless the rectum be very full, clysters give no better results, and are far less convenient than suppositories. At the age of two months the following prescription may be ordered :

℞. Saponis, ... gr. vj
Olei theobromæ, ... ʒj.
M. et ft. supposit. No. vj.
Sig.—One to be inserted every morning or morning and evening.

Or a small glycerin suppository may be used.

Careful regulation of the diet is often all that is required to remove the tendency to constipation, and is a most important element of the treatment even in those cases where it is necessary to call in the aid of medicines.

Bottle-fed babies must be fed upon cows' milk, so modified by the addition of cream, sugar of milk, and water as to be as nearly like human milk as possible; and, should the bowels still remain confined, some laxative article, as Mellin's food or oatmeal, can be added. An admirable mixture for a child of three months is:

Milk,	f ℥ ij
Cream,	f ℥ ss
Sugar of milk,	℥ j
Bethlehem oatmeal (fine powder),	℥ ij
Water,	f ℥ iss.

In preparing this, the water must be heated—just short of boiling—in a tin vessel, and the oatmeal added slowly, with stirring, until a smooth, white mixture is obtained; the other ingredients are then to be added, and the whole administered from a perfectly clean feeding-bottle. It is usually unnecessary to add the oatmeal to every bottle; one or two meals of it, each day, being sufficient. Or:

Cream,	1 tablespoonful (f ℥ ss)
Milk,	4 tablespoonfuls (f ℥ ij)
Milk sugar,	1 teaspoonful (℥ j)
Phosphate of sodium,	2 grains (gr. ij)
Wheat water,	3 tablespoonfuls (f ℥ iss).

To make wheat water, add to 1 pint of water 1 or 2 tablespoonfuls (according to effect desired) of thoroughly cooked cracked-wheat porridge, heat a little short of the boiling-point, stir constantly until a mixture is obtained, and strain. Dissolve phosphate of sodium in a teaspoonful of hot water, and add to food just before administration. One or more feedings as required. Encourage infant to take water.

Often, if the infant's digestive powers will permit of it, constipation may be overcome by simply increasing the quantity of cream in each portion of food.

During childhood the food selected must be of good quality, thoroughly digestible and varied. Starches and meat are to be allowed in moderation; pastry, salt meat, and sweets forbidden, and a judicious use made of such articles as cream, oatmeal or cracked wheat in the form of mush, well-cooked spinach, celery, cabbage, and peas, baked apples, stewed prunes, thoroughly ripe peaches and pears, or the juice of oranges. For example, for a child from eighteen months to two and a half years:

First meal, 7 A. M.—A breakfast-cupful (f℥viij) of new milk, with an additional tablespoonful (f℥ss) of cream; 2 to 4 tablespoonfuls of thoroughly cooked oatmeal or cracked-wheat porridge, with cream and salt; two slices of whole-wheat or bran bread, buttered; the juice of a ripe orange, or half of a moderate-sized ripe apple scraped with a spoon, or a small ripe pear, scraped, or a peach.

Second meal, 11 A. M.—A teacupful (f℥vj) of milk, with an additional tablespoonful (f℥ss) of cream; a slice of bran bread.

Third meal, 2 P. M.—A breakfast-cupful (f℥viij) of mutton- or chicken-broth, or 1 or 2 tablespoonfuls of underdone roast mutton, or beef, or chicken minced fine and pounded to a paste; purée of spinach; mashed cauliflower-tops; asparagus-tops; stewed celery; whole-wheat or bran bread, buttered; junket and cream; rice-and-milk pudding with stewed-prune juice; baked apple with cream.

Fourth meal, 6.30 P. M.—Milk, one or two breakfast-cupfuls (f℥viij–xvj), with additional cream; whole-wheat or bran bread, buttered; stewed fruit.

For drink, pure water only. No condiment but salt.

To encourage peristalsis, warm sweet oil may be gently

rubbed into the skin of the infant's abdomen for ten minutes twice daily, the natural course of the colon being followed; and with children more advanced in age, cool spongings of the belly, followed by frictions with a coarse towel until the surface is red, are very beneficial. Regular habits for evacuation, as regards time of day, must be encouraged.

The ordinary cathartics, castor oil and rhubarb, are not adapted to the treatment of habitual constipation, because their primary laxative action is followed by a secondary astringent effect, and they consequently increase the original trouble. There are, however, other medicines of the same class that are free from this disadvantage, and one of them, or, better, a combination of several of them, may be employed.

For infants a very serviceable prescription is :

℞. Mannæ opt.,
Magnesii carb., ... āā ℥ij
Ext. sennæ fld., ... f℥ss
Syrupi, ... f℥j
Aq. menth. pip., ... q. s. ad f℥iij. M.
Sig.—A teaspoonful once, twice, or three times daily for a child of six months.

Or should a sallow skin, yellowish conjunctivæ, and loaded tongue indicate torpor of the liver :

℞. Resinæ podophylli, ... gr. ss–j
Alcohol, ... ♏xlviij
Syrupi, ... q. s. ad f℥iij. M.
Sig.—A teaspoonful two or three times daily for a child of one year.

If it be difficult to make the infant take medicine, manna—which imparts only a sweet taste—may be dissolved in the food, and given from the bottle as often as required. Phosphate of sodium—an admirable laxative—can also be administered in the same way, in doses of two to five grains three times each day, at the age of six months.

Children of three or four years and upward do best upon

aloës and belladonna. Tincture of aloës and myrrh in doses of five drops thrice daily, or in a single dose of ten drops at bedtime, acts well; but if the patient be old enough to swallow a pill, the following prescription is to be preferred:

℞. Ext. belladonnæ, ... gr. ss
Pil. aloës et myrrh., ... gr. xij
Ol. cari, ... gtt. iij
Ext. taraxaci, ... gr. xij.
M. et ft. pil. No. xij.
SIG.—One pill at bedtime for a child of six years.

Or the aloës and belladonna may be combined in a mixture,* thus:

℞. Tr. belladonnæ, ... ♏xij
Tr. aloës et myrrh., ... f℥ss
Mucilag. acaciæ, ... q. s.
Aquæ menth. pip., ... q. s. ad f℥iij. M.
SIG.—One teaspoonful for a dose.

In using aloës and myrrh, it is usually necessary to reduce the dose after a time, as its purgative action increases rather than diminishes with repetition.

Another useful laxative is cascara, in the form of a fluid extract or an elixir; of the first preparation ten drops, of the second, twenty drops may be given, once or several times daily to a child of six. It does not quickly lose its effects by repetition.

I have lately used with much satisfaction a laxative confec-

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*A clearer mixture may be made by using a solution of aloës and myrrh instead of the officinal tincture. The following is the formula:

℞. Aloës,
Myrrhæ, ... āā gr. iiss
Alcohol, ... f℥ss
Glycerini, ... f℥j
Aquæ, ... q. s. ad f℥iij. M.

This solution was compounded, at the author's request, by Mr. J. J. Ottinger, of Philadelphia. The dose is the same as the tincture.

tion, composed of tamarind pulp (gr. xxxvj) and senna in powder (gr. iv), aromatized with aniseed and lemon, and acidulated with tartaric acid. One of these may be eaten every evening, or as often as necessary, by a child three years of age. They are regarded as sweets rather than medicine, and the little patients eat them readily.

APPENDICITIS.

Under this heading is now included those inflammatory conditions about the cæcum which were formerly classed as "typhlitis" or "cæcitis," "perityphlitis," and "perityphlitic abscess." Typhlitis as an independent lesion undoubtedly does occur, but it is a comparatively rare condition, and, probably, is always secondary to fæcal impaction. Appendiceal inflammation may be either catarrhal or ulcerative in form and its course may be acute, or chronic and recurrent.

Morbid Anatomy.—The lesions are usually seated in the right iliac fossa, but they are no more fixed in position than the appendix itself, which may lie away from its normal place, and be in the pelvis, in the region of the kidney, or in the neighborhood of the umbilicus. In the catarrhal form the walls of the appendix are thickened by cell infiltration, its cæcal orifice is closed, it is markedly distended by mucus, pus, and fæces or other foreign matter, and its peritoneal surface is congested. This condition may disappear without further trouble, or it may, especially after repeated attacks, produce ulceration and perforation.

Typhoid fever and tuberculosis of the intestines may be attended by appendiceal ulceration, but the term ulcerative or perforative appendicitis covers only the form due to inflammation excited by a foreign body within the appendix. In some cases the ulceration gradually effects a small perforation; in others the appendix becomes overdistended by the products

of inflammation and gangrene sets in with the sudden production of a large opening. The consequences of this perforation depend upon the rapidity of its occurrence and upon the position of the appendix; that is, whether or not it is so situated that adhesions are readily formed. If the perforation takes place slowly, the general peritoneal cavity is protected by an exudate of lymph about the appendix; if suddenly, there is an immediate congestion or beginning inflammation of the entire peritoneum; this, when the appendix is favorably situated, is soon limited by plastic adhesions. If infective material has escaped, at the time of perforation, an abscess forms; if not, the result is a localized plastic peritonitis. The seat of the abscess depends upon the position of the appendix; usually it is in the right iliac fossa, but it may be in the pelvic cavity or in the lumbar region. The abscess, in the absence of surgical interference, tends to open externally, into the rectum or other portion of the intestinal canal, or into the peritoneal cavity; in the latter case setting up a general peritonitis. When the position of the appendix is such that adhesions cannot form about it, or if these be absent or incomplete, sudden perforation gives rise to septic peritonitis with all its dangers.

The foreign bodies or appendiceal concretions resemble in shape and size cherry or date stones. They are hard, often laminated in structure, have a smooth, waxy-looking surface, are grayish or brown in color, and are composed of earthy phosphates combined with inspissated mucus and fæcal matter. Pins, shot, splinters of bone, strawberry seeds, hairs, and little masses of hardened mucus, may form the nuclei of these calculi.

Hepatic abscess, pyæmia, empyema, and pneumonia may follow perforative appendicitis.

Etiology.—Appendicitis is not, strictly speaking, an affection of childhood; nevertheless children between four and

twelve years of age are liable, particularly to the perforative form; it occurs with greater frequency in boys than in girls. A constipated habit is the chief predisposing cause. In this class, too, may be placed obstinate diarrhœa and intestinal disorders generally. The existence of the tuberculous diathesis, too, while it has little influence in increasing the susceptibility to appendicitis, does augment the tendency to ulceration and perforation after inflammation is established.

Retention of hardened fæcal matter in the cæcum, the so-called "typhlitis stercoralis"; accumulation of the seeds of certain fruits, as strawberries or raspberries, in one of the pouches of the cæcum; the passage of these, or of fæcal concretions or foreign bodies,—shot, pins, and bone spiculæ,—into the appendix, and the habitual use of coarse, indigestible food, are the most common excitants. Cold and exposure, blows upon the abdomen, violent exertion with strain of the abdominal muscles, and the abuse of drastic cathartics, are also sometimes determining causes.

The bacterial cause of appendicitis is, probably, the bacterium coli commune; this germ is constantly present in the intestinal canal, and has little or no influence upon a sound mucous membrane, but, given destruction of the epithelium, it has pathological and pyogenic properties.

Symptoms.—Catarrhal appendicitis presents rather obscure symptoms. The patient is frequently not ill enough to make complaint or to be confined to bed, and the condition probably often passes to recovery without being recognized. The characteristic symptoms are moderate pain in the cæcal region, with tenderness on pressure, most decided at McBurney's point; sometimes vomiting; constipation, and moderate elevation of temperature, the mercury rarely ranging above 101° F.

Perforative appendicitis develops, as a rule, after the ill-defined features of the catarrhal form have been present for

several days. It begins suddenly, with pain in the right iliac region and vomiting, and sometimes with a chill. The pain is constant and severe, and is increased by coughing, sneezing, vomiting, and by efforts to stand or walk. While generally limited to the cæcal region, it may be reflected to the navel, or even be most marked on the left side of the abdomen. The vomiting is attended by distressing retching; is often repeated, and the ejections consist, first, of food, and afterward of bile-stained fluid. The patient has an anxious face and the appearance of serious illness; lies on his back slightly inclined to the right side, with the right thigh drawn up, and complains if an attempt be made to straighten it. Abdominal respiratory movements are partially suppressed; the right iliac region is full and even prominent, very tender to the touch, dull on percussion, and the abdominal wall is more or less rigid. Palpation, when it can be practised, reveals a resistant mass occupying the right iliac fossa. There is fever, indicated by a coated tongue, extreme thirst, a frequent and somewhat wiry pulse, and a temperature ranging about 101° or 102° F. The bowels are confined.

With these initial symptoms the future course depends upon the result of the perforation, whether followed by (*a*) localized plastic peritonitis, (*b*) localized suppurative peritonitis, or (*c*) general peritonitis.

(*a*) There is severe pain, tenderness, and diffuse induration in the right iliac region; vomiting; constipation, and moderate fever, the temperature ranging from 100° to 102° F. After six or seven days the fever gradually disappears, the pain and tenderness abate, and the area of induration diminishes, finally leaving a nodulated mass as large as a hen's egg, which may not entirely disappear for weeks. Recurrent attacks are probable.

(*b*) In some cases of localized suppurative peritonitis, the fever, pain, and tenderness of the earlier stages continue and,

after several days, a distinct tumor may be detected in the right iliac fossa and pus may be reached by aspiration or by an exploratory incision. In others the acute symptoms subside, though the temperature does not quite recede to the normal point and the pulse is too frequent; then after an interval of inactivity, of very variable duration, the temperature slowly rises, pain and tenderness become more marked and more extended, the indurated mass enlarges and assumes greater prominence, suppuration takes place and gradually progresses until large quantities of pus accumulate. Occasionally abscess formation is attended only by slight pain, moderate pyrexia, and retraction of the right thigh.

(*c*) In these instances the initial symptoms are succeeded by those of general peritonitis. Vomiting continues; tenderness and pain are no longer localized, but extend over the whole abdomen; the bowels are locked and tympanites is pronounced. Prostration is rapid and extreme, the pulse grows frequent and feeble, the temperature generally ranges from 101° to 103°, but may be normal or even subnormal, and death, the usual outcome, is preceded by cold sweats, hiccough, stercoraceous vomiting, and general collapse. Sometimes after the acute onset the symptoms abate, showing a tendency to the formation of limiting adhesions, but this improvement is of brief duration, the incomplete barriers giving way, and the ordinary course is soon resumed.

Typhlitis Stercoralis is a condition of congestion and tumefaction of the cæcum due to distention of this portion of the gut by fæcal accumulation, or by a retained mass of mingled fæces and undigested food. While fæcal distention of the caput coli is often the forerunner of appendicitis, instances are not infrequent, especially in children, in which typhlitis alone is present, the appendix being quite uninvolved. The recognition of such cases is important, as the prognosis is much more favorable than in appendiceal inflammation and

operative interference is usually unnecessary. The symptoms are the *initial* presence of a doughy, sausage-shaped tumor in the right iliac region, moderate tenderness, slight elevation of temperature and increased pulse rate, infrequent vomiting, and constipation or, occasionally, spurious diarrhœa. The diagnostic feature is the *initial tumor;* the other symptoms are those of appendicitis, the difference being merely in degree.

Recurrent appendicitis of mild type frequently results from digestive disorders, and may be produced by one special article of food. Several attacks may occur and be followed by entire and permanent recovery.

Chronic relapsing appendicitis differs from the recurrent form in that the interval between the attacks is not a period of health; the patient suffers from flatulence, constipation, or diarrhœa; there is pain in the cæcal region, increased by exercise or fatigue; the attacks are more acute, are attended by the development of a tumor, which may, in fact, never entirely disappear, and by the symptoms of localized peritoneal inflammation. Finally, the general health is undermined and there is decided anæmia and loss of flesh.

Diagnosis.—A sudden attack of pain referred to the right side of the abdomen; vomiting; constipation; a pinched, anxious face; fever; a dorso-lateral decubitus; flexion of the right thigh, and the presence of an intensely tender tumor in the cæcal region, with increased resistance of the parietes, are the characteristic symptoms of appendicitis.

Perforative ulceration may be suspected if these symptoms disappear and reappear several times, or if, after a free evacuation of the bowels, the local pain, tenderness, and swelling continue.

A blood count is of great value in establishing the diagnosis in obscure cases, the presence of leucocytosis indicating pus formation.

Sometimes it is impossible to differentiate the catarrhal from the ulcerative form, as the onset of the former may be acute and violent, and perforation may occur without the development of the characteristic symptoms.

Intussusception resembles typhlitis in some of its features, but in this condition tenderness is a late symptom ; the tumor is situated more to the left of the abdomen ; sometimes the lower end of the invagination can be felt in rectal examination, and there is severe tenesmus with the expulsion of blood-stained mucus.

Appendicitis must not be confounded with colic or intestinal indigestion in infants, or with local suppuration—the abscess of Pott's disease or of psoitis—in the right iliac fossa in older children.

Prognosis.—Many cases of appendicitis, especially the catarrhal form, terminate in recovery. The duration of active illness is from four to twelve days, though several weeks often pass before the local tenderness and induration entirely disappear, and the functions of the intestine are restored. Recurrence is less apt to occur in children than in adults, and can usually be traced to a too early abandonment of treatment and resumption of ordinary diet and manner of living. If the cure has been thorough, a second attack is not to be particularly dreaded.

In perforative appendicitis the outlook is much less favorable. In cases resulting in the formation of a single, localized abscess, recovery is the rule under proper treatment. On the contrary, if general peritonitis be set up, at any stage of the disease, death must be expected, though by prompt surgical intervention a life may be occasionally saved.

In tuberculous patients the prognosis is always less favorable than in others.

Treatment.—For prevention, it is necessary to guard against habitual constipation, by a properly selected diet, by

regular exercise, and by enforcing the rule of making daily attempts to evacuate the bowels at a fixed hour. Nature may be assisted by a teaspoonful of compound licorice powder at bedtime, or one of the following pills:

℞. Resinæ podophylli, ... gr. iss
Ext. belladonnæ, ... gr. j
Ext. taraxaci, ... gr. xij.
M. et ft. pil. No. xij.
Sig.—One pill every night for a child of six years.

Or—

℞. Ext. belladonnæ,
Ext. nucis vomicæ, ... āā gr. j
Ext. colocynth. comp., ... gr. vj
Ol. cari, ... gtt. iij
Confec. rosæ, ... gr. vj.
M. et ft. pil. No. xij.
Sig.—One pill every night.

Should there be a tendency to fæcal accumulation, the mass is to be removed by purgative enemata. One teaspoonful of table salt to a pint of warm water will be efficient for this purpose—assisted by a course of calomel, followed by a saline laxative in small, repeated doses. The patient should be warmly clothed, especially about the abdomen; the feet must be kept dry, and exposure to cold and dampness avoided.

A child attacked by appendicitis must be put to bed and kept at rest upon the back; a small pillow may be placed under the right knee to support the thigh. The iliac region is to be covered with an ice-bag or a hot flaxseed poultice, or, if the child be robust and the tenderness and pain excessive, two or three leeches may be applied before poulticing. The non-retentive condition of the stomach, the inability of the involved portion of intestine to care for the little food that can be retained, and the necessity of avoiding every source of local irritation, all point to restriction of food to the smallest possible amount.

For the first two or three days small quantities of water at short intervals—one or two tablespoonfuls every half-hour—should alone be allowed. After pain and tenderness have abated and the bowels have been freely moved, cautious feeding may be begun, with one or two teaspoonfuls of raw-beef juice or panopepton every two hours. Later still, and for some time, no food but milk, or milk with a little mutton- or chicken-broth, is allowable, and these are to be given in small quantities at short intervals. A patient six years old may take every two hours :

Milk,	f ℥ ij
Barley water,	f ℥ ij
Saccharated solution of lime,	gtt. xv.

Saccharated solution of lime is used as an alkali instead of lime water, on account of its adding no bulk to the food ; it is prepared in this way :

Take of—

Slaked lime,	℥ j
Refined sugar, in powder,	℥ ij
Distilled water,	f ℥ xvj.

