PROGRESS IN PEDIATRICS

REVIEW OF THE LITERATURE ON THE FEEDING AND GASTRO-INTESTINAL DISEASES OF INFANTS, FOR THE YEAR 1913-1914

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CHICAGO

BREAST-FEEDING

1. Kleinschmidt: *Monatschr. f. Kinderh.*, 1913, xii, 423.
2. Czerny: *Med. Klin.*, 1913, ix, 895.
3