Mix the lime and sugar by trituration in a mortar ; transfer to a bottle containing the distilled water, cork, and shake occasionally for a few hours. Finally, separate the clear solution with a siphon and keep in a stoppered bottle.

When broth is used, it may take the place of milk at three or four feedings during the twenty-four hours, or if the milk produces pain, the diet must be restricted to broth and beef-juice. Whey mixtures and peptonized milk may also be employed.

The medicinal treatment is simple and consists in the administration of saline cathartics in small repeated doses until free purgation is produced. Sulphate of magnesium in doses of gr. xv–xx every two hours is usually readily tolerated by the stomach and is painless and efficient in its action. Citrate of magnesium or Rochelle salts may also be used. After the

intestines are emptied, the saline should be discontinued and the laxative action continued by broken doses of calomel; this has a valuable antiseptic action, and by its effect on the portal circulation relieves congestion of the ileo-colic vein and its tributaries. The less opium employed, the better; it is only permissible in the event of extreme colicky pains, and should be administered either hypodermatically or in suppositories.

As soon as convalescence begins,—*i. e.*, when pain, rigidity, and local tenderness subside,—the diet may be cautiously increased; a belladonna plaster substituted for the poultices; mild laxatives and tonics administered, and the patient allowed to sit up in bed, and after a time,—two or three weeks,—as health returns, to be up and about. Very active exertion should be avoided for several months.

If, on the other hand, the symptoms are worse at the end of forty-eight hours, or sooner if there be severe, lancinating pain, greater tenderness, and rigidity, and either local or general tympanites, the patient must pass from the hands of the medical man into those of the surgeon for operative interference.

Stercoral typhlitis requires the same regimen and medical treatment as appendicitis.

Recurrent appendicitis requires operation when the attacks are very frequent and show a tendency to a lessening interval and an increasing severity; but surgical interference must not be hasty.

Chronic relapsing appendicitis usually demands operation.

INTUSSUSCEPTION.

In intussusception or invagination one portion of the intestine is forced, from above downward, into another portion immediately continuous with it.

Apart from fæcal accumulation, this is practically the sole cause of intestinal obstruction in infancy. For, although instances are on record in which the bowel, in children, has been closed by peritoneal adhesions, by a twisted vermiform appendix, and by morbid growths, these are but pathological curiosities.

Two forms are met with: namely, intussusception without symptoms, and intussusception with symptoms.

INTUSSUSCEPTION WITHOUT SYMPTOMS.

This condition, which must be regarded rather as an accident than a disease, is frequently encountered in autopsies upon young children who have met death from very diverse affections.

Such intussusceptions occur shortly before, or during, the death agony, and are probably produced by irregular and violent contractions of the muscular fibres of the gut; occasionally they have been observed to occur after death, during autopsy. They consist simply of an involution of the bowel, without evidence of inflammatory action at the site of lesion, and can be readily reduced by traction. Sometimes there is but one inversion, though usually there are several; as many as ten or twelve distinct invaginations, at a distance of a few inches from each other, having been found in the same subject. The length of gut displaced is rarely more than three or four inches. The small bowel is the uniform seat; and of this division of the intestines, the lower part of the jejunum and the upper part of the ileum are most frequently involved.

Without a post-mortem examination, it is impossible to recognize the existence of this form of intussusception, on account of the entire absence of symptoms. Nevertheless, its discovery may be anticipated when death has resulted from cerebral or spasmodic diseases, or from acute or chronic entero-colitis.

INTUSSUSCEPTION WITH SYMPTOMS.

True intussusception is, fortunately, not very frequently met with in children, though it is more common in early infancy than in later childhood, youth, or adolescence.

Morbid Anatomy.—The probable mechanism of an intussusception is that a limited portion of the intestine contracts forcibly, and, by elongating and moving forward, enters a non-contracted segment immediately below, drawing in more or less of the latter, together with its mesentery or meso-colon.* Next, new peristaltic movements force the invaginated bowel further and further along, until extension is arrested by resistance from the mesentery, or by secondary inflammatory adhesions. The intussusception must, therefore, be made up of three layers of intestine, one above the other. The outer layer is called the sheath, or intussuscipiens; the middle and inner ones, the intussusceptum. Of these, the external and middle have mucous surfaces in contact; the middle and internal, serous surfaces. The involuted mesentery or meso-colon lies between the two last-named layers, and, on account of the firm attachment at its roots, exerts a one-sided traction upon the intussusceptum, curving it upon its axis and drawing the lower opening—which is elongated to a narrow fissure—from the centre toward the side of the sheath. The sheath itself is much folded or puckered, and on this account, with the curving of the intussusceptum, the apparent length of gut involved is always much less than the actual length. This varies from a few inches to several feet; in extreme cases an intussusception beginning at the ileo-cæcal valve may become apparent to the touch or sight at the anus. Increase in

* Nothnagel believes that invagination is caused by the normal gut being drawn over the spasmodically contracted part, rather than by that being mechanically driven into its sheath. Treves also calls attention to the influence of the longitudinal muscular fibres of the bowel wall, acting from the contracted part as from a fixed point, and drawing the unconstricted portion over the other.

length is accomplished by peristaltic action from behind; it takes place, always, at the expense of the external layer, and depends, for its degree, upon the force of peristalsis, the width and laxity of the mesentery or meso-colon, and the amount and character of the contents of the intestine behind the seat of involution.

The results of an intussusception are, first, occlusion of the lumen of the canal with partial, or generally complete, arrest in the passage of the intestinal contents; and, second, obstruction of the blood current in the middle and inner tubes, due to the pressure upon the mesenteric vessels. The obstruction of the circulation leads to deep congestion of the tissues of the intussusceptum; the mass becomes purple and swollen; the mucous surfaces exude a bloody material, and soon the opposed serous surfaces are glued together by inflammatory adhesions.

Should there be complete strangulation, the intussusceptum becomes gangrenous, and, under favorable circumstances, may be detached *en masse* or in pieces, and discharged through the anus. When this occurs, provided firm adhesions have formed, the sheath, being united at its upper extremity to the intestine directly above the point of inversion, forms with the latter a continuous tube, notwithstanding the separation of the intervening portion.

Several accidents may happen during this process. Thus, the inflammation in the opposed serous coats may extend beyond the involution, and give rise to general peritonitis. Or, ulceration and perforation of the sheath may be produced by the pressure and irritation of the free end of the intussusceptum. Again, when adhesions are imperfect, the contents of the intestine may escape into the peritoneal cavity through a rent, resulting from the separation of the sloughing intussusceptum; and, finally, even after the gangrenous mass is expelled, the adhesions may give way and permit extravasation.

Generally, in those fortunate cases in which sloughing is followed by recovery, no permanent injury results from the cicatrization at the point of junction of the sheath and uninvolved intestine. The cicatrix, though at first contracted, gradually stretches and a free passage-way is established.

Sometimes intussusception is attended with so little constriction of the involuted gut that the passage for the contents of the uninvolved intestine is quite free enough to allow of the maintenance of life for months, the patient finally dying of exhaustion.

In infants the invagination is almost invariably ileo-cæcal. The end of the ileum with the ileo-cæcal valve is forced into the cæcum, and, as the intussusception increases, penetrates further and further into the colon, drawing along more of the ileum, and doubling in, first, the cæcum, and then the ascending, or even the transverse and descending, portions of the colon. In some cases a few inches of the gut pass through the ileo-cæcal valve before the cæcum is inverted. Occasionally an intussusception involves the colon alone, and, very exceptionally, the small intestine.

Upon opening the abdomen, in an ordinary case, much of the colon appears to be wanting, and a tumor is found occupying the left side or the left iliac fossa. This mass—the intussusception—is slate-gray in color, elongated or sausage-shaped, and doughy to the touch. By more or less forcible traction, the involution may be reduced, though the gut is usually softened and apt to be torn in the effort. If an incision be made through the sheath, exposing the intussusceptum, two orifices will be observed at the lower end of the latter, one leading through the valve, the other into the cavity of the appendix vermiformis. The invaginated intestine is either of a uniform deep red color, resembling a long firm clot of blood, or presents the appearances common to gangrenous and sloughing tissues. If death has occurred early, there are

few evidences of inflammation between the serous surfaces; if later, these are adherent, the adhesions extending a few lines beyond and above the neck of the intussusceptum on to the sound intestine. The gut situated above the point of obstruction is usually greatly distended with accumulated fæcal matter and flatus; whilst that below is collapsed and empty, or at most contains a small quantity of mucus, stained with blood, pressed out from the capillaries of the strangulated mass.

As the age of the child advances the more likely is the intussusception to be confined to the small intestine.

Etiology.—As already indicated, early age seems to act as a powerful predisposing cause. Of fifty-two cases in children, recorded by J. Lewis Smith, twenty-three occurred between the ages of three and six months; eight between the sixth and twelfth months; and eighteen between the first and twelfth years. Of Leichtenstern's four hundred cases, one-fourth occurred in the first year, after the third month. The greater liability in infancy is due partly to anatomical peculiarities, and partly to the want of regularity and the energy of the intestinal movements. Thus, in infants, the large intestine holds to the abdominal space that it is forced to occupy the relation of about three to one, necessitating doubling of the gut upon itself. At this time of life, too, the meso-colon is much wider than in later years, except where it passes over the kidneys, in which position it is very narrow, or even almost absent. These two conditions, combined with unrhythmical and violent peristalsis, cannot but favor involution.

Many more males are affected than females. Rilliet and Barthez record twenty-five cases, all but three in boys, and the statistics of other authorities bear out their figures.

The exciting causes are imperfectly understood. Attacks have been attributed both to obstinate diarrhœa and prolonged constipation; to the presence of intestinal worms; to polypoid growths; to strictures and tumors of the intestine; to pre-

viously existing adhesions; to the use of irritating and indigestible food; and to external violence.

Symptoms.—These vary considerably, according to the age of the sufferer and the completeness of intestinal obstruction.

In patients under one year the onset is abrupt, whether it occur in the midst of health, or during the course of some derangement of the digestive tract. The child is seized with intense pain in the abdomen, turns excessively pale, screams, and then cries violently, writhing and drawing up his legs. The contents of the stomach are vomited, and usually, unless the bowels have been evacuated just before the attack, there is a single discharge of somewhat liquid feculent matter. After a time the pain passes away, leaving the little sufferer pallid and exhausted. There is now a rest from pain, but not from vomiting; all food or medicines taken into the stomach are returned at once, either by the easy process of regurgitation, or by violent retching; and if the viscus be empty, the ejections consist of a little bile-stained mucus, or even of blood. Sooner or later—the interval varying from a few minutes to several hours—there is another paroxysm of pain, accompanied by violent tenesmus, resulting in the evacuation of blood and mucus.

At this time the abdomen differs little from its normal condition. There is no fulness nor tenderness, nor any tumor appreciable to the touch; on the contrary, gentle friction often relieves the colicky pains, and the child prefers to lie upon its belly. The hands and feet may feel cool, though, otherwise, the temperature of the surface is unaltered. The mind is clear, but the expression of face is anxious, and denotes severe illness. The tongue may be lightly furred, and there is increased thirst, leading to a greedy consumption of the contents of the feeding-bottle or a ravenous sucking at the breast. There is also restlessness, constant whining or moaning, and an in-

ability to sleep. After a period of twelve or twenty-four hours, in which the paroxysms of pain and tenesmus have grown more frequent and severe, the abdomen becomes full; there is tenderness in the left iliac fossa, and if deep pressure be made in this region, during the absence of pain, a distinct swelling may be detected. The tumor gradually becomes more defined; it is elongated or sausage-shaped, of doughy consistence, and ranges in size from that of a hen's egg to that of a clenched fist. Later, it may change its position, moving toward the left side. When easily detected by external palpation, the tumor may be touched by a finger inserted into the rectum, and under these circumstances feels much like the cervix uteri in a vaginal examination. Occasionally the lower end of the involuted intestine protrudes from the anus, looking not unlike a prolapsed rectum.

While these features are developing, vomiting continues, and bloody mucus is expelled, with great straining, from the rectum, but there is no passage of either fæces or flatus. The amount of blood varies considerably; in some cases there is no more than sufficient to stain the diapers; in others, three or four ounces are voided several times daily. The tongue is red and glazed, or covered with a dry, brown coating; the pulse becomes frequent and feeble; the temperature rises to 102° or 103° F.; the abdominal respiratory play is restricted, and the flesh wastes. The urine may be greatly diminished in quantity; this, however, is by no means a constant condition, and seems to bear no relation to the seat or extent of the intussusception.

By the third day symptoms of collapse set in. The face becomes pinched; the eyes sunken and surrounded by dark circles; the skin feels cool and clammy, and the thermometer indicates a subnormal temperature. The attacks of vomiting are less frequent; the pain less intense; the bloody evacuations lessen or disappear, and the child lies upon his back, in

an apathetic condition, with half-closed eyelids, until the end comes at some time between the fourth and sixth day. Occasionally death is preceded by convulsions.

If, by any means, the invagination be reduced, the vomiting stops, pain disappears, flatus and thin, copious, semi-liquid and offensive stools are voided, and the patient finds rest in sleep. Afterward there is pallor, languor, and weakness, though the appetite quickly returns and flesh and strength are soon regained.

When older children are attacked, the picture differs in some of its details.

Thus, abdominal distention appears earlier and is more marked. The gut behind the position of obstruction being filled with fæces and flatus, is greatly stretched, and the outline of its coils may be distinctly seen and felt through the tense wall of the belly. This is especially the case during the paroxysms of pain, when, too, waves of peristalsis may be seen, and loud, gurgling sounds heard. The tumor is large and better defined, and the dull percussion note that it yields contrasts strongly with the general tympany.

Vomiting is more apt to be stercoraceous. This characteristic symptom is absent in many cases, and very naturally so; for, if Brinton's theory be adopted,—namely, that fæcal vomiting is due to a reverse axial current in the contents of the intestine, and not to anti-peristalsis,—it is apparent that, for the development of this symptom at all, the obstruction must be either in the large intestine or in the lower part of the ileum. The date of its onset must depend upon the distance of the starting-point of the reverse current, or the obstruction, from the stomach; upon the rapidity with which the bowel above is filled by ingestion and secretion; and, should the colon alone be involved, upon the readiness with which the resistance of the ileo-cæcal valve is overcome.

Evacuations of blood are much less uniformly observed.

Whether this symptom be present or absent depends solely upon the degree of constriction of the invaginated bowel. When the constriction is just sufficient to obstruct the circulation and overfill the vessels, hemorrhage is constant; but when there is actual strangulation, with complete arrest of circulation, no blood escapes. In older children strangulation is much more apt to occur than in infants, partly because the invagination more frequently involves the ileum or jejunum,—which have a smaller calibre than the colon,—and partly from the fact that in them, life being more prolonged after the accident, there is greater opportunity for inflammatory swelling. Hence it is that in this class of cases there is, in many instances, absolute constipation without bloody stools, though in others, where the intussusception is ileo-cæcal or colic, hemorrhage from the anus may be noticed as an early and permanent feature.

The blood appears in a liquid form, mixed with mucus, or in small clots. It always has the venous hue, and is darker in color and smaller in quantity, in proportion to the distance of the involution from the anus.

The older the child, the more likely is gangrene, separation, and elimination of the invaginated gut to take place. This result is usually noted during the course of the second week of illness, and can be attributed to the greater power of resistance and tenacity of life displayed by older children than by infants. It is a fortunate ending, but, unfortunately, rarely occurs at any age. After the process of separation is completed, violent straining efforts set in, expelling the black, ill-smelling, gangrenous mass, either in its entirety or in patches and shreds, together with a large quantity of dark, offensive, feculent matter. The child then falls into a deep sleep, and awakes much refreshed. Thirst diminishes; the appetite returns; the paroxysms of pain cease; the face expresses ease and comfort, and the path to health is rapidly traversed.

When death occurs, it is usually due to asthenia, and may, as in infants, be preceded by convulsions. General peritonitis is very uncommon.

In addition to the form of intussusception just described, and which may be termed *acute*, a variety having a much more prolonged course is sometimes encountered.

Chronic intussusception may occur at any age, and may exist for weeks, or even months, without producing severe illness. It originates most frequently in ileo-cæcal intussusceptions, and depends upon the inflammatory union of the outer and middle layers, and the restoration of the permeability of the inner tube by the complete disappearance of the swelling. The patient wastes, has periodical attacks of colicky pain, constipation, and vomiting, and occasionally passes a little blood. Palpation reveals a tumor that alters its position, shape, and density from time to time, and, on account of hypertrophy of the muscular coat above the partial obstruction, the knuckles of the intestine show distinctly through the emaciated abdominal wall.

Such cases may end in recovery, by separation; or in death, by perforative peritonitis; or by steadily increasing marasmus with chronic diarrhœa.

Diagnosis.—Intussusception may be strongly suspected when a child in good health, or previously affected with simple diarrhœa, is suddenly seized with violent, paroxysmal abdominal pain and vomiting, quickly followed by straining efforts, resulting in the evacuation of mucus and blood, and by intense prostration.

The suspicion will be reduced to a certainty if, at the same time, it be possible to detect a sausage-shaped tumor *on the left side* of the belly, or to touch the lower end of the inverted intestine upon rectal exploration. It is necessary to remember, however, that often, at the commencement of the attack, there is a single loose feculent stool, and also that,

in older children, bloody, mucous discharges may be entirely absent.

The diseases with which intussusception is most likely to be confounded are simple colic, perforative peritonitis, dysentery, and fæcal accumulation within the bowel.

In simple colic, the pain, though often severe, is never distinctly paroxysmal. It is attended by suppression of urine, is relieved by the discharge of flatus per anum, and is followed by copious urination. During the attacks the skin may be hot, and the belly is usually hard and tense. There is no vomiting, tenesmus, or discharge of bloody mucus. The misfortune of confounding intussusception with colic can hardly be overestimated; for a laxative, as castor oil, while relieving the latter by clearing out the intestinal canal, cannot fail to aggravate the former by increasing the force of the peristaltic contractions.

In perforative peritonitis there is pyrexia from the beginning, the abdomen is distended and tense, and pressure in the right iliac region—since the seat of perforation is usually the vermiform appendix—produces pain. On the other hand, tenesmus and the evacuation of blood and mucus from the rectum are never observed, neither is it possible to detect a tumor by abdominal palpation, nor the lower end of an intussusception by rectal exploration.

Dysentery presents, in the character of the dejections and the severe pain and tenesmus, features similar to intussusception, but it lacks the sudden onset, the obstinate vomiting, and the abdominal tumor. The two diseases differ, too, in their course.

A fæcal accumulation, as it produces actual occlusion of the intestine, has many symptoms similar to invagination. Thus, there is vomiting, colicky pain, tenesmus, constipation, and a tumor. The former accident, however, is preceded, for some time, by the passage of hard and scanty stools; while the

attendant vomiting is less obstinate; there are no bloody evacuations; and the tumor is more superficial, more fixed, and of such consistence that it can be indented by moderately firm pressure with the fingers. A purgative enema, also, rapidly leads to the expulsion of the impacted mass and relieves the symptoms.

Prognosis.—Every case of intussusception affords an outlook that is grave in the extreme, though the danger to life depends directly upon two factors: namely, the age of the patient attacked, and the acuteness and consequent severity of the symptoms. In children under one year, death almost invariably results. With those who are older, the constitutional resistance being greater, sloughing of the intussusception is more apt to take place and recovery follow; but the rarity of this fortunate termination at any time of life has already been alluded to.

Treatment.—In no other disease does the prospect of success rest so much upon an early diagnosis and appropriate management.

The indication to be met is the total arrest of all action of the muscular fibres of the intestine. To accomplish this end, the patient must be kept in a state of absolute repose; must be made to take enough opium to relieve pain and check intestinal peristalsis, and must be carefully and properly fed. Absolutely no purgative measure should be instituted.

Opium may be employed alone or in combination with belladonna, and may be administered by the mouth, by the rectum, or, in children over a year old, by hypodermic injection. A combination of the two drugs and their administration by the rectum is to be preferred in ordinary cases. For a child of one year the following suppository may be ordered:

℞. Ext. opii, ... gr. iss
Ext. belladonnæ, ... gr. ss
Ol. theobromæ, ... ʒij.
M. et ft. supposit. No. xij.

In the beginning, one of these suppositories can be introduced every two hours; but the interval must be lessened or the dose increased to the point necessary to relieve pain and tenesmus.

When the mouth is selected as the channel of exhibition, the opium and belladonna may be prescribed in a mixture, as:

℞. Tr. opii deod., ... f℥j
Tr. belladonnæ, ... f℥ss
Aquæ anisi, ... q. s. ad f℥iij. M.
SIG.—One teaspoonful every two hours (or p. r. n.) for a child of one year of age.

When the hypodermic method is selected, it is still best to combine the two drugs, thus:

℞. Morphinæ sulphatis, ... gr. $\frac{1}{3}$
Atropinæ sulphatis, ... gr. $\frac{1}{20}$
Aquæ destillat., ... f℥j. M.
SIG.—Inject ten minims p. r. n. for a child of six years.

The application of anodynes to the surface of the abdomen has certainly some power in relieving pain, and should, consequently, not be neglected. For this purpose a piece of soft flannel, large enough when doubled to cover the whole belly, should be dipped in hot water, wrung moderately dry, sprinkled with a teaspoonful of laudanum, laid over the surface and covered with oiled silk.

As to food, only so much as is absolutely required to sustain life should be allowed. For the first twenty-four or forty-eight hours, especially if there be vomiting, food must be altogether withheld, and a teaspoonful of barley water or a small bit of ice given every fifteen minutes to allay the thirst. Later, milk and barley water for infants, and milk, beef juice or broths, and strong beef essence for older children, are admissible; but always in minimum quantities and at intervals of two or three hours. Thus, for a child of one year, half an ounce of milk and barley water, in equal parts, every two

hours, will be quite enough; while at the age of six years two ounces of milk, one ounce of broth or beef essence, or two fluidrachms of beef juice every three hours will suffice. It is well to peptonize the food, as in this way it is prepared for assimilation, and little residue is left in the intestinal canal. Everything must be taken cold.

When the strength begins to fail, brandy must be administered. The following mixture is a good food and stimulant:

Brandy, ... 4 fluidounces
Cinnamon water, ... 4 fluidounces
The yolks of two eggs,
White sugar, ... ½ ounce.
Rub the yolks and sugar together, then add the cinnamon water and spirit.

DOSE.—A dessertspoonful to two tablespoonfuls every two hours, according to the age.

Should the patient be seen before the fourth day of the attack, in addition to the above measures of treatment, efforts should be made to reduce the involution mechanically. Mechanical interference can be successful only before inflammatory adhesions have formed, and is contraindicated when there is tenderness over the seat of lesion. There are three possible ways of accomplishing reduction: viz., by taxis, by forced injection of water, and by insufflation of air. To perform either of these successfully the patient, unless an infant under one year, must be previously put thoroughly under the anæsthetic influence of ether.

Taxis consists in kneading and otherwise manipulating the abdomen with the warmed and oiled hand; it is usually employed in conjunction with one of the other methods.

If forced enemata be resorted to, the child is placed upon his back in bed, with the pelvis elevated, so that the trunk is inclined at an angle of 45 degrees. Then, with a Davidson's or fountain syringe, the physician himself must inject, carefully and slowly through a catheter, as much normal saline

solution, at a temperature of 105°, as the capacity of the intestine will permit; reflux being prevented by firm compression of the buttocks. While this is being done, the abdomen must be kneaded in such a manner as to force the water upward along the bowel in the direction of the invagination. At times the obstruction can be felt to give way; but the best proofs of this fortunate occurrence are the subsidence of the more urgent symptoms and the onset of sound sleep. Soon, too, there is a discharge of bloody mucus from the rectum, and then a free, offensive, semi-fluid fæcal evacuation.

Insufflation of air is suited to those cases in which, the intussusception having descended into the rectum, little or no water can be injected or retained. The apparatus for this purpose consists of a bellows, having its nozle attached, by means of a piece of flexible rubber tubing, to a caoutchouc tube about a foot in length; the latter is inserted into the rectum, care being taken to prevent escape backward by the means employed in injecting liquid. The air should be pumped in slowly and gently, and during its introduction taxis is practised in the same manner as in the forced injection of water. After reduction, the patient must be kept in bed and under the influence of opium for several days; the diet must be very low, and cathartics must be avoided for three or four days.

Should the above measures of reduction fail, or should the case be seen for the first time after the third or fourth day, the question may arise as to the propriety of laying the abdomen open and reducing the intussusception by direct traction. For the details of the operation of laparotomy, the reader must be referred to works on surgery. Briefly stated, it consists in making an incision in the median line of the abdominal wall, opening the peritoneum, finding the intussusception, and working it back at the neck in the same manner as a hernia is reduced. The result of operation depends

greatly upon the stage of the disease at which it is performed. If undertaken early, before adhesions have formed, a fair proportion of cases are successful. If so late that the invagination cannot be reduced by traction after opening the abdomen, or after gangrene has set in, death is the almost invariable termination. Surgical interference, then, should not be delayed after a brief but thorough trial of the ordinary methods of reduction.

When spontaneous separation and discharge of the invaginated segment of the intestine takes place, it is necessary to exert the utmost care lest the new-formed adhesions be broken down. The patient must lead a passive life; the food must be readily digestible and restricted in quantity, and all farinaceous and fermentable articles are to be excluded from the dietary.

In chronic intussusception great reliance can be placed upon the free administration of opium and belladonna, with forced enemata, or, in proper cases, insufflation of air; and as this condition generally occurs in late childhood, laparotomy, when other measures fail, is more frequently successful.

INTESTINAL WORMS.

The common parasitic worms that find their habitat in the human intestines may be divided into two classes, each including several varieties, namely:

NEMATODES.	*Oxyuris vermicularis.* *Ascaris lumbricoides.* *Tricocephalus dispar.*
CESTODES.	*Tænia saginata*, or *mediocanellata.* *Tænia solium.* *Bothriocephalus latus.* *Tænia cucumerina.* *Tænia nana.*

Of these, the oxyuris vermicularis (small thread worm) and

the ascaris lumbricoides (long, round worm) are most frequently found in children. The tænia, or tape-worm, is uncommon before the age of six or seven years.

DESCRIPTION AND MODE OF ENTERING THE BODY.

Oxyuris Vermicularis.—These worms are silvery-white in color and of small size; the males being one-sixth of an inch, the females one-half an inch long. To the unaided eye they present the appearance of small, white threads. They inhabit the cæcum and whole length of the colon, but are most abundant in the sigmoid flexure and rectum, where they derive nourishment from the fæces, and where, alone, they give rise to symptoms or evidences of their presence.

Oxyures enter the body by direct passage of the ova into the mouth. They are introduced clinging to fruit and various articles of food, or are conveyed to the lips by the hands of the child previously used to relieve itching occasioned by the presence of the parasites in the neighborhood of the anus. Having entered the stomach, the embryos are liberated by the action of the gastric juice and pass into the small intestine, which they descend with the food, developing so rapidly that they become sexually mature by the time they reach the cæcum.



FIG. 10.—EGG OF OXYURIS VERMICULARIS.

The eggs, as seen by the microscope, are $\frac{1}{500}$ of an inch in length, ovoid and unsymmetrical. They are produced in great numbers, each female giving birth to several broods, numbering from ten to twelve thousand, and they are extremely tenacious of vitality.

Ascaris Lumbricoides.—This parasite has a certain superficial resemblance to the common earth-worm. It is cylindrical, tapering at both extremities, is reddish or brownish in color, has a body marked with fine transverse rings, and possesses a peculiar, disagreeable odor independent of the

substance in which it lives. The head of the worm presents three prominent labial papillæ surrounding the mouth, and the tail is conical. The male is from three to six inches in length and one-eighth of an inch in thickness, with an incurved tail and a penis consisting of a pair of slender, clavate, chitinous spicules, the ends of which protrude from a cloacal aperture at the root of the tail. The female measures from six to fourteen inches in length and one-fourth of an inch in thickness. The genital aperture is situated on the ventral surface, near the anterior third of the body; the ovarian tubes may be observed as long, tortuous canals, and the uterine tubes as short, straight canals; the latter contain many millions of ova. The ripe ova are laid in the intestine, and are expelled, with the stools, in great numbers, sometimes even in large masses. The eggs are $\frac{1}{500}$ of an inch in diameter, and are oval, with a thick, elastic, brownish, double shell and nodulated surface. After expulsion from the rectum, they are very tenacious of life, remaining in a condition capable of development for several years. This is particularly the case when they find their way into water or moist earth. Here the embryos slowly develop.

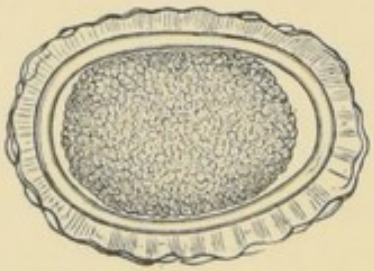


FIG. 11.—EGG OF ASCARIS LUMBRICOIDES.

It is not positively known in what way children become infected with the parasite, but impure water is, without doubt, the medium. Recent experiments on both animals and men have demonstrated that infection cannot be directly produced by taking the recently laid, ripe ova into the stomach. It is probable, therefore, that the ova passed by an infected subject, after entering—through drainage or otherwise—moist soil or running water, and undergoing partial development, are eaten by some common, but unknown, minute aquatic animal. Within the bodies of these they are still further developed, so

that, when the animalculi are ingested with impure drinking-water, and the embryos liberated by the action of the digestive solvents, the latter are in a position rapidly to assume their mature characters. Epstein denies that an intermediate host is necessary, having found by experiment that five weeks' cultivation of eggs taken from evacuated fæces is sufficient, under proper conditions of light and air, to develop the embryos, and that in three months after these are fed to children ova appear in the stools and worms are expelled after the administration of an anthelmintic.

Lumbrici inhabit the small intestine principally, though they frequently migrate. Their number in a single individual may vary from two to several hundred.

Tricocephalus Dispar.—The whip-worm, as this parasite is sometimes called, is yellowish-white in color, with the anterior half, or more, of the body attenuated in a hair-like filament. The male is about one inch and a half in length, has the thick portion of the body enrolled, and a blunt tail. The female is two inches long, with a conical tail. The eggs of this worm are laid in the intestine and voided with the fæces; nothing is known of their subsequent history, or of the method in which the human being is infected.



FIG. 12.—EGG OF TRICOCEPHALUS DISPAR.

Whip-worms inhabit the lower end of the ileum, the cæcum, and the vermiform appendix, and feed on the intestinal contents. They are met with in small colonies, varying in number from two to twelve. Their occurrence is considered to be exceptional in this country, but this may be explained in two ways: first, as they are rarely voided with the fæces, like other worms, they escape ordinary observation; and, second, as their presence gives rise to no symptoms during life, few think of looking for them on the post-mortem table.

Tæniæ infest children over the age of six years with almost

the same frequency as adults. Of the several varieties, the *tænia saginata*, beef tape-worm, and *tænia solium*, pork tape-worm, are the most common ; while of these two, the former is met with in by far the greater number of cases.

Tænia saginata is a soft, yellowish-white, band-like worm, varying in length from six to twenty or more feet. The head has about the bulk of a yellow mustard-seed, is rounded quadrate, and provided with four hemispherical suckers. Between the head and body is a short, unsegmented, flattened neck, narrowest at its upper extremity and gradually broadening as it merges into the body. The latter is distinctly segmented. The first segments are several times wider than long, but become successively larger until the length exceeds the breadth two or three times ; their number may reach twelve hundred, and the largest measure from one-fourth to one-third of an inch in width, and a quarter to a full inch in length. The parasite is usually solitary. It inhabits the small intestine, in which position the segments, as they ripen, are spontaneously detached, some having already expelled their burden of eggs (often numbering 35,000), others still laden. Both eggs and liberated segments then become mixed with the intestinal contents, pass downward into the colon, and are finally expelled with the fæces. The mature ova are brown, oval in shape, and of minute size ; they have a thick inner shell, and an outer longitudinally striated envelope. Each ovum contains an embryo—a spherical or oval body—having at one pole three pairs of divergent, boring spiculæ.



FIG. 13.—EGG OF TÆNIA SAGINATA.

In rural districts, it is a very common habit, with both adults and children, to stool in a fence corner, or other more or less secluded spot, at any time there is a call for evacuating the bowels. Should ova-laden tape-worm segments or

liberated eggs be contained in the fæces so carelessly deposited, these are apt to be swallowed by cattle grazing in the neighborhood. Having once entered the stomach, the embryos, liberated from the eggs by the action of the digestive solvents, attach themselves to the mucous membrane of the viscus, perforate it by means of their powerful boring apparatus, and, either directly or through the medium of the blood current, migrate into the tissues of the body, usually the muscles or liver. After attaining their destination, they become fixed and slowly undergo development, dropping the spiculæ and being transferred into the larval form or *scolex*. The scolex consists of a head like that of the mature worm, with a neck terminating in a capacious cyst, within which the head and neck are inverted. In this form each parasite is surrounded by a sack of connective tissue; the new formation, depending upon the presence of the larva, acting like an embedded foreign body. The flesh, liver, and other organs of cattle so infected are said to be "measly." Now should measly beef be taken into the stomach insufficiently cooked, or should it be administered raw,—a frequent practice in the treatment of certain intestinal diseases,—the parasite, during the process of digestion, is liberated from the investing connective-tissue envelope, everts its head from the containing sack, attaches itself to the mucous membrane of the small intestine, feeds upon the intestinal contents, and, growing from its caudal extremity, rapidly develops into a mature tape-worm. The time required for development has been proved by experiment to be less than two months, and the natural duration of life is very protracted.

Tænia Solium.—This species of tape-worm enters the human body through the medium of measly pork. The methods of propagation and development are identical with those of the tænia saginata. In general appearance, also, the two worms are very similar. The pork tape-worm, however,

is white in color and broader and shorter, the usual length being between five and ten feet. The head, which presents the most prominent distinguishing features, is about the size of that of an ordinary pin; it is spheroidal in shape, is surmounted by a blunt papilla, encircled by a double row of hooks, and, at the same time, has the four hemispherical suckers to be noticed in the beef tape-worm. The ova are somewhat smaller, but otherwise identical; the scolices, long known as *Cysticercus cellulosæ*, likewise possess the double row of hooks to the head, and in this way may be distinguished from the larvæ of the other variety of tænia. The period occupied in development is about three months; the length of life probably twelve years or more.

As in the United States pork is but little used as food in comparison with beef, and when used is thoroughly cooked, the difference in the frequency of occurrence of the two species of worms can be readily explained. In regard to this point, Prof. Leidy states: "Since the writer distinctly recognized the beef tape-worm, within the last twenty years, all the specimens of tæniæ, from people of Philadelphia and its vicinity, that have been submitted to him for examination—perhaps in all about fifty—have appeared to belong solely to tænia saginata. The prevalence of this species with us is no doubt due to the common custom of eating underdone or too rare beef, while the pork tape-worm is comparatively rare, as with us pork is only used in a well-cooked condition."

Bothriocephalus latus is very uncommon except in some portions of Europe. The larvæ have their habitat in certain fish, and through this form of food are introduced into the human body.

Tænia Cucumerina.—The larvæ of this worm develop in a parasite living upon the skin of dogs and cats. Children who make companions of these animals carry the larvæ to their mouths upon their hands; even very young subjects may

be infected in this way; in fact, most of the tape-worms found in infants belong to this variety. The worm is much smaller than either the T. saginata or T. solium, the full length being from six to twelve inches; it is also much less frequently encountered.

Tænia nana is, as yet, very rarely met with in this country, but it is common in Italy, and with increasing immigration its more frequent occurrence may be anticipated. This variety of worm especially affects children, and may exist in great numbers in one individual. It is very small, measuring from four to six lines in length; the head is armed with four suckers and a rostellum of hooks, capable of being protruded or withdrawn.

Symptoms.—These may be divided into two classes: general and special.

The general symptoms are those always present, irrespective of the particular species of worm infecting the patient. They depend not so much upon the mere presence of the parasite, as upon the peculiar condition of the mucous membrane of the alimentary canal which accompanies and is, perhaps, essential to their development and existence. This condition is one of catarrh, with an excessive production of mucus.

The patient wastes, and the face is pale or leaden in hue, dark circles surround the orbits, the eyeballs are sunken, the pupils dilated, and the upper lip swollen. The skin generally is muddy, covered with dry, epidermic scales, and devoid of natural softness and elasticity.

The lips and mucous membrane of the mouth are pale, the breath is offensive, and the tongue is flabby, with the edges indented by the teeth and the dorsum covered with a thin, slimy coating. There is often moderate hypertrophy of the tonsils and swelling of the lymphatic glands at the angles of the jaw. The appetite is capricious, sometimes almost absent,

and at others insatiable. Nausea, acid eructations, and vomiting are common. Constipation is the usual state of the bowels; occasionally there is tenesmus, with constant unproductive efforts at defecation, and there is liability to attacks of diarrhœa, attended with great straining and the passage of black, slimy, ill-smelling motions. Free mucus may be discharged from the rectum, and, in girls, from the vagina. The abdomen is always distended, feels hard on palpation, and to percussion yields a tympanitic note. Constant complaints are made of pain in the belly, especially in the neighborhood of the umbilicus. Its character varies, being in some cases tearing or cutting; in others, simply an uneasy, creeping sensation, and in others still, a sensation of coldness.

The urine is frequently voided with pain and difficulty, and may have a turbid, milky appearance.

The pulse is weak, altered in frequency, and occasionally irregular; a harassing, paroxysmal cough may be present, and not uncommonly there is sighing, sobbing, and hiccough.

The child's temper is altered; he becomes irritable or sullen; his sleep is broken by bad dreams or night terrors; and there are many and very diverse nervous manifestations, such as annoying itching of the nose, temporary delirium or stupor, sudden blindness, loss of voice, squinting, fixation of the eyeballs, vertigo, and general convulsions.

These features, of course, are not equally marked in all cases, their degree depending upon the grade of intestinal catarrh.

Special symptoms—those due directly to the presence of the worms—differ according to the species.

The oxyures occasion violent itching at the anus, especially at night, when they prevent sleep and lead to troublesome scratching. The irritation, transmitted to the genitalia, combined with the constant application of the hands to these parts, produces erections in the male, and may induce the habit of

masturbation in both sexes. Two conditions of the bowels are observed; either forcible but ineffectual straining, often attended by prolapsus ani, or diarrhœa. Finally, the oxyures may, on inspection, be discovered moving about in the radiating folds of the anus.

Occasionally these parasites migrate into the vagina, uterus, urethra, œsophagus, and stomach. When they occupy the vagina, they give rise to leucorrhœa.

Lumbrici occasion more or less pain in the umbilical region; also headache, vertigo, convulsions, epileptiform attacks, transient paralysis, and even chorea. The irritation of their presence may cause chronic diarrhœa, with scanty, offensive, thin, mud-colored stools, voided with much straining, and most numerous during the night. They often migrate into the stomach, whence they are quickly expelled by vomiting. Less frequently they pass into the common bile-duct and gall-bladder; also the nose, larynx, trachea, larger bronchi, vagina, urethra, and bladder; in each position giving rise to symptoms of irritation. They have been found, too, in abscesses communicating with the intestine, having escaped by entering a pre-existing fistulous opening, or, perhaps, in some instances, by directly perforating the gut. These abscesses usually occupy the abdominal wall in the umbilical or inguinal regions, or are seated in the substance of the liver.

As already stated, the tricocephalus dispar causes no special symptoms.

Tæniæ are attended by sensations of weight and gnawing in the abdomen; occasional attacks of colic, and distention, particularly of the umbilical region. With a huge appetite, there is progressive emaciation and general lassitude. A persistent headache is sometimes a feature, and there may be annoying cramps in the muscles of the legs and arms.

Diagnosis.—While the occurrence of the symptoms detailed strongly indicates the presence of worms, the only

positive proof of their existence is the discovery of the parasites themselves or of their eggs in the stools; their appearance, as in the case of oxyures, at the margin of the anus; and their expulsion, as in the case of lumbrici, from the stomach in the act of vomiting. Therefore a purgative, by emptying the intestinal tract and expelling some of the parasites, is the crucial test.

In some cases the symptoms are severe enough to suggest tuberculosis or tuberculous meningitis; though a mistake may be readily avoided by bearing in mind this possibility and applying the test.

Prognosis.—Intestinal worms rarely cause death. When a fatal termination does occur, it results from convulsions; from the consequences of the migration of the parasite into the bile duct and air passages, or from some secondary affection; proving dangerous because the strength of the frame attacked has been sapped by its guests.

Treatment.—The diagnosis having been established, either by the spontaneous appearance of the worms or by their discovery after the administration of a dose of calomel or calomel and rhubarb, remedial measures must be directed to the accomplishment of two objects: First, the expulsion of the worms; and second, the removal of the alkaline mucus—the essential nidus—and the restoration of the alimentary canal to its normal condition.

First: For expelling the parasites, the anthelmintic to be chosen depends upon the infecting species.

Oxyures, as they inhabit the rectum, are within the reach of enemata, and are best treated by this means. The object being to kill the worm, it is essential thoroughly to empty the lower bowel by an enema of warm water, immediately before injecting the parasiticide, so that the latter may come in contact with the mucous membrane, upon which the great mass of the worms lies. One or two medicated injections can be

administered daily; they act best when cold, and their bulk should not be so large as to distend the gut and lead to a quick return; from one to two fluidounces is the proper quantity for a child of two years.* Liquor calcis; common salt and water, in the proportion of one teaspoonful to a pint; a solution of castile soap, thirty grains to a pint of water, or one of sulphuret of potassium, twelve grains to a pint; oil of turpentine in milk; half a teaspoonful to four fluidounces of pure olive oil; and lard beaten up with water until it becomes liquid, all constitute good injections, the last two having the property of quickly relieving itching, in addition to their parasiticide action. In my experience, however, the injection of an infusion of quassia has been most uniformly successful. The infusion is best prepared in the nursery, thus:

℞. Quassiæ (rasped), ... ℥ij.
Sig.—Place in a porcelain vessel and pour on a pint of boiling water, macerate for two hours, then strain and inject two fluidounces once or twice daily.

With children past the second year the proportion of quassia may be gradually increased to one ounce, at the age of seven.

While employing enemata it is well to aid their action, and relieve itching at the anus, by anointing the parts with some mild mercurial ointment, and at the same time pushing a little into the rectum. A good preparation of this kind is:

℞. Hydrargyri chloridi mitis, ... gr. lxxx
Unguenti petrolei, ... ℥j. M.
Sig.—Apply morning and evening.

When there is intense rectal irritation, an injection of laudanum and starch water (gtt. iij to f℥j) and cold compresses applied to the fundament give great comfort.

* All of the succeeding directions for treatment are adapted to children of this age.

Diarrhœa and tenesmus are to be overcome by the administration of a teaspoonful of castor oil, with five drops of paregoric, once, twice, or three times daily, according to circumstances. Should there be constipation, one teaspoonful of Husband's magnesia, or the appropriate dose of some other saline, must be given every morning until the symptoms disappear. Besides keeping the bowels regular, it is well to secure several free watery evacuations, at intervals of three days, for the purpose of dislodging any oxyures that may be inhabiting the upper part of the large intestine, and of clearing away accumulations of mucus ; to accomplish this, saline cathartics are to be selected.

Against lumbricoides several drugs are useful. Of these, santonin, spigelia, and chenopodium are the most efficient. To insure the greatest success, the patient for whom any of these medicines is ordered must be placed on a restricted liquid diet, that the alimentary canal may be as empty as possible ; and during their administration the bowels must be kept active by cathartics, that the dead worms and the ova may be swept away. Broken doses of the purgative chosen can be combined with the anthelmintic, or an occasional full dose may be given during the course of the treatment.

Santonin is almost tasteless, and when combined with sugar is readily taken by children ; it may be prescribed in the following ways :

℞. Santonini, ... gr. vj
Sacchari, ... gr. xxx.
M. et ft. chart. No. xij.
Sig.—One powder morning and evening, each second dose to be followed by two teaspoonfuls of castor oil or a purgative dose (gr. j) of calomel.

Or—

℞. Santonini, ... gr. vj
Hydrarg. chlorid. mit., ... gr. vj
Sacchari, ... gr. xxiv.
M. et ft. chart. No. xij.
Sig.—One powder morning and evening.

Santonin sometimes produces xanthopsia, or "yellow-seeing"; this is of no importance, and quickly disappears after the drug is discontinued. It is best, however, to advise the mother or nurse of the possibility of this occurrence. Occasionally, too, it increases the flow of urine and gives the fluid a reddish color.

Spigelia is a very useful remedy, though as it simply narcotizes the worm, it must always be administered in association with a purge. The officinal preparation, extractum spigeliæ et sennæ fluidum, is as good a combination as can be employed; it may be given in doses of one teaspoonful three times daily. If it be desired to make success doubly sure, it is well to add santonin:

℞. Santonini, ... gr. iv
Ext. spigeliæ et sennæ fld., ... f℥iss
Syrupi, ... f℥ss
Elix. simplicis, ... q. s. ad f℥iij. M.
SIG.—Two teaspoonfuls three times daily.

Chenopodium is a very safe, non-irritant anthelmintic, being especially indicated when the evacuations are increased in number, are liquid, and contain mucus or blood. The volatile oil may be administered dropped upon a lump of white sugar, in doses of five drops three times daily. A purgative is then necessary, every twenty-four or forty-eight hours, or, for convenience, both remedies may be combined in a mixture:

℞. Olei chenopodii, ... f℥ij
Olei ricini, ... f℥iss
Olei cinnamomi, ... ♏v
Syr. acaciæ, ... q. s. ad f℥iij. M.
SIG.—One teaspoonful three times daily.

Should there be reason to suspect ulceration of the bowel, five minims of oil of turpentine added to each dose of this

formula will both improve the condition of the mucous membrane and increase the specific action.

The only disadvantage possessed by oil of chenopodium is that it is not so acceptable to the taste or stomach as either santonin or the liquid extract of spigelia and senna.

Whip-worms, when detected, can be removed by the same means as lumbricoides.

Tæniæ are the most difficult of the intestinal parasites to eradicate; evacuations of many feet of segments are easily brought about, but reproduction steadily continues until the head is finally expelled. This portion is obstinate in its adherence to the intestinal mucous membrane and being minute in size, is easily shielded from the action of the parasiticide by the tenacious mucus which is always secreted in excess when a tape-worm is present.

It is essential, therefore, to diminish, or, if possible, entirely remove, this secretion, before commencing the actual treatment. For one week the child * must take the following prescription:

℞. Ammonii chloridi, ... ℥ij
Ext. sennæ fld., ... f℥vj
Inf. gentianæ comp., ... q. s. ad f℥iij. M.
Sig.—One teaspoonful before each meal.

At the same time the diet must be restricted, and non-farinaceous in character; for instance:

Breakfast at 8 A. M.—A tumblerful and a half (12 oz.) of milk, with two slices of gluten bread.†

Luncheon at 12 M.—A teacupful (4 oz.) of milk.

Dinner at 2.30 P. M.—A bowl (8 to 12 oz.) of beef-, mutton-, or chicken-broth; two slices of gluten bread.

Supper at 7 P. M.—Same as breakfast.

* This and the succeeding formulæ are adapted to children of six years.

† Gluten flour can be obtained in any of the larger cities, and is made into bread in the same manner as wheat flour.

For drink at dinner or between meals only pure filtered water in small quantities.

At the end of the week's preparation one of the anthelmintics particularly adapted to this species of worm may be ordered.

For a long time the bark of the pomegranate root has been known as a remedy for "tænia," or tape-worm; but the difficulty of procuring it fresh, the short time it keeps good, and its unpleasant taste have greatly limited its use. Besides, it has been ascertained that its action is variable, according to the season of collecting, the age and vigor of the tree, etc. It is this uncertainty that compelled Professor Laboulbene, Member of the Academy of Medicine, who has made the cure of tænia a specialty, and who considers the bark of pomegranate root the best and most efficacious remedy, to say: "I wish that some one would discover and separate from the tæniacide plants a sure alkaloid, always identical, and that would act with certainty, which is something we cannot obtain from pomegranate bark, or from old koosso, which is nearly inert."

M. Tanret has found this alkaloid, and for his discovery has been awarded the "Barbier Prize" by the Academy of Sciences. He calls it pelletierine, in honor of the illustrious chemist, who, with Caventou, has made numerous discoveries in organic chemistry of great benefit to humanity.

Tanret's pelletierine has given the most satisfactory results in the hospitals where it has been tried; for instance, at the Marine Hospitals of Toulon, St. Mandrier, etc., and in Paris, St. Antoine, La Charité, Necker and Beaujon, etc. Dujardin-Beaumetz, Member of the Academy of Medicine, declared to the Society of Therapeutics that he was successful in thirty-two cases out of thirty-three treated with pelletierine, and Professor Laboulbene was successful in every case in which he used it, fourteen in all. My own experience with

this drug has been most successful, and I have relied upon it exclusively for a number of years past.

Pelletierine is dispensed in bottles containing the proper dose for an adult, and one dose is usually sufficient. For children from nine to twelve years, half the adult dose is sufficient. In administering the drug, certain preliminaries are indispensable to insure success.

When pieces of tape-worm are or have been ejected within a short time after some other remedy has been taken without expelling the head, pelletierine should not be taken until some pieces of the worm are again noticed.

In the evening the patient must be given a large laxative injection, and be placed on milk diet. The next morning mix half, or less, according to age, of the contents of a bottle with a half-glass of sweetened water, and administer at one dose; three-quarters of an hour to an hour after, give from two to four fluidrachms of compound tincture of jalap, mixed with two fluidounces of sweetened water. Compound tincture of jalap is the best purgative, but it can be substituted by any other quickly acting cathartic.

If the bowels are not relieved in a few hours after giving the purgative, then administer either another purgative or an injection of normal saline solution. A few minutes after taking pelletierine there will be a sensation of giddiness, and the entire tape-worm will be passed from two to four hours later.

Oleoresin of male fern—oleoresina filicis—is frequently employed and is quite efficient; it should be given in one or two drachm doses, either floating upon a little peppermint water (f℥ss) or in a mixture, such as:

℞. Oleoresinæ filicis, ... f℥ij–iv
Syr. acaciæ, ... f℥ij
Aq. cinnamomi, ... q. s. ad f℥j. M.
Sig.—Tablespoonful for a dose.

The plan of administration has much influence on the

issue. For the best result, the patient, unless much debilitated, must, upon the day on which the treatment is instituted, begin a fast after his dinner; in the evening two fluidrachms of castor oil should be given; next morning, after the bowels have been thoroughly evacuated, a dose of fern; and three hours later, a second dose of castor oil. A few hours subsequently the worm will probably be expelled. During the interval, occasional sips of water may be allowed to relieve thirst. The nauseating taste of the oleoresin of fern may lead to its quick rejection from the stomach; in such cases the viscus should be quieted by a few drops (3 to 5) of McMunn's elixir of opium, and a second dose of the anthelmintic administered after the lapse of half an hour.

Kameela (*Rottlera*) is another good remedy for tape-worm, possessing the advantage of being in itself an aperient, and hence doing its work without the aid of purgatives. The same period of absolute fasting is necessary as when administering male fern, and on the morning of the day following the beginning of abstinence, two doses of fifteen grains of powdered kameela must be taken, at an interval of three hours. The drug may be exhibited suspended in syrup or in mucilage of acacia, a few drops of some aromatic oil being added in either case. A capital prescription, containing both kameela and male fern, is:

℞. Kameelæ, ... gr. xxx
Syr. acaciæ, ... f℥ij.
Misce, et adde—
Oleoresinæ filicis, ... f℥j–ij
Aquæ cinnamomi, ... f℥j. M.
SIG.—To be taken in two doses at an interval of three hours.

A formula very similar to this has been in long and most successful use at the Children's Hospital, Philadelphia.

In some cases oil of turpentine is very efficient, even when the remedies already mentioned fail. This may be given in

one large dose, or in small doses frequently repeated. By the former method, from two to four fluidrachms are given in the morning after the usual fast, and followed in three hours by a dessertspoonful of castor oil, unless the bowels have been previously relieved. To carry out the latter, the following mixture may be used:

℞. Olei terebinthinæ,
Mellis, ... aa f℥ss
Ol. menth. pip., ... gtt. vj
Mucilag. acaciæ, ... q. s. ad f℥iij. M.
SIG.—Two teaspoonfuls every six hours.

Every second day, preferably in the morning, two grains of calomel must be administered.

Another useful drug is pumpkin seed; this may be given in the form of an electuary, six drachms of the seeds being beaten up with sugar, and taken in one or two doses; a brisk purge must be ordered after it.

Koosso and its active principle, koossin, are recommended by some authorities. One drachm of the powdered drug suspended in water, or five or ten grains of koossin in capsule, are the proper doses for a child of eight years. To prevent nausea, it is better to break the dose into two or four; additional purgation is usually not required.

After administering any anthelmintic, it is impossible to decide at once whether the tape-worm has been eradicated or not unless the head be discovered in the stools. The physician must not trust to the mother or nurse to find the head, but must look for it himself. The stools immediately following the action of the parasiticide must, therefore, be preserved until his visit; the chamber in which they are received being filled with water containing a small quantity of carbolic or salicylic acid. This is to be gently shaken in order to separate the worm from the fæces, and then allowed to stand for ten minutes; during which the parasite, from its

greater specific gravity, sinks to the bottom of the vessel. Next, the supernatant liquid is poured off, the vessel refilled with water, and the process repeated until the fluid remains nearly colorless. Then the head, if present, is readily found. Should the head not be discovered, it is impossible, although all symptoms may disappear, to give a positive opinion as to complete expulsion until two or three months have passed. Any return of symptoms requires a second course of treatment.

Second: The removal of the alkaline mucus and the restoration of the normal condition of the alimentary canal are to be accomplished by the same attention to diet and the same therapeutic measures recommended when discussing chronic gastro-intestinal catarrh (p. 261 *et seq.*).

CHAPTER IV.

TUBERCULOSIS OF THE MESENTERIC GLANDS AND INTESTINES.

Tuberculosis of the mesenteric glands, and of the intestines, may occur as an element of the disseminated disease, may be secondary to tuberculous deposits in other parts of the body, or may be primary, the bacilli finding entrance into the system in contaminated food—usually milk from tuberculous cows.

TUBERCULOSIS OF THE MESENTERIC GLANDS. (TABES MESENTERICA.)

In this condition the glands of the mesentery, of the gastro-hepatic omentum, and the retro-peritoneal glands situated along the aorta are involved. It is a common form of the disease in childhood; "thus, of 127 cases of fatal tuberculosis in children, noted by Woodhead, these structures were involved in 100, while Ashby states that of 103 consecutive post-mortems on children dying of tuberculosis, in 62 there was tuberculous ulceration of the intestines; in 71, cheesy mesenteric glands; in 55, both ulcers and cheesy glands; in 7, tuberculous ulcers without involvement of the glands; and in 16, cheesy glands without ulcers."*

The infection may be limited to a few of the glands, it may be merely an item in a chronic generalized tuberculosis, or it may be associated with ulceration of the intestines or involve-

* Osler, "American Text-book of the Diseases of Children."

ment of the peritoneum; in the latter case it is most productive of characteristic symptoms. The majority of cases occur after the third year.

Etiology.—The predisposing causes are the same as those usually favoring tuberculous infection.

Children who live in filthy, overcrowded, dark, and ill-ventilated houses are much more likely to be affected than those born to more fortunate surroundings; coarse, over-stimulating, or bad food is also potent for evil, by irritating the intestinal mucous membrane and producing catarrh and follicular ulceration.

Tuberculous disease of the lungs, of the cervical and bronchial glands, or of the bones and joints, and tuberculous ulceration of the bowels, are usual associates, and frequently predispose to the development of tabes mesenterica. In addition, measles and scarlet fever, from their tendency to induce inflammation of the mucous membrane of the bowels and glandular hyperæmia, must be ranked as predisposing agents, and so, also, must whooping-cough.

The essential cause is now recognized to be the bacillus tuberculosis.

Symptoms.—The signs elicited by physical exploration of the abdomen, and the symptoms arising from the presence of a mass of enlarged, tuberculous glands, are much more characteristic than the general features. The shape of the belly and the tension of its walls may be perfectly normal. Such is generally the condition during the earlier stages of the disease; later, and particularly when there is intestinal ulceration, there is considerable distention. This is due either to the accumulation of flatus in the bowel or to the large size of the glandular tumor. In the first instance, the degree of prominence varies from day to day; when marked, the wall is tense, percussion is tympanitic, and it is difficult or impossible to grasp the glands; in the second, the enlargement is

constant and greatest in and about the umbilical region; here there is resistance to the palpating hand rather than tension; the tumor is easily felt, and percussion over it gives a dull sound; around it, a tympanitic one. The tumor varies in size from that of a hen's egg to that of a double fist; it is nodulated, hard, somewhat tender, slightly movable when small, and fixed when large. When of considerable size, the mass can readily be touched by placing the fingers on the umbilical region and pressing backward toward the spine. Otherwise, it is well to put one hand on each side of the abdomen and gently bring them together toward the median line, the patient being placed on his back with his shoulders and thighs elevated so as to relax the parietes. By this method it is possible to detect a tumor as small as a walnut.

The secondary manifestations of the presence of a large mass of glands in the abdominal cavity are pains and cramps in the legs, due to pressure upon the nerves; and œdema of the legs and distention of the superficial abdominal veins, from compression of the great venous trunks. The veins are often very prominent, and ramify over the wall of the belly to join those of the thoracic wall, which are also distended.

If the glands in the notch of the liver be enlarged, direct pressure is exerted upon the portal vein, and ascites results; this, however, is a very unusual symptom.

In some instances the glands shrink and become calcareous. This change lessens the size of the tumor, diminishes the tension of the parietes, and, by relieving pressure, leads to the disappearance of the secondary derangements.

Softening is another, but, fortunately, a rare termination. Adhesion may then take place between the gland and a loop of intestine, so that the softened matter is evacuated into the bowel without harmful result; but should the discharge be directly into the peritoneal cavity, acute peritonitis is set up, and death soon follows.

The general symptoms depend for their development upon the condition of the intestinal mucous membrane. Usually there is tuberculous ulceration, with or without general catarrh.

If ulceration and catarrh be associated, the child wastes; grows pale and feeble; presents a haggard appearance; is fretful and peevish; has a capricious appetite and much thirst; complains of wandering pains in the abdomen, and is affected with diarrhœa, attended by the expulsion of offensive, dark, watery stools, which, on standing, deposit flaky matter, mucus, and small, black blood clots. Sleep is restless, and at night the temperature rises one or more degrees above normal.

When catarrh is absent, the bowels are often constipated; the patient looks ill; is pale and languid; his muscles are flabby, and he has more or less flatulent pain in the belly; but there is no marked wasting and none of the evidences of great impairment of general nutrition.

Should there be no disease of the mucous lining of the bowels, flesh is retained; the spirits and strength are good; the appetite and bowels are undisturbed; the temperature is normal and there is nothing to show ill health save some pallor of the skin.

Diagnosis.—The only positive proof of the existence of tabes mesenterica is the detection, by palpation, of a glandular tumor. Particular caution must be given against the mistake, so frequently made, of attributing every case of abdominal distention to disease of the mesenteric glands. Prominence of the belly is a frequent symptom in children, and in the vast majority of cases depends upon intestinal catarrh. In this condition there is imperfect digestion and assimilation of food, and, consequently, debility, affecting the muscles of the intestines as well as the system generally. Now, imperfectly digested food readily undergoes fermentation, with the production of flatus, and this distends the bowels; the more so

as they are wanting in tone from the weakness of their muscular coat. Such inflation of the gut must lead, of course, to a prominent abdomen, but one which is uniformly tympanitic on percussion, moderately soft and flaccid to the touch, and entirely free from the signs of enlargement of the mesenteric glands.

Again, distention of the superficial abdominal veins is merely an indication of obstructed circulation in the deep venous trunks, and only becomes a symptom of importance in the diagnosis of tabes mesenterica when hepatic disease can be excluded.

Even should a tumor be felt, the question arises whether it may not be an accumulation of fæces. In the latter there is no tenderness; the mass occupies the position of the transverse or descending colon, is oblong in shape, with its long diameter corresponding to the axis of the gut in which it is placed, and is so soft that it may be somewhat moulded by the pressure of the fingers. Should there be any doubt, an enema of warm normal saline solution must be thrown into the bowel and retained for a few moments, by firm pressure upon the anus. When expelled, this will bring away a quantity of light-colored, brittle matter, if the mass be due to fæcal accumulation; and the previously detected tumor will be found, on examination, to have disappeared or lessened in size. On the other hand, if the tumor be glandular, the expulsion of flatus and fæces, induced by the injection, only renders it still more prominent.

The diagnosis must not be considered completed by the detection of the tumor, but must extend to the discovery or elimination of the different complications—ulceration of the intestines, tuberculous deposits in the lungs, and tuberculous peritonitis.

Prognosis.—Tuberculosis of the mesenteric glands is dangerous, but the danger does not spring from the gland-

ular disease so much as from the conditions that precede and accompany it.

When the sole discoverable lesion is swelling of the glands, and there is no rise in the evening temperature nor marked impairment of nutrition, the hope of subsidence of the enlargement and ultimate recovery, may be reasonably entertained. On the contrary, if there be wasting, diarrhœa, and fever, indicating ulceration of the bowels, secondary, perhaps, to chronic disease of the lungs, the prognosis must be grave. Again, the occurrence of tuberculous peritonitis renders the prospect most unfavorable.

Treatment.—Much may be done in the direction of prophylaxis by keeping a strict watch upon the stomach and intestines in children having a tendency to tuberculosis, so as to remove any apparently trifling disorder as quickly as possible. Supplying good food, fresh, pure air, and warm clothing, and maintaining the activity of the skin are also important preventive measures.

After the disease is established, much can be accomplished by attention to the diet and general regimen. In regulating the diet, it is necessary to take into consideration the catarrhal state of the intestinal mucous membrane usually present, and the almost useless condition of, at least, a number of the mesenteric glands, and to select those articles which are absorbed in the stomach or taken directly into the blood-vessels, without the intermediate action of the lacteals and mesenteric glands. The food must be sufficient to maintain the general strength, but not so abundant as to overtax the process of digestion. The following may be taken as an average daily schedule of both diet and regimen for a child of four years, in whom there is no excessive wasting or weakness :

On waking in the morning, say at 7 A. M., a thin slice of dry, stale bread, and three fluidounces of hot chicken-, mutton-, or veal-broth.

At 8.30 A. M. a cold bath, given in this manner: Being taken from bed, the whole body is briskly shampooed with a soft towel until the surface is aglow. The child is next made to stand in a tub sufficiently filled with hot water to cover his feet and ankles, and two gallons of cold water, containing an ounce of sea-salt or concentrated sea-water, are slowly poured over his shoulders. The skin is then thoroughly dried and rubbed until reaction is established; the child is wrapped in a blanket and put back to bed for half an hour. On rising, the abdomen should be completely enveloped in a flannel binder, and the body clad in woolen underclothing from head to foot.

At 9.30 A. M., breakfast.—A soft-boiled egg and two slices of stale bread.

From 10.30 A. M. to 12 M.—A walk or romp in the open air, in good weather.

At 12 M., lunch.—Six raw oysters or a bit of sweetbread or fish, and a slice of dry, stale bread.

At 3 P. M., dinner.—Six fluidounces of beef-, mutton-, or chicken-broth; a bit of minced roast beef, beef-steak, roast mutton, chicken, or wild fowl. A moderate quantity of purée of spinach, stewed celery, boiled cauliflower, or other non-farinaceous vegetable, and one or two slices of dry, stale bread. No dessert except junket occasionally.

At 7 P. M., supper.—Same as lunch, alternating the fish, sweetbread, or oysters.

Nothing should be taken for drink but filtered water or, better still, good spring-water.*

When there is much emaciation and weakness, the morning bath must be omitted or substituted by a simple warm sponging; and some stimulant, as a teaspoonful of old whiskey, should be given three times daily.

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* Directions for Philadelphia.

Diarrhœa demands an exclusive liquid diet, and it is advisable to artificially digest the meat broths and milk, which must form the basis of this.

The most useful drugs are cod-liver oil, syrup of hydriodic acid, and the syrup of the iodide of iron, since the indications are to build up the general health and restore the glands to a healthy condition. The former can be given as an emulsion with lactophosphate of lime in two-drachm doses three times daily, after eating, at the age of four years ; either of the latter in fifteen-drop doses after meals.

Locally, some good may result from the daily inunction of a weak mercurial or iodine ointment ; for example :

℞. Ung. iodi comp., ... ℥ij
Ung. belladonnæ, ... ℥j
Ung. aquæ rosæ, ... ℥v. M.

Or—

℞. Ung. hydrargyri, ... ℥iij
Adipis, ... ℥v. M.

Of either, a piece as large as a cherry may be rubbed into the skin over the tumor once every day.

Other remedies, of course, are required to arrest diarrhœa, or to relieve the different complications that may arise.

Should the circumstances of the patient permit, change of residence to some locality having an equable climate, a bracing atmosphere, and a dry, porous soil, will greatly assist in effecting a cure.

TUBERCULOSIS OF THE INTESTINES.

Tuberculosis of the intestines may occur as a primary affection, but in the majority of instances it is a part of a general infection, and secondary in character. The lesions are chiefly confined to the ileum, and primarily affect the solitary follicles

and Peyer's patches, particularly those about the ileo-cæcal valve. The follicles become enlarged from tuberculous infiltration, then undergo caseous degeneration and softening, with the formation of isolated ulcers in the case of the solitary glands, and clusters of coalescing ulcers in that of the patches of Peyer. From having, at first, the shape of the follicles and patches, they gradually extend by a similar process of corpuscular infiltration, caseation, and softening in the surrounding tissues. The fully formed ulcers are irregularly oval in shape, with their greatest diameter directed transversely to the axis of the gut; their edges are indented, thick, and somewhat undermined; their floors are red or gray, and formed by one or the other tissue of the intestine, as far down as the peritoneum, according to the depth of destruction. Perforation is rare on account of localized adhesive peritonitis. Tubercles may be found in the tunica adventitia of the small arteries and lymphatics, or on the reddened and cloudy peritoneal surface corrésponding to the ulcers. Cicatrization takes place rarely, but may be the cause of stricture.

The uninvolved mucous membrane is congested, thickened, and softened. The mesenteric glands are enlarged and cheesy, and miliary tubercles are usually found in the lungs or elsewhere.

Etiology.—The disease is met with in children who have passed the fourth year, and in whom the tuberculous diathesis exists. Bad hygiene, bad food, and exposure act as predisposing causes, by interfering with general nutrition and paving the way for the development of accidentally introduced bacilli. An unsuitable diet, too, may indirectly lead to this form of ulceration, by bringing about an abnormal and more susceptible condition of the lining membrane of the bowel.

Symptoms.—In addition to the features indicating a tuberculous tendency, the child, after suffering for a variable time from the symptoms of simple intestinal catarrh with either

constipation or diarrhœa, begins to have fever and to pass excessively offensive stools, composed of dirty-brown liquid that, on standing, deposits flocculi, mucus, pus, and small black clots of blood, and which a microscopic examination shows to contain tubercle bacilli. There is colic preceding the evacuations ; moderate distention of the belly, with at times tension of the parietes over the right iliac region, and tenderness on pressure there. Abdominal palpation may reveal enlargement of the mesenteric glands, and physical examination of the chest the evidences of pulmonary phthisis. Such cases usually result fatally, after a more or less protracted course, the direct causes of death being tuberculosis of the lungs or of the meninges of the brain.

Treatment.—Pure air, warm clothing, good food, and tonics comprise the measures of treatment. The best of the tonics is cod-liver oil, which, in these cases, often seems to lessen the tendency to diarrhœa. Half to one teaspoonful three times daily is quite enough for a child of five years. It may be given combined with maltine, or in an emulsion with lacto-phosphate of lime, or the compound syrup of the hypophosphites. The following is an admirable formula :

℞. Olei morrhuæ, ... f ℥ ij
Ext. malt (dry), ... ℥ iv
Calcii hypophos.,
Sodii hypophos., ... āā gr. xvj
Potassii hypophos., ... gr. viij
Glycerini, ... f ℥ ij
Pulv. acaciæ, ... ℥ ij
Aquæ, ... q. s. ad f ℥ iv. M.

Sig.—One teaspoonful three times daily.

Creasote is also a useful remedy, beginning with doses of one minim three times daily and gradually increasing each dose to five or even ten minims ; it may be administered in a mixture or in the form of a pill or perle.

In addition to this general treatment, attention must be paid

to the intestinal condition. A dressing of cotton, covered with oiled-silk, should be placed over the right iliac region or over the whole abdomen. Internally, subcarbonate of bismuth with compound ipecacuanha powder, nitrate of silver, and intestinal antiseptics are of service, and, if there be severe abdominal pain, enemata containing laudanum may be employed.

CHAPTER V.

AFFECTIONS OF THE LIVER.

Hepatic diseases do not occur so frequently during childhood as in adult life. Fatty and amyloid changes are the most common affections; syphilitic disease, cirrhosis, tuberculous deposit, and parenchymatous inflammation stand next in the order named; while echinococcus is very rare, and cancer almost unknown. Jaundice, on the contrary, is often met with, but this condition, though a complex and striking one, is simply an indication of disease of the viscus itself, or of its excretory duct. Congestion of the organ is also common.

JAUNDICE.

Icterus, irrespective of the age at which it occurs, is characterized by yellowness of the skin and conjunctivæ, clay-colored stools, and yellow-brown urine. During the first few days of life, especially after a difficult and tedious birth, there is apt to be intense congestion of the skin, followed, as the redness fades, by a brownish-yellow discoloration. This appears on the second or third day, and disappears by the tenth.

It is not jaundice, for it is entirely independent of liver disorder, and there is no yellowness of the conjunctivæ, and no alteration in the fæces or urine. A form of true jaundice, however, does occur in the newborn, termed icterus neonatorum, which may be studied before describing the condition as it is seen in later childhood.

ICTERUS NEONATORUM.

Both mild and dangerous types of this variety of jaundice are met with.

The mild type occurs in infants prematurely born, or weak from other causes ; in those early exposed to the depressing action of cold, dampness, and foul air, and particularly in those who are born partly asphyxiated after tedious labor. It is difficult to understand the exact method in which these causes act. Cold undoubtedly produces catarrh of the duodenal mucous membrane, and plugging of the bile-duct by mucus ; the others, the last especially, act, in all probability, by altering the hepatic circulation. At birth there is a sudden transference of the blood supply from the umbilical to the portal vein, a change—according to Frerichs—temporarily followed by comparative emptiness of the blood-vessels of the liver, a diminution of vascular tension, and the passage of bile into the blood. Weber attributes the jaundice to pressure from congestion and œdema, the result of an arrest of the circulation in the umbilical vein before the establishment of respiration—conditions present in infants born semi-asphyxiated. Birch-Hirschfeld has demonstrated that a dense areolar sheath surrounds the vessels in the notch of the liver and extends into the viscus along with the portal vein ; this becomes œdematous and greatly swollen when there is venous obstruction in the liver during difficult parturition, and, by pressure, obstructs the flow of bile into the intestine.

The grade of jaundice in this type varies considerably. Sometimes the yellow discoloration is confined to the face, chest, and back ; the conjunctivæ are but lightly tinged ; the urine and fæces are unaltered, and after three or four days the trouble is at an end. In other cases, the yellowness extends to the abdomen and arms ; the conjunctivæ are distinctly yellow ; the urine is dark and stains the diapers, but

the stools still retain their natural color—golden yellow; the duration is about seven days. The best-developed instances present universal and moderately deep discoloration of the skin; the conjunctivæ are very yellow; the urine brownish, and the stools clay-colored. With this degree of jaundice there is malaise, loss of appetite, constipation, and enlargement of the liver; the lower edge of the right lobe often extending below the costal border as far as the umbilicus.

Occasionally, instead of constipation, there is diarrhœa, with moderate heat and tenderness of the belly, and a quick pulse, indicating severe intestinal catarrh. These cases recover after a fortnight or more, though occasionally diarrhœa arising and persisting in a feeble infant, is sufficient to determine a fatal issue.

The **treatment** is simple. The infant must be kept in a warm, well-ventilated room; the activity of the skin must be maintained by bathing, and chilling prevented by proper clothing. Constipation is to be relieved by fifteen or twenty drops of castor-oil, a soap suppository, or an enema, and, if the skin be slow in resuming its normal color, it is well to prescribe an alkali, as:

℞. Sodii bicarbonatis, ... gr. xxxij
Aq. menth. pip.,
Syrupi, ... āā f℥ss
Aquæ, ... q. s. ad f℥ij. M.
Sig.—One teaspoonful three times daily.

The grave type depends upon congenital malformation of the bile-ducts and gall-bladder, compression of the bile-ducts by syphilitic inflammation and growths, and umbilical arteritis and phlebitis.

(*a*) Congenital malformation is rare, but when it occurs is liable to affect several members of the same family in succession; boys suffer twice as often as girls. There are a number of varieties: thus, the gall-duct may be converted into a

fibrous cord; the ductus communis may be contracted, obliterated, or absent; the gall-bladder may be rudimentary and the ducts absent; or all the ducts may be wanting. Whatever the condition, the result is enlargement of the liver with cirrhotic change, more or less marked in proportion to the duration of life. The organ is dark green or almost black in color, feels unnaturally firm to the touch, and under the microscope shows an excess of connective tissue.

From one to two weeks after birth the retained bile begins to give rise to jaundice; this appears as a slight yellowness of the skin, and steadily grows more distinct, though it varies considerably in intensity from day to day; at the same time, the conjunctivæ are stained and the urine dark-colored. After a day or two, the liver begins to encroach upon the abdominal cavity and rapidly enlarges; the spleen, too, increases in size, and these two lesions, together with flatulent distention of the bowels and occasional ascites, produce decided prominence of the belly. In spite of a uniformly good appetite, there is constant wasting. The bowels act sluggishly, the fæces are offensive, clay-colored, or dark green, from the presence of altered blood, and dilated hemorrhoidal veins can often be seen by inspecting the anus. Another frequent symptom is oozing of blood, either arterial or venous, from the umbilicus. This hemorrhage is capillary in nature, and usually begins at night, and soon after the fall of the navel string, an event that occurs between the fifth and ninth day. It may be combined with bleeding from the nose, mouth, stomach, or bowels, and is exhausting and always difficult to control.

This form of jaundice ends in death. When umbilical hemorrhage occurs, the course is short, varying from a few hours to six or seven days; in other cases, life may be prolonged as many months, and death result from some intercurrent disease. In the latter class, the secreting elements of

the liver are so far crippled by the constantly progressing cirrhosis that little bile is formed, and the yellowness of the surface fades, or almost entirely disappears, before life ends.

(*b*) Syphilitic inflammation of the liver with its lesions and symptoms will be referred to in another place (see page 401).

(*c*) Inflammation of the umbilical blood-vessels is due to septic infection entering at the umbilical wound. The infecting agent is apparently identical with that producing puerperal fever in the mother, the same pyogenic germs frequently having been discovered in the blood of infants so affected. In consequence, the liver undergoes marked degenerative changes; the connective tissue about the portal vein and its branches becomes swollen and presses upon the bile-ducts, and from this, as well as from alterations in the crasis of the blood, jaundice results.

Discoloration of the skin makes its appearance a few days after birth and rapidly increases; the urine is very dark, and the stools are scanty and passed at long intervals. The face is livid and pinched; the hands and feet are purple; petechiæ appear under the skin; the abdomen is distended by flatus and by enlargement of the liver and spleen; there is tenderness with fluctuation on palpation, and blood or bloody pus exudes from the umbilicus. The tongue is dry, there is little appetite, and the stomach rejects what food is taken, together with quantities of greenish mucus. Pyrexia is noticeable from the beginning, and becomes more marked as the disease progresses; the pulse is quick and the breathing hurried.

The course is always short, and the invariably fatal termination may be preceded by convulsions and coma.

Treatment in either variety is most unsatisfactory; little can be done beyond the employment of measures to maintain the vital forces as long as possible. Umbilical hemorrhage may be arrested by the application of Monsel's solution, or, if this fail, by inserting two hare-lip pins through the skin at

the root of the navel and twisting a ligature tightly around them in the form of a figure of eight.

Syphilitic inflammation demands appropriate constitutional remedies, and in pyæmic cases the abdominal tenderness must be relieved by warm fomentations and sedative applications.

ICTERUS IN OLDER CHILDREN.

Jaundice in late infancy and childhood usually depends upon catarrh, extending from the mucous membrane of the duodenum into the ductus communis; sometimes it is due to plugging of the duct by inspissated bile; and, again, to occlusion by the entrance of a lumbricoid worm. Certain structural lesions of the liver, poisoning by phosphorus, and miasmatic influences also produce it.

Catarrhal jaundice—the only form necessary to consider in this connection—presents the features so common to, and so characteristic of, the same condition in adults. Briefly stated, there is more or less yellow or brownish-yellow discoloration of the skin, with troublesome itching, yellowness of the conjunctivæ, porter-like urine, and clay-colored stools, devoid of the natural fæcal odor. Other symptoms are anorexia, craving for acid drinks, a yellow-furred tongue, disordered digestion, listlessness, slowness of the pulse, slight reduction of the surface temperature, and disturbed sleep. The liver may be somewhat enlarged, projecting two inches or more below the costal border, and tender, or even painful, on pressure. The result is always favorable, and the duration rarely longer than two or three weeks.

Treatment.—Warm clothing, daily bathing followed by gentle friction to promote the activity of the skin, and a diet based on the same plan as for intestinal catarrh, are the first requisites.

The medicinal treatment can be begun by a moderate dose of calomel, followed by a saline; but if a laxative be required

later, the drugs that stimulate the secretion of the liver and act upon the upper bowel must be excluded, and those selected which affect the lower segment, as aloës and castor oil.

Duodenal catarrh—the causal factor—is most speedily removed by alkalies. Four fluidounces of some saline water, as Kissingen or Vichy, should be drunk at each meal, and the following mixture taken :

℞. Ammonii chloridi, ... ℥ij
Aq. menth. pip., ... f℥iij. M.
Sig.—One teaspoonful, diluted, three times daily after meals, for a child six years old.

Or—

℞. Sodii phosphatis, ... ℥j
Ext. pancreatis (Fairchild's), ... gr. xxiv
Pulv. rhei, ... gr. vj.
M. et ft. chart. No. xij.
Sig.—One, suspended in water, three times daily after food.

Nux vomica is also useful, and two or three drops of the tincture may be administered thrice daily before eating.

CONGESTION OF THE LIVER.

Congestion of the liver may occur as an active or passive condition, and is most frequent in children of four years of age and upward.

Morbid Anatomy.—There is an increase in the size, weight, and density of the organ, and its peritoneum is tense and shining. On incision, blood flows freely, and the section presents a mottled or "nutmeg" appearance, partly from dilatation of the intralobular veins and partly from staining of the cells by retained bile. In long-standing cases, those due to cardiac disease, for example, the cells in immediate proximity to the dilated intralobular veins atrophy; those near them are stained with bile, and those most distant undergo

fatty degeneration. In time the atrophied cells disappear; their place is taken by connective tissue, which shrinks and produces a cirrhotic condition, the surface of the liver becoming granular and the capsule thickened.

Etiology.—Even in health the amount of blood in the hepatic vessels varies from time to time, and there is always a temporary increase during the process of digestion. This normal hyperæmia readily becomes abnormal and continuous —active congestion—when there is habitual overfeeding; when the food is highly spiced and too stimulating; and when insufficient exercise is taken. Congestion is often produced by chills, whether resulting from exposure to cold or from the poison of malarial fever, since, in either case, the blood is driven from the surface to the interior of the body. Cardiac and pulmonary disease, by obstructing the return of blood from the lung and overfilling the vena cava and portal vein, are the chief causes of passive congestion. This condition also results from chronic malarial poisoning.

Symptoms.—In active congestion the skin is sallow, or, together with the conjunctivæ, distinctly, but not intensely, jaundiced. There is malaise, headache, yellow furring of the tongue, anorexia, nausea, relaxed bowels with clay-colored, offensive stools, and dark-colored urine loaded with lithates. Pain in the right hypochondrium is usually present, and, as this is increased by turning upon either side, the patient maintains a dorsal position; there is also tenderness in this region, and the suffering is increased by coughing or deep breathing. On palpation, the right lobe of the liver can be detected, extending two or three inches beyond the costal border, while sometimes at its edge is felt the gall-bladder distended into a pyriform tumor of variable size. At the same time the upper limit of percussion dulness begins in the third interspace, or at the level of the third rib, instead of the fourth interspace, as in health.

In passive congestion the hepatic symptoms are associated with albuminuria and œdema of the feet and legs, and are often marked by the features of the causal conditions.

Diagnosis.—Many instances of disordered digestion, with the expulsion of putty-like, undigested material from the bowels, are attributed to congestion of the liver, when in reality the gastro-intestinal tract alone is at fault. Such a mistake can be avoided, if it be remembered that to establish the existence of the hepatic disease it is necessary to have enlargement of the organ, with pain and tenderness, jaundice and clay-colored, offensive stools, combined with disturbance of the functions of the stomach and intestines.

Extension of the liver a finger's breadth or more below the costal border does not absolutely indicate enlargement, since this often occurs without disease, in short-chested children, and in those whose chests are contracted and deeply grooved by rickets. Downward displacement and apparent enlargement may also be caused by pleuritic and pericardial effusions, and by emphysema of the lungs. On the other hand, an enlarged liver may be completely under cover of the ribs, for, in addition to being normally high in the thorax, it may be pushed upon by a collection of fluid or a growth in the abdominal cavity, or drawn up through the shrinking of a collapsed or indurated lung. It is essential, therefore, to fix the position of the upper limit by percussion, as well as the lower edge by palpation, before forming a conclusion.

Prognosis.—The course of the active form is short, and there is no danger unless the child be greatly reduced by previous ill health. In passive congestion the duration and result correspond to, and depend upon, the gravity of the determining lesion.

Treatment.—In acute cases the child may be put to bed, or, if not ill enough to be so confined, should be kept within doors. The abdomen must be protected by a flannel

binder or a layer of cotton batting covered with oiled silk, and the skin kept active by a daily warm bath, administered, in walking cases, just before retiring to bed. Too much food of any kind is bad; meat and highly seasoned dishes are to be excluded from the diet; and it is best not to extend the list beyond milk, mutton- or veal-broth, fish, bread, and plain light puddings, as rice and milk.

In the beginning, a child of six or eight years should get the following powder:

℞. Hydrargyri chlorid. mit., ... gr. ij
Pulv. ipecacuanhæ, ... gr. ss
Sacchari, ... gr. v.
M. et ft. chart. No. j.
Sig.—To be taken in the evening and followed, next morning, by a teaspoonful of magnesia.

Subsequently, five grains of chloride of ammonium or phosphate of sodium should be given after food, and a small tumbler (five fluidounces) of Vichy taken with each meal.

Aloës and the salines are the best remedies to relieve constipation during the course of the attack. When convalescence is established, regular exercise in the open air must be insisted upon and a plain diet maintained. Change of air is often most useful to break up the "bilious habit."

In passive cases, treatment must be directed chiefly to the producing disease of the heart or lungs; when chronic malarial poisoning is the etiological factor, antiperiodics are of little avail until the hepatic congestion is relieved.

FATTY LIVER.

Enlargement of the liver due to fatty infiltration or degeneration is usually a secondary condition in childhood.

Morbid Anatomy.—The liver is increased in all its dimensions, its surface is yellowish and oily, its margins rounded,

and its texture doughy. On section, the cut surface is distinctly yellow, mottled with brownish-red spots, and if a bit be put under the microscope, abundant granules and globules of fat are seen.

Etiology.—One cause of fatty liver is an excess of farinaceous food. Then the deposition is physiological and transitory, the excess of carbohydrates supplied from without being deposited in the liver in the form of fat. The second cause is chronic, exhausting disease, such as tubercle, rickets, caries of bone, intestinal catarrh, and syphilis. Here the fat is absorbed from the subcutaneous and other fat-containing tissues of the body. The lesion may also be produced by acute affections, as measles, variola, scarlatina, and typhoid fever, and by accidental poisoning with arsenic or phosphorus.

Symptoms.—It is only in well-marked cases that special features are developed. An increase in the bulk of the liver, with a rounded inferior margin, may be detected by percussion and palpation; but this is frequently impossible on account of the tendency the organ has, from its softness, to fall away from the abdominal wall. There is a sense of weight in the right hypochondriac region and disturbed gastro-intestinal function due to portal obstruction. Jaundice and ascites are absent, and there is neither pain nor tenderness over the viscus.

The **diagnosis** is not difficult when enlargement, softness, and blunting of the edge of the viscus can be detected by examination.

The **prognosis** depends upon the cause rather than the degree of change; occurring in the course of a protracted, wasting disease, fatty infiltration shows dangerous impairment of nutrition. When fatty degeneration of the viscus is produced by acute affections or by accidental poisoning, the result is invariably unfavorable.

Treatment.—Beyond a rigid exclusion of farinaceous and fatty foods from the dietary, all remedies must be directed to the relief of the originating disease.

AMYLOID LIVER.

Amyloid degeneration of the liver is moderately common in childhood, usually constituting a part of a widespread degenerative change affecting several of the abdominal viscera.

Morbid Anatomy.—The disease consists in a more or less complete infiltration of the cells by a peculiar translucent, refracting substance, possessing the property of fixing iodine and assuming a mahogany-brown color, which, on the application of sulphuric acid, changes to green, blue, violet, or red. The infiltration begins in the hepatic arterioles and capillaries, and at first is limited to the middle zone of the lobules; thence it extends to the periphery and centre, destroying the normal elements of the cells and converting them into irregularly shaped, glassy-looking blocks. Fatty infiltration is often associated. Uniform enlargement; increased density; yellowish-gray color; smooth, shining peritoneum; thin edges, and the exposure, on section, of dry, homogeneous, glistening surfaces, are the gross characteristics.

The spleen, kidneys and lymphatic glands are often similarly altered, and sometimes the mucous membrane of the stomach and intestines.

Etiology.—Amyloid degeneration of the liver is always produced by some chronic disease attended by suppuration and purulent discharge. Empyema with a fistulous opening in the chest-wall; dilated bronchi with copious muco-purulent expectoration; tuberculous abscess; chronic pulmonary tuberculosis; suppurative diseases of the bones and joints, and constitutional syphilis, are the most frequent causes. It occurs

at any age, but is more frequent after the fifth year, and in boys than girls.

Symptoms.—There are few rational symptoms other than those belonging to the originating disease. Tenderness and pain in the hepatic region are absent, and so, too, are jaundice, distention of the superficial abdominal veins, and ascites; unless the glands in the fissure of the liver be coincidently enlarged by waxy deposit, when, from pressure upon the portal vein and bile-ducts, the last three phenomena may be developed. The patient complains of weight, discomfort in the right hypochondrium, and is weak, wasted, and anæmic, with pale, sallow skin, clubbed fingers, and œdematous feet and ankles. When the kidneys are involved, the urine is increased in quantity, has a low specific gravity (about 1.014), is pale, lemon-colored, and contains albumin, and, at times, hyaline tube-casts. Dropsy of the extremities is due in great part to this complication. If the stomach and intestines be implicated, there is a tendency to vomiting and diarrhœa.

Physical examination yields very characteristic signs. The abdomen is prominent, especially over the upper third, and both percussion and palpation show that the liver is greatly and uniformly enlarged. The upper margin of dulness is higher, by an inch or more, than normal; while the lower edge of the right lobe, somewhat blunted, but perfectly well defined, can often be felt as low down as the level of the umbilicus. The portion uncovered by the ribs feels very dense and firm, and perfectly smooth, except where broken by the natural fissures.

The spleen can often be detected projecting as a hard mass from beneath the left costal border. The absence of enlargement, however, is no proof against the existence of amyloid change in the organ; in about half the cases there is no alteration in size.

In course, the disease is always slow.

Diagnosis.—This is readily made from the physical signs furnished by the liver and spleen; the absence of jaundice and ascites; the previous history of cachexia and suppuration; the character of the urine; the anæmia, and the gastro-intestinal symptoms.

Congestion of the liver with consequent enlargement has a different clinical history, rarely occurring in cachectic or anæmic cases. A fatty liver, while large, is soft and yielding to the touch, and is unattended by albuminuria or by increase in the size of the spleen.

Prognosis.—The prospect of ultimate recovery is better in children than in adults, for, provided the cause of the degeneration can be removed, it is quite possible for the liver to return to its natural dimensions and to an apparently healthy condition, through the active reparative power always present in early life. Nevertheless, amyloid change in the liver adds greatly to the danger of the originating disease, and is fatal in most cases.

Treatment.—It is almost needless to state that attention must first be given to the removal or amelioration of the cause. It is much more difficult to cure the disease when once developed, than to prevent it by checking chronic suppuration, removing carious bone, healing diseased joints, energetically treating constitutional syphilis, and building up the health in cachectic subjects.

To combat the disease itself, the diet must be as nutritious as the activity of digestion will permit; a moderate quantity of alcoholic stimulants must be taken daily; the child must be properly clothed, to prevent chilling, and must live as much as possible in the sunlight and open air, or, if confined to the house, in a light, airy room. Alkalies, iron, and iodine are the most useful drugs.

Of alkalies, chloride of ammonium is the best, and it may be given in combination with a bitter, as:

℞. Ammonii chloridi, ... ℥ij
Inf. gentianæ comp., ... f℥iij. M.
SIG.—One teaspoonful four times daily at the age of six years.

It is often well to combine iron with the ammonia salt, for example :

℞. Tr. ferri chloridi, ... f℥j
Ammonii chloridi, ... ℥ij
Inf. calumbæ, ... q. s. ad f℥iij. M.
SIG.—One teaspoonful three times daily.

Another good way of administering iron is in the form of a modified Basham's mixture :

℞. Tr. ferri chloridi, ... f℥j
Acid. acetici dil., ... f℥iss
Liq. ammonii acetatis, ... f℥x
Elix. aurantii, ... f℥v
Syrupi, ... f℥j
Aquæ, ... q. s. ad f℥vj. M.
SIG.—One tablespoonful four times a day.

This formula is particularly useful when there is kidney complication with œdema.

Iodine is most efficient if there be a syphilitic taint ; it may be given in the form of iodide of potassium, five grains or more three times a day, with a bitter infusion ; or syrup of hydriodic acid can be employed in doses of fifteen to thirty drops, diluted, thrice daily.

Complications must be met as they arise. Vomiting, by creasote, bismuth, and counter-irritation to the epigastrium ; diarrhœa, by astringents, with small doses of opium ; and dropsy, by diaphoretics and diuretics.

SYPHILITIC INFLAMMATION OF THE LIVER.

Syphilitic hepatitis is frequently encountered in the newborn, though rare in more advanced childhood.

Morbid Anatomy.—The liver may be the seat of acute

swelling, which, without showing marked gross alteration, is associated with a diffused growth of connective-tissue elements; again, there may be a localized gummatous change; and, finally, the inflammatory process may be confined to the septa—peripylephlebitis syphilitica. The proliferation of connective tissue takes place both between the hepatic islands and in their interior, thus differing from cirrhosis, where the increase is only between the lobules. When jaundice occurs, the small bile-ducts are thickened and occluded by epithelial cells, and the organ is enlarged, and brownish-yellow in color.

Symptoms.—In mild cases these are few and uncharacteristic; in those that are grave there are jaundice, ascites, hemorrhage from the umbilicus and intestines, ecchymosis of the skin, subnormal temperature, rapid wasting, and often syphilitic lesions of the skin and mucous membranes. On abdominal exploration, the liver is found to be enlarged and hard, and the spleen increased in size.

Diagnosis.—The early age, the history of an inherited taint, the association of enlargement of the liver with jaundice and ascites, make this a matter of little difficulty in cases that are at all marked.

Prognosis is unfavorable, though the opinion must rest upon the degree of cachexia. Goodhart states that all of his cases proved remarkably amenable to mercurial treatment, but this does not correspond with the experience of other observers.

Should deep jaundice, ascites, and hemorrhage occur, death is the almost invariable end.

Treatment.—As in other syphilitic affections, mercurials must be followed by tonics. One-eighth of a grain of calomel, or one grain of mercury with chalk, may be administered morning and evening; or ten grains of mercurial ointment may be rubbed into the skin once a day, either

directly by the fingers of the nurse, or by being smeared upon the flannel binder.

After the liver has been reduced in bulk and other manifestations of the poison are under control, syrup of the iodide of iron, in two-drop doses three times daily, is the most efficient tonic.

Iodide of potassium is also useful; it acts best when combined with chloride of ammonium, as:

℞. Potassii iodidi, ... gr. xxiv
Ammonii chloridi, ... gr. xxxvj
Syrup. sarsaparillæ comp., ... f℥ss
Aquæ, ... q. s. ad f℥iij. M.
SIG.—Teaspoonful three times daily for an infant of one month.

In those fortunate instances that yield to treatment, splenic enlargement disappears less rapidly than that of the liver, and requires the daily application of compound iodine ointment diluted in the proportion of one part to seven of lard.

CIRRHOSIS OF THE LIVER.

In childhood, cirrhosis must be classed among the uncommon diseases of the liver; the fact of its occasional occurrence, however, has been abundantly proved by post-mortem examinations.

Morbid Anatomy.—There are two forms: namely, the atrophic and the hypertrophic.

In atrophic cirrhosis, or hob-nailed liver, the organ is contracted and dense in texture, with nodulated surfaces, thin edges, and thickened capsule; on incision, the cut surface is grayish-yellow in color, and traversed by a distinct fibrous network. The lesion begins as a chronic inflammatory condition of the branches of the portal vein, and consists of a rapid development of embryonic cells, with subsequent conversion into fibrous tissue. The new-formed tissue follows

the branches of the portal vein within the substance of the gland; extends into the interlobular spaces and forms meshes of variable size, but always embraces several lobules. Some enlargement may attend the primary formation of embryonal tissue, but the shrinking of cicatricial contraction invariably follows; the cells become flattened and atrophied; there is a marked reduction in size, and the circulation in the hepatic portal vessels is greatly obstructed. The smaller bile-ducts are little affected, and blood for the nourishment of the organ and for the formation of bile is carried by vessels developed in the neoplasm.

In hypertrophic or biliary cirrhosis the liver is usually enlarged, perhaps to twice its normal dimensions. It has a smooth surface, a thin edge, and on section is orange-yellow or green. The fibroid growth begins around the intralobular branches of the bile-duct, and envelops and isolates separate lobules; it follows the ramifications of the bile-ducts; is more diffused than in the atrophic form, and denser and thicker in some portions than in others. The portal circulation is not necessarily embarrassed, but the biliary ducts are obstructed and dilated, and have their epithelial lining increased in thickness.

In both forms there is enlargement of the spleen, and in some cases there is an association of the characteristic lesions.

Etiology.—The causes are, as yet, ill determined. Alcoholic excess, the prime factor in adults, is, of course, inoperative in children, except in very rare cases; some authorities, however, are inclined to look upon the intemperance of parents as, at least, a predisposing element, and regard the vice of drunkenness as one of the sins of the fathers visited upon their offspring. Congenital deficiency of the bile-duct is always attended by cirrhosis. Constitutional syphilis frequently, and general tuberculosis occasionally, precede it. It is not limited to any sex or age, though more frequent in

boys than girls, and oftener met with between the sixth and twelfth years than at an earlier period of life.

Symptoms.—Both forms are preceded, for a variable time, by the evidences of defective nutrition, but, as might be expected from the different pathological conditions, the after-symptoms are dissimilar. With atrophic cirrhosis the child is peevish and restless, sleeps badly at night; has indigestion, flatulence, and costive bowels; a pale and pasty complexion, and dark circles about the eyes. His muscles grow flabby, there is general wasting, and the urine is thick with lithates, or is very acid and deposits a brick-dust sediment of uric acid. After these symptoms have been present for a period —usually a long one—pain in the region of the liver and ascites are developed. With the ascites there is prominence of the abdomen, dilatation of the superficial abdominal veins, and, at first, enlargement of both the liver and spleen. Soon the liver begins to decrease in size, but the spleen continues to enlarge.* Weakness and loss of flesh are progressive; the ascites becomes more marked; there is œdema of the feet and legs; the skin is sallow, and harsh to the touch; the tongue is coated; the appetite impaired; the stomach irritable; the bowels alternately confined and relaxed; there is abdominal pain; hemorrhoidal swellings are noticeable; hemorrhages occur from the stomach, bowels, nose, and gums, and petechial spots appear beneath the skin.

The course is prolonged and is interrupted by periods of apparent improvement, during which the ascites diminishes and the patient is free from discomfort, and in some degree recovers health and spirits.

General dropsy, severe diarrhœa, or hemorrhages indicate

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*If ascites be extreme, it is often difficult to detect the spleen by palpation when the patient is in the ordinary dorsal position, or on the right side. In such cases, placing the patient upon the hands and knees entirely removes the difficulty.

that the end is near. Sometimes intercurrent inflammation of the pleura or lungs is the direct cause of death.

In hypertrophic cirrhosis, the skin, conjunctivæ, and urine are deeply stained by bile, and the stools, which vary greatly in number and consistency, are clay-colored. The liver and spleen are enlarged, but there is no distention of the superficial abdominal veins, and no ascites. At times the jaundice and enlargement of the liver increase rapidly; then there is moderate fever, with much pain in the right hypochondrium. As the end approaches the pulse becomes markedly irregular; the tongue grows dry and brown; the teeth are covered with sordes; there is complete anorexia, rapid wasting, bleeding from the gums, from the stomach, or beneath the skin; apyrexia, drowsiness, stupor, and, finally, convulsions. The course is more rapid than in the former variety, but still protracted. Should both forms exist together, there is a combination of jaundice, ascites, and distention of the veins in the abdominal wall.

Diagnosis.—The characteristic features of atrophic cirrhosis are diminution in the area of liver dulness, following a temporary increase in the bulk of the organ; enlargement of the spleen, dilatation of the superficial veins, ascites, hemorrhoids; a dry, earthy skin, and gastro-intestinal hemorrhages, occurring, without fever, in a child who has a history of prolonged ill health, feebleness, and wasting.

The second and more uncommon variety, while having very much the same preliminary history, presents as its distinguishing marks enlargement of the liver and spleen without ascites; jaundice, with fever; pain in the hepatic region; and, subsequently, malignant jaundice, with typhoid symptoms, rapid wasting, coma, and convulsions.

Acute yellow atrophy, which has many of the symptoms of the final stage of the biliary cirrhosis, is distinguished by its abrupt onset and rapid course, and is rare in children.

Prognosis.—The result is almost invariably unfavorable, and it is only under the most fortunate conditions that even a temporary improvement can be obtained.

Treatment.—Before a diagnosis is established, and while the patient is merely suffering from ill-defined symptoms of bad health, with imperfect digestion, hygienic and therapeutic measures are to be directed to the restoration and preservation of the general strength, and to correcting any disorder of the organic functions.

When the hepatic affection declares itself, an alkaline or a purely tonic treatment may be adopted. Alkalies are indicated when the hepatic and gastro-intestinal symptoms are in excess of the wasting and general debility ; tonics, under opposite circumstances. In the former case, the following prescription is useful :

℞. Sodii bicarb., ... ʒ ij
Tr. nucis vom., ... ♏ xviij
Inf. calumbæ, ... q. s. ad f ℥ iij. M.
SIG.—Two teaspoonfuls three times daily, for a child of ten years.

In the latter, Basham's mixture may be employed, or a combination of iron and quinine, as :

℞. Quininæ sulph., ... gr. xij
Tr. ferri chloridi, ... f ℥ j
Syr. zingib., ... f ℥ j
Aquæ, ... q. s. ad f ℥ iij. M.
SIG.—Two teaspoonfuls three times daily.

Both plans must be followed out steadily and continuously, to obtain any beneficial results. In cases of syphilitic origin, mercurials or iodide of potassium, in full doses, are indicated.

To relieve constipation, from two to four fluidounces of Hunyadi water should be taken every morning on an empty stomach. Diarrhœa can be controlled by subcarbonate of bismuth, and hemorrhage by gallic acid or aromatic sulphuric acid.

It is important to order a liberal diet—milk, eggs, meat, and farinaceous foods in full proportion to the capacity of digestion. As in other diseases of the liver, the skin must be kept active by daily warm baths, and chilling prevented by flannel underclothing.

If ascites be so great as to impede the action of the diaphragm, paracentesis must be resorted to at once. A fine trocar or one of Southey's tubes may be used.* The operation should be repeated so soon, and as often, as reaccumulation renders it necessary. When performed early enough, it sometimes has, as in adults, more than a merely palliative effect.

SUPPURATIVE HEPATITIS.

Abscess of the liver is an extremely uncommon disease in children. The lesion may result from traumatism, or may be secondary to pylephlebitis originating in the umbilical vein, or following appendicitis, suppuration of the mesenteric glands, or peritonitis following typhoid fever. It is also due to the migration of lumbricoid worms from the intestine into the hepatic ducts, and is sometimes produced by dysentery; in many cases, however, it is quite impossible to trace the etiology.

A single abscess or several abscesses may be developed in the liver; the former is the case in traumatism; the latter, when the cause is pyæmia or pylephlebitis. The right lobe is the usual seat.

Symptoms.—In traumatic abscess, the injury is immediately followed by the superficial evidences of contusion and by pain in the hepatic region with the symptoms of perihepatitis. These features may disappear or continue until suppuration begins. The formation of pus gives rise to rigors, frequency of the pulse, night sweats, and fever, the latter often resem-

* See section on Ascites.

bling the pyrexia of quotidian or tertian intermittents. Jaundice is present only in exceptional instances. Sometimes the general symptoms are very latent, in many cases no suspicion of an abscess being entertained until its discovery by manual exploration, or by the discharge of pus in various directions, and sometimes even not until revealed by post-mortem examination.

The local symptoms, on the contrary, are usually well marked, especially when the abscess occupies an accessible position in the right lobe of the viscus; thus there is localized, though extensive, enlargement of the involved lobe, and upon this enlargement there is an ill-defined, oblong tumor extending beyond the level of the abdomen. The skin covering this tumor is at first slightly œdematous, but perfectly movable and normal in color and temperature. From day to day, as the tumor becomes more circumscribed and approaches the surface, the hepatic enlargement increases; and conjointly with the appearance of fluctuation the œdema disappears, the skin becomes dusky-red in hue, hotter than the surrounding integument, and adherent. There is also tenderness on pressure; pain excited by deep inspiration or any jarring movement, and a peculiar bending forward of the body in walking. The situation of the pain is not constant; it may be in the epigastrium, in the umbilical region, in the lower segment of the abdomen, or, at times, in the right shoulder. Again, after opening such an abscess, all these symptoms subside, and there is puckering of the skin and rapid reduction in the size of the liver; its projecting margin remaining semicircular, smooth, and well defined. Finally, there is slight contraction of the affected lobe.

There are two other points of importance: viz., the detection, by palpation, of a smooth edge of dense tissue bordering the area of fluctuation, which gives the impression that the fluid is contained in a cup-shaped cavity in a solid organ; and

the characters of the fluid, which is more puriform than purulent, yellow or red in color, and shows, under the microscope, numerous minute granules, fat globules,—free or in large cells,—leucocytes, and abundant minute rhombic or clustered acicular crystals of bilirubin.

If the abscess be seated at the convexity of the liver, there is usually cough and dyspnœa, or the symptoms of pleuritis may develop, inflammation extending through the diaphragm or pus escaping into the pleural cavity. When the lesion occupies the lower portion of the organ, there is obstinate vomiting and other indications of gastro-intestinal sympathy.

Multiple or pyæmic abscesses, being produced by infection from some point in the portal area, are preceded by a history of suppuration. Therefore, active abdominal symptoms are present, before jaundice, hepatic pain and enlargement, chills, intermittent temperature, and sweating indicate involvement of the liver. With the jaundice, features of the typhoid state appear: the tongue becomes dry and brown; sordes collect upon the teeth; there is diarrhœa, subsultus, low, muttering delirium, or stupor; the urine grows scanty, is high-colored from excess of bile pigment, and contains albumin, blood, and epithelial and granular casts. Death occurs from convulsions or exhaustion.

Diagnosis.—The recognition of hepatic suppuration is always difficult unless the abscess is large, so situated that it can be readily palpated through the abdominal wall, or unless "liver pus" can be obtained by aspiration. The characteristic features are the presence of one of the known causal factors, and the development of chills, intermittent fever, sweating, and a painful tender enlargement of the liver, presenting a localized area of extreme elasticity or of actual fluctuation.

Hepatic abscess is frequently confounded with malarial fever. From this it may be distinguished by its non-response to the administration of quinine, and by the absence of

marked splenic enlargement and of malarial organisms in the blood.

Certain cases closely resemble empyema. Here the points of distinction are that in hepatic abscess the upper margin of dulness is usually higher in front than behind and that the lung is everywhere in contact with the abscess, whereas in empyema it is compressed and forced toward the spine and upper part of the thoracic cavity.

When, as is often the case, it is necessary to resort to aspiration to establish the diagnosis, the patient must be anæsthetized and the needle inserted—several times, if required—into any tender, yielding spots in the portion of the liver projecting below the costal border and into the seventh right intercostal space in the axillary line, or at the same level in front or behind if the area of dulness extends above these points. Such puncture is usually harmless, though it may be attended by considerable bleeding so long as the needle remains in the organ.

Prognosis.—In multiple abscess the outlook is very grave, the ordinary termination being in death. The same may be said of a single abscess situated beneath the diaphragm on the convexity of the right lobe. On the other hand, a single abscess, if superficial and so placed that it can be readily reached by the aspirating needle or knife, offers a much more favorable prognosis.

Treatment.—The general management of circumscribed hepatitis, prior to the formation of pus,—if the symptoms be such as to lead to a diagnosis at this time,—simply requires careful regulation of the diet, rest, and attention to the various functions of the body, particularly that of the bowels; for even if the existence of inflammation be ascertained, it is hardly probable that anything can be done to prevent suppuration.

When an abscess has formed, the treatment is purely

surgical. A few cases have recovered after aspiration, but free incision and subsequent drainage are alone to be depended upon. After operation strict rest should be enjoined, and tonic and supporting measures employed. Subsequently, nutritious diet and exercise in the open air, the latter adapted to the strength of the patient, are much more important than mere medication.

Tuberculosis of the liver is sometimes associated with tuberculous peritonitis, and is commonly encountered at the autopsies of children who have succumbed to acute general tuberculosis. In such cases the liver is anæmic, yellowish, and somewhat enlarged. Semi-transparent granules (miliary tubercles) are seen upon the capsule and detected by the microscope in the connective tissue that surrounds the branches of the finer bile-ducts. The tubercles may attain considerable size in chronic cases, and undergo rapid softening, with the formation of abscesses containing bile-stained pus; these vary in size from that of a pea to that of a marble, and, at times, are very numerous. There are no definite symptoms and a diagnosis is hardly possible without post-mortem section.

Hydatid disease and **cancer** are so infrequent in childhood, and when they do occur present so nearly the symptoms of the same conditions in adults, that it is unnecessary to devote space to their consideration.

CHAPTER VI.

AFFECTIONS OF THE PERITONEUM.

PERITONITIS.

Children, like adults, are subject to attacks of inflammation of the peritoneum. These may be primary or secondary in origin, acute or chronic in course, and general or local in distribution.

The affection occurs at any age from birth to puberty, and there are indisputable evidences on record of its developing during the later months of intra-uterine life. The primary or essential form is almost uniformly acute and general. Secondary peritonitis, on the contrary, may be either general or local, the inflammation often beginning in a limited area and gradually extending over the whole surface. It is also more common than the primary variety, and, while often acute, more frequently runs a chronic course.

Morbid Anatomy.—In acute general peritonitis the blood-vessels of the subserous tissue of the peritoneum are engorged with blood, and the membrane is reddened, either generally or in patches, mottled by isolated spots of ecchymosis, and opaque and thickened. Serum, sometimes clear, sometimes mixed with pus and flakes of fibrin, fills the abdominal cavity; or, again, the effusion may be purulent; in either case, it is most abundant in the pelvis and between the mesenteric folds.

Acute local peritonitis occasions connective-tissue hyperplasia, omental and intestinal adhesions, and, at times, localized suppuration.

Chronic general peritonitis gives rise to a sero-fibrinous exudate; this may be sufficiently abundant to appear as a thick membrane, and in time may undergo fatty, caseous, or calcareous degeneration.

Chronic local peritonitis results in the formation of circumscribed adhesions, membranous exudations of limited extent, and sacculated collections of pus.

Etiology.—Fœtal peritonitis is caused by syphilis or some specific infection of the mother. During the first few days of life it may be due to inflammation, suppuration, or gangrene of the umbilicus; to congenital occlusion of the anus; or to infection from a mother ill with puerperal fever. Later in childhood, primary peritonitis arises from blows upon, or other injuries to, the abdomen, from severe burns, and sometimes from sudden chilling of the body after violent exercise. The secondary form most frequently results from the escape of fæcal matter into the abdominal cavity through a perforation of the intestine—the so-called perforative peritonitis. Appendicitis is the condition in which this accident usually occurs, intestinal perforation during typhoid fever being rare in childhood. It may also occur during the course of one of the infectious diseases, pneumonia and scarlatina especially. Finally, it may be occasioned by extension of inflammation from some one of the abdominal viscera, or from the pleura; in the last instance there may be an element of sepsis.

The bacteria commonly associated with peritonitis in early life are: the streptococcus, particularly in the newborn; the pneumococcus in cases associated with pneumonia or empyema; and the bacterium coli commune in those due to intestinal perforation.

Chronic peritonitis sometimes follows an acute attack, but is most often an attendant of tuberculosis and presents the characters of chronicity from the outset.

Symptoms.—In primary peritonitis, and in other cases of

the acute general disease not due to perforation or sepsis, the attack begins with more or less rigor, abdominal pain, and vomiting. The pain is stinging or lancinating in character, and is limited, at first, to one flank, to the supra-pubic region, or the neighborhood of the umbilicus, but soon becomes general ; it is increased by pressure or by any act calling the abdominal muscles into play, as deep breathing, sneezing, coughing, and vomiting. The vomiting is frequent and very violent, producing so much distress and fatigue that after each effort the patient falls back on the pillow with pale, haggard, and sweat-bedewed face. The material rejected consists, in the beginning, of partially digested food ; later, of bile-stained mucus.

Fever quickly follows the shivering, and as soon as inflammation is fully established, the axillary temperature may reach 104° F., although the usual range is from 101° to 102°. With the pyrexia there is a frequent, small, wiry pulse, and the breathing assumes the superior costal type ; in some cases (where there is a large effusion) growing hurried and difficult. The child ceases to move his legs, or takes to bed early and lies immovably upon his back, with the knees drawn up. The face is pale and anxious, the nose sharp and the nostrils thin and expanded. The abdomen is distended and passive, so far as respiratory movements are concerned ; palpation yields a certain sense of resistance, sometimes develops fluctuation,* and always excites intense pain ; percussion elicits tympany over the upper anterior portion of the belly and dulness over the dependent parts, and on auscultation, friction sounds may be heard when there is a fibrinous exudation.

* When fluctuation is indistinct, Duparcque recommends that the child be placed on one side for a few moments, so that the whole quantity of fluid may gravitate to the depending flank ; then quickly turned upon the back, when dulness and temporary fluctuation will be found at the site of accumulation.

The tongue is pointed, red at the tip and edges, and covered in the centre with a dry, moderately heavy, brown-white fur. There is anorexia and increased thirst. Constipation is the rule if the intestinal peritoneum be involved; then, too, there are frequent attacks of severe griping pain; on the other hand, there may be diarrhœa, with watery evacuations, if the inflammation be attended by œdema of the submucosa with transudation of serum into the bowel.

The urine is high-colored and somewhat reduced in quantity, and, while ordinarily passed with freedom, is retained when the serous coat of the bladder is involved in the inflammation.

Sleep is disturbed and restless; in infants there may be convulsions; in older children, delirium, though the mind often remains clear.

During the course of the attack, which usually extends over a period of seven days, the strength steadily fails; there is considerable loss of flesh, and the symptoms present at the onset continue unabated and unchanged. As death approaches vomiting usually stops, but the other symptoms become more and more grave. The patient lies in an apathetic condition, with sunken eyes and half-closed lids; his face is drawn and either pale or cyanosed; the tongue is dry, brown, and pointed; there is marked tympanites, and the pulse is extremely small and frequent.

Occasionally this variety of acute peritonitis ends in recovery, the exuded fluid being either reabsorbed or spontaneously evacuated through the umbilicus or abdominal wall.* In the first instance, the symptoms subside gradually; in the second, rapidly; though in both the course is protracted, the fistulous openings left after the discharge of pus rarely closing under four or five weeks.

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* M. Gauderon mentions ten such cases, eight of which recovered.

Perforative peritonitis requires separate description, since it has a set of symptoms entirely its own. It is the most common form of the disease in children, and in the majority of cases, as already stated, results from rupture of the vermiform appendix ; perforation of typhoid or tuberculous ulcers being exceptional in this class of patients.

The attack begins suddenly, with intense pain in the abdomen, quickly followed by profound collapse. The face soon becomes pale and haggard ; the eyes are deeply sunken, and the hands and feet cold, though the body heat is increased, the rectal temperature ranging to 103° or 104°. Other features are great thirst, occasional vomiting, a dry, red, and pointed tongue ; locked bowels ; a rapid, small, thready pulse ; thoracic respiration, often hurried and difficult, and suppression of urine. From the beginning the belly is greatly distended by gas escaping from the intestine ; the abdominal respiratory movements cease ; palpation is very painful, and percussion yields a uniformly drum-like tympany that extends high up under the ribs, and completely masks the liver dulness. Death almost invariably takes place either on the third or fourth day of illness, and is usually preceded by a few hours' freedom from suffering.

While this is the ordinary course of perforative peritonitis, it happens sometimes that the shock is so great that the patient neither feels pain nor complains of tenderness when the abdomen is touched, and there is a general latency in the symptoms. Again, extravasation being limited by preformed adhesions, the inflammatory action is circumscribed, and the resulting abscess, by pointing and discharging through the abdominal wall or into the intestine, may either end in recovery, or in the production of a permanent fæcal fistula.

In septic peritonitis the symptoms are either inherently latent, or are masked by the collapse that follows the onset of a new inflammation in a patient already debilitated by dis-

ease. There is usually rapid prostration, restlessness, and delirium, with a tendency to stupor; a pale, anxious face; swollen belly; persistent watery diarrhœa; a frequent, wiry pulse, and quick, costal breathing. Pain, tenderness, tension of the abdominal walls, dulness on percussion and fluctuation may be entirely absent. Without care, such attacks are readily overlooked.

Should peritoneal inflammation become chronic the pain lessens and is more paroxysmal in character; the fever is remittent, with evening exacerbations; constipation alternates with diarrhœa; there is great emaciation, and death occurs from exhaustion. However, on account of the usual tuberculous origin, the symptoms of this form will be more appropriately studied in the following section under the head of "tuberculous peritonitis."

Local peritonitis is almost uniformly secondary, that attending inflammation of the cæcum and vermiform appendix being the most common in children.

Diagnosis.—An immovable dorsal decubitus; a pale, haggard face; a frequent wiry pulse; distention, pain, and tenderness of the belly; and inactivity of the abdominal muscles in respiration, suffice to render the diagnosis of acute general peritonitis easy. Intense pain, sudden collapse, and rapid and extreme meteorism characterize the perforative variety.

In colic there is constipation and vomiting, with severe pain; but between the paroxysms there is no abdominal tenderness, and the pulse is never so rapid, small, and wiry, nor is there the fear of movement so noticeable in peritonitis.

Rheumatism of the abdominal muscles is attended by tenderness on pressure; distressed facial expression; dorsal decubitus with knees drawn up, and constipation, and thus simulates peritonitis; but the face is never haggard, there is no vomiting nor hiccough, nor distention of the belly, neither is tenderness extreme. The pulse is soft, compressible, and

only moderately frequent; the temperature is nearly normal, and the urine is scanty, high-colored, acid, and scalding.

It is important to remember that constipation is the rule in peritonitis when the inflammation involves and paralyzes the muscular coat of the bowel; diarrhœa, when it spreads through the muscular coat to the mucous membrane.

The great difficulty in diagnosis is experienced with latent peritonitis, whether septic or due to other causes. Suspicion of its existence may be entertained when, in the course of any predisposing disease, the patient suddenly grows pale and haggard, and has a full belly, with a tendency on the part of the abdominal muscles to become rigid on palpation. Restlessness, delirium and stupor, a change in the type of respiration and in the character of the pulse, all strengthen the suspicion. Under these circumstances it is well to practice Duparcque's method for detecting the presence of fluid, and this, if successful, leaves no further doubt.

In the words of Eustace Smith: "In cases of chronic empyema we should always be on the watch for the occurrence of peritonitis. If the child, after a period of improvement, ceases all at once to gain ground, and begins to look pale and distressed, with an elevated temperature, a more or less distended belly, and a rapid, wiry pulse, we are justified in suspecting peritonitis, although there be no tension, tenderness, or other sign connected with the abdomen to give support to this opinion."

Prognosis.—This must always be most grave. In the newborn and in infancy death is the almost invariable result. Perforative peritonitis also is very fatal. The primary variety, when due to cold, exceptionally ends in recovery, and so, too, does the partial form.

Treatment.—Absolute rest in bed and quiet surroundings are essential. Hot applications, in the form of light flaxseed poultices and of turpentine stupes, should be made to the sur-

face of the belly; or, if these fail to give relief, cloths wrung out of ice-water may be applied; they must be frequently changed, to secure the constant action of cold. Leeching is sometimes of great service in subduing pain, but it is only to be employed with robust subjects and in an early stage of the attack.

Of drugs, opium alone can be relied upon. It may be exhibited by the mouth, the rectum, or subcutaneously, and can safely be pushed to the point of producing drowsiness, with decided contraction of the pupils, provided ease from suffering be not attained before. For a child of six years, three drops of laudanum every two hours, by the mouth or rectum; and, by hypodermic injection, one-eighteenth of a grain of sulphate of morphine, repeated as required, are the average commencing doses.

At the very outset of the attack a saline cathartic may be employed, but under no other circumstances is a purge to be given. Should constipation be obstinate, and the indications urgent to unload the bowels, a simple enema may be employed. It is a good rule, however, to interfere as little as possible in this way.

The patient's strength must be sustained by concentrated liquid food in small quantities and at short intervals. Three fluidounces of peptonized milk and from two to four fluiddrachms of raw-beef juice, alternating, every two hours, with the occasional substitution of the yolk of a soft-boiled egg for one or the other, would be a proper diet for a child of six years; stimulants are also necessary, and so soon as there is evidence of failing strength a teaspoonful of good whiskey must be added to each portion of milk. Bits of ice may be allowed from time to time to allay thirst and quiet the stomach.

Should the inflammation subside, the opium is to be gradually withdrawn and its place supplied by sorbefacients and

tonics ; at first mercury in alternate doses, or iodide of potassium, with quinine ; and, later, syrup of the iodide of iron. At the same time, the hot or cold application being removed, a weak mercurial ointment should be rubbed into the skin of the belly once or twice daily ; for example :

℞. Ung. hydrargyri,
Ung. belladonnæ, ... āā ʒij
Adipis, ... ʒiv. M.
Sig.—Use locally as directed.

A most important point is to make no change in the diet, except, perhaps, to increase gradually the quantity of liquid food, until convalescence is fully established. Operation is rarely to be considered in acute peritonitis in children, except in cases due to perforation, and in these every form of treatment is of little avail. When the active stage has passed and pus has formed, surgical interference is always demanded.

TUBERCULOUS PERITONITIS.

As a rule, peritonitis due to the presence of tubercle in the abdominal cavity runs a chronic course, and is associated with tuberculosis of some other organ of the body—of the brain or lungs, for instance ; less frequently it occurs as an isolated affection. Acute tuberculous peritonitis is not unknown ; it is detected with difficulty during life, and is invariably an element of general tuberculosis. The disease is quite common after the age of seven years, but is rare in earlier childhood and in infancy.

Morbid Anatomy.—Tuberculous peritonitis occurs in several distinct forms :

(*a*) *Miliary Tuberculosis.*—The peritoneum, especially in infants, may be involved in acute or subacute general miliary tuberculosis ; under these circumstances miliary tubercles are

deposited, generally diffusely, over the membrane, giving rise to little inflammation and no special symptoms.

(*b*) *Miliary Tuberculosis with Ascites.*—Here miliary tubercles are deposited discretely or in large groups and produce varying grades of inflammation. The serous membrane is congested and there is an exudate of fibrin in small quantities and of serum or sero-purulent or bloody fluid in great, though not excessive, bulk; this fluid is free in the general peritoneal cavity in acute cases, sometimes sacculated in those that are chronic.

(*c*) *The Fibrous Form.*—In this variety, which is the most chronic, the products of tuberculous inflammation undergo transformation into fibrous tissue, nature's effort for health restoration. The outcome of the process is the formation of more or less extensive organized adhesions between the intestinal loops and between these and the abdominal wall. Ascites may or may not be present. If the former, the fluid may be serous or sero-purulent, and either free or sacculated.

(*d*) *The Ulcerative Form.*—This form stands midway between *b* and *c* in point of chronicity, and is frequently encountered during childhood. It is usually general, but may be localized. There is an extensive fibrinous exudate, causing the coils of the intestines to adhere to one another and to the viscera and abdominal walls. In this the tuberculous deposit appears as small, yellow nodules and large caseous masses, which have a tendency to undergo softening. The same caseous deposits are found in the omentum and mesentery, which are much thickened. The adhesions also form sacks containing serum or more often purulent matter. Tuberculous deposits are present in the intestinal peritoneum, and infiltrate the intestinal walls, leading to perforation or to fistulous communication between the coils of the gut. A similar infiltration may affect the abdominal walls and be attended by cellulitis and suppuration, the abscess opening externally, gene-

rally in the umbilical region. This form of the disease may originate as such, or may follow the miliary or fibrous forms, and is always associated with tuberculosis, usually advanced, in the lungs or other organs of the body.

Etiology.—The factors leading to peritoneal tuberculosis are identical with those producing other tuberculous affections. The age at which the disease is most prone to occur has already been mentioned. Male children seem to suffer more frequently than those of the opposite sex.

Symptoms.—The features of tuberculous peritonitis vary considerably with the form the disease assumes, but the following description portrays the general clinical picture. The onset is slow and insidious, and the physician is apt to have his attention diverted from the abdomen by more striking manifestations of tuberculosis in the lungs or other organs. Unless such features be present and precedent, there is but little evidence of failing health in the beginning, and the first symptom to attract notice is an abnormal prominence of the belly. The patient gradually grows dull and listless, looks ill, and, on account of abdominal tenderness and the pain produced by jarring, becomes slow and guarded in his movements.

Often after the disease is fully developed the child "keeps about," but the face is drawn and wears an expression of anxiety and suffering; the frame slowly wastes, and the skin becomes dry and harsh and loses its healthy hue. Complaints are made of tenderness and griping pains in the abdomen, and the little sufferer takes very characteristic precautions to lessen his ills by steadying his belly with his hands in walking, and by moving downstairs backward so as to pass from step to step on his toes, to avoid jolting. The symptoms denoting disturbance in the functions of the gastro-intestinal tract are inconstant; the tongue either shows little alteration or is lightly frosted or more pointed and red than natural; nausea and vomiting may be entirely absent, and

are never so persistent and severe as in simple peritonitis; the appetite often remains unimpaired, and the bowels are alternately relaxed and confined. On the other hand, the signs to be detected by abdominal exploration are very constant and characteristic. The belly is oval in shape and somewhat irregularly distended, the greatest enlargement occupying the epigastric and umbilical regions; the natural folds and furrows are obliterated; the superficial veins are prominent; and the integument has a smooth, shining appearance, as if smeared with oil. When the hand is applied to the surface, the recti muscles become tense, in an involuntary effort to protect the tender parts beneath; some portions of the abdomen feel soft and flaccid; in others, firm masses are perceptible to the touch; tenderness on pressure is universal, though most marked over the firm masses. Palpation also reveals fluctuation; this is usually indistinct, though occasionally, when enlarged glands or cheesy masses exert pressure on the portal vein, there is a large collection of fluid in the peritoneal cavity, and the fluctuation wave is readily elicited and very distinct. The edge of the right lobe of the liver can often be felt extending half an inch or more beyond the right costal border. On percussion, tympany will be elicited over the flaccid portions of the abdomen; dulness over the firm masses and flatness over the flanks—in the recumbent position—while, if the patient be rolled to one side, the note on the flank turned uppermost becomes tympanitic.

The respiratory movements are somewhat increased in frequency and thoracic in type; the pulse is quickened and feeble in proportion to the general weakness; the axillary temperature ranges from 98° F. in the morning to 101° F. in the evening; and there is dysuria with high-colored, but otherwise unaltered, urine. Sometimes, with a large collection of fluid in the peritoneum, there is œdema of the feet and legs; then, too, the urine may be slightly albuminous.

In time the patient is forced to go to bed, where he lies on his back, or partially turned on one side, with his legs drawn up; this position is rigidly maintained, for every movement is painful. Now the wasting is rapid; the face wears a haggard expression; the cheeks and temples are hollow, and the skin becomes inelastic and dotted with purpuric spots. The tongue is dry, heavily coated, or red and smooth; the appetite fails and there is urgent thirst. The bowels are in one of two conditions: relaxed, with watery, offensive stools, containing flaky matter and small black clots of blood, when there is tuberculous ulceration; obstinately confined, when the intestines are pressed upon, or obstructed by adhesions. In the latter case the belly becomes greatly distended, and there are frequent attacks of severe colicky pain. Under other circumstances, however, the size of the belly may diminish, and then hard, tender lumps are felt in contact with the abdominal wall. The pulse is more frequent and feeble; the evening temperature ranges as high as 103° and 104°, and night sweats are common.

The course of the disease is not uniformly progressive, being interrupted by remissions and exacerbations. During the former the tenderness and distention of the abdomen diminish, the appetite returns, nutrition improves, and false hopes arise of rapid recovery. Death occurs after a lapse of time varying from several months to a year or more.

Sometimes before death an abscess forms, and pus is discharged through the abdominal wall in the neighborhood of the umbilicus; in other cases the intestines may be perforated from without, but this complication scarcely hastens the fatal termination, for extravasation is limited by adhesions between the knuckles of the intestines. Such complications as tuberculosis of the lungs and cerebral meninges, however, certainly hasten death.

Acute tuberculous peritonitis always occurs as an element of disseminated tuberculosis, and presents the general features of that condition; usually there are no local manifestations other than abdominal fulness and slight pain—symptoms sufficiently common in children to be altogether indefinite. The course of these acute attacks is measured in little more than a week.

Diagnosis.—Ordinarily the formation of a correct opinion is not difficult. The distinctive features are the irregular distention of the abdomen; the smooth, shiny appearance of the investing skin; tenderness; unequal resistance to the touch in different positions, and indistinct fluctuation, combined with alterations in the temperature; impairment of nutrition; an insidious onset; a family record of tuberculosis; the presence of the tuberculous diathesis, and the existence of symptoms of tuberculous deposit in some other organs of the body. In doubtful cases, where there is little distention or tenderness, and fluctuation is absent, it is well to try the effect of a sudden jar; this may be done by directing the child to jump from a low chair to the floor. Free fluctuation is to be regarded as a point in the negative.

Many children have prominent bellies and suffer severely from abdominal pain, both due to the accumulation of flatus in the intestines, the consequence of a chronic catarrh of the mucous lining. These patients, though pale and flabby, are but little wasted, and express in their faces no trace of severe illness; they are lively in action; their temperature is normal; there is no tenderness or involuntary contraction of the recti muscles on palpation; the abdominal distention disappears spontaneously at times, and subsides entirely when a non-farinaceous diet is ordered. There can be no greater mistake than that of attributing every instance of abdominal distention to tuberculosis.

As already stated, the diagnosis of the rare acute form is

very difficult, and is often made only at the postmortem table. Typhoid fever is the disease most likely to be confounded with it, but the absence of rash and splenic enlargement, and the difference in the degree and course of the fever should prevent error.

Prognosis.—This depends upon the form the disease assumes. The ulcerative form is always fatal; in the ascitic and fibrous varieties the outlook is much more favorable, especially since laparotomy has been generally recognized as the proper method of treatment.

Treatment.—While little is to be expected from therapeutic measures, the physician's ambition will be to obtain a favorable result if he can. To accomplish this end it is necessary, first, to keep the child at perfect rest in bed; and, second, to select a diet that will meet the capacity for digestion, excluding as nearly as may be the farinaceous foods so prone to cause acidity and flatulence, with their attendant suffering. The following is a sample diet list for a patient of seven years:

For breakfast, at 7.30 A. M.—The yolk of a soft-boiled egg, a slice of well-toasted bread lightly buttered, and a tumblerful (f℥viij) of warm milk.

For luncheon, at 12 M.—The soft parts of a dozen oysters or a bit of fish, or a bowl (f℥vj) of good meat-broth, with a biscuit.

For dinner, at 3 P. M.—Two to four tablespoonfuls of minced mutton or chicken, one or two thin slices of stale buttered bread, eight tablespoonfuls of rice and milk or junket.

For supper, at 7 P. M.—Two slices of milk-toast and a tumblerful of warm milk.

Such a list can only be used in the earlier stages of the disease; later, when the appetite fails, it is necessary to resort to liquid food, milk, and meat-broths, administered in small quantities at short intervals.

Stimulants—and whiskey is the best—are required from the beginning, and must be given in increasing quantities as the strength fails.

Of drugs, opium, quinine, and syrup of the iodide of iron with cod-liver oil, when the stomach will bear them, are the most useful. Opium must be given sufficiently freely to relieve pain, and quinine in doses large enough to maintain the flagging forces. Constipation is to be remedied only by simple enemata, while excessive diarrhœa may be checked by full doses of bismuth combined with ipecacuanha and opium, as :

℞. Pulv. ipecacuanhæ comp., ... gr. xxiv
Bismuth. subcarb., ... ʒj
Pulv. aromat., ... gr. xij.
M. et ft. chart. No. xij.
SIG.—One powder every two or three hours for a child of seven years.

A good formula for the same purpose is :

℞. Ext. hæmatoxyli, ... gr. xxx
Tr. opii deod., ... ♏xxiv
Vin. ipecacuanhæ, ... ♏xxxvj
Mist. cretæ, ... q. s. ad fʒiij. M.
SIG.—Two teaspoonfuls every three hours.

Externally, light flaxseed poultices are useful in relieving pain. Sometimes even the lightest poultice is uncomfortable, then the abdomen may be anointed once daily with :

℞. Ext. belladonnæ, ... ʒij
Glycerini, ... fʒvj; M.

and covered with a thick layer of cotton batting. While these methods are useful in maintaining strength and relieving symptoms, the only treatment that carries any promise of radical curative results is surgical interference in properly selected cases.

ASCITES.

The collection of a quantity of transparent serum in the sack of the peritoneum is not of very common occurrence during

childhood. The condition is, probably, always secondary, and must be regarded rather as a symptom than a disease proper; it is of sufficient import to warrant a brief separate consideration.

Etiology.—Ascites is produced by simple or tuberculous inflammation of the peritoneum; it also depends upon obstruction to the return of venous blood, due to diseases of the liver or heart; to enlargement of the mesenteric glands, and, occasionally, to disease of the lungs; again, it may be the result of a general hydræmic state of the blood, attending affections of the kidneys and anæmia. It is sometimes impossible to decide upon the pre-existing lesion.

Symptoms.—In a well-developed case the abdomen is distended and globular, the exact shape depending upon the position of the patient, being broader in the recumbent than in the erect posture, as then the fluid tends to spread and collect in the flanks. The integument is smooth and shining; the superficial veins are very distinct, and the normal depression at the umbilicus is either effaced or there is a projection at this point. There is a sense of fulness, with moderate resistance, but no tenderness on palpation; and if a hand be placed on either side of the belly, and a sharp tap given with one of the fingers, a distinct impulse—fluctuation wave—is felt by the other hand; this is not interrupted, as in the case of flatulent distention, by pressure, made by an assistant, on the median line. While the child lies upon its back, percussion is tympanitic over the upper anterior parts of the belly, where the intestines float free, and dull elsewhere; a change in position alters the relation of the areas of tympany and dulness, and the extent of the latter depends entirely upon the amount of fluid present.

Pain is not a prominent symptom; if present, it is paroxysmal, and has the griping character of the colic of intestinal indigestion. Such attacks are often attended or followed by

moderate diarrhœa; in the intervals the bowels may be confined. Should the effusion be large, the mere weight of the fluid causes discomfort; then, too, respiration is embarrassed, even to the extent of orthopnœa; micturition is painful; the urine is scanty, high-colored, and albuminous; and there may be œdema of the genitalia and legs, resulting solely from pressure.

Cases having an obscure etiology furnish a few additional features; there are no constant or characteristic alterations of the tongue, appetite, appearance of the skin, or temperature; for these, with other rational symptoms, depend upon the determining disease.

When due to inflammation of the peritoneum, the amount of effusion is usually moderate; the abdomen is tense and tender; the temperature is usually elevated, and the general symptoms of acute or chronic peritonitis are more or less marked.

In hepatic disease, especially cirrhosis, the effusion is great; the superficial abdominal veins are very prominent; the hemorrhoidal veins are distended; the spleen is often enlarged; the digestive functions are impaired, and the general integument has a sallow hue or is decidedly jaundiced.

Cardiac disease causes anasarca and hydrothorax as well as ascites, and these conditions are apt to be associated; the face is livid; the lips and finger-tips blue; the jugular veins are distended and pulsating; there is dyspnœa, and a scanty, albuminous urine, with the physical signs of heart lesion.

Diagnosis.—There is little difficulty in detecting ascites, unless the effusion be so small that it sinks away into the pelvis or between the folds of the intestine beyond the reach of the examiner's hand. Under these circumstances it is well to try Duparcque's method (see page 415) of increasing the distinctness of fluctuation, or to put in practice another plan for the same purpose: namely, placing the patient on the

hands and knees so that the fluid may gravitate to the most dependent portion of the abdomen—now the neighborhood of the umbilicus—and come within the range of palpation.

A large belly, produced by flatulent distention of the intestines, may yield indistinct fluctuation, the palpation stroke being transmitted through the bowels; but the imperfect wave is readily interrupted by pressure in the median line, and the results of percussion are quite different from those obtained in ascites.

The collection of a large quantity of fluid in the pelvis of one or other kidney—hydronephrosis—is attended by abdominal distention, fluctuation, and percussion dulness. The enlargement, however, is more noticeable on the side of the affected kidney; here, also, there is more resistance and greater dulness, the opposite flank being often tympanitic; changes of position have little effect in altering the percussion sounds, the umbilicus rarely protrudes, a kidney-shaped outline can often be detected, and tapping liberates a liquid charged with urea.

The **prognosis** depends chiefly upon the nature of the originating disease. When this cannot be discovered, the forecast must be based upon the general strength and nutrition, the condition of the skin, the temperature, and the character of the urine. If the strength be moderately preserved, the appetite and digestion fairly good, the skin natural in texture and color, the temperature normal, and the urine free and non-albuminous, the prognosis for an ultimate recovery is good, irrespective of the amount of effusion.

Treatment.—This must, in the main, be regulated by a consideration of the primary disease. Cases of obscure origin, as well as those depending upon anæmia or disease of the liver, are much benefited by full doses of iron. Basham's mixture or the tincture of the chloride of iron or the dried sulphate are, perhaps, the best preparations to use, and their

effect is increased by the addition of quinine. The following is a serviceable formula :

℞. Ferri sulph. exsiccat., ... gr. xxiv (to be increased to ʒj)
Quininæ sulph., ... gr. xij
Acid. sulphurici dil., ... ♏xij
Syrupi, ... fʒj
Aquæ menth. pip., . . . q. s. ad fʒiij. M.

Sig.—Two teaspoonfuls three times daily, taken diluted and after eating, for a child of six years.

Diuretics can be employed at the same time, if there be no kidney complication, for example :

℞. Potassii acetatis, ... ʒij
Spt. juniperis comp., ... fʒss
Spt. ætheris nitrosi, ... fʒvj
Syrupi, ... fʒij
Aquæ, ... q. s. ad fʒvj. M.

Sig.—Two teaspoonfuls every three hours.

A combination of acetate of potassium, squill, and digitalis is often useful.

Should this class of remedies fail, much may be accomplished by a properly regulated course of purgatives. For this purpose, thirty grains of compound licorice powder, thirty grains of sulphate of magnesium, or ten grains of compound jalap powder, may be given from two to three times daily. Sometimes it is advisable to begin this treatment by two grains of calomel, administered at bedtime, and followed next morning by a teaspoonful of magnesia.

It is always important to keep the skin active by a daily warm bath, and to maintain an equal surface temperature by woolen underclothing.

The diet should contain as little fluid as possible ; thus the child may eat :

For Breakfast.—A saucer of oatmeal porridge or cracked wheat with cream ; a soft-boiled egg ; two slices of stale bread or toast with butter ; a teacupful (four fluidounces) of milk.

For Dinner.—A bit of roast chicken, or tenderloin of beef-steak, or roast beef or mutton; mashed potatoes with gravy, or spinach or cauliflower; two or three slices of stale bread; rice pudding or junket and a glass of filtered water.

For Supper.—A poached egg on toast, or a bowl of cream toast and a cup of milk.

Between meals, some water must be taken to relieve thirst; but the less, the better.

When the fluid does not diminish after a thorough trial of ordinary remedies, the peritoneal cavity must be tapped. It is best to make the puncture with a very fine cannula; the instrument having been inserted, is left in position; a rubber tube is attached, and the fluid allowed to drain away slowly for some eight or ten hours, constant and equal pressure being maintained in the mean while by a broad bandage. After the cannula is removed, the abdomen must either be strapped or carefully bandaged. The effusion is never entirely removed in this way, but enough is taken to relieve pressure and allow absorption to go on. This method of operation causes so little pain, that, if necessary, but slight objection is offered to its repetition; in very timid subjects, though, it is well to lessen the sensibility of the skin by the momentary application of ice and salt to the point selected for puncture. Paracentesis is often a remedial agent of much value; though in some cases it is merely palliative.

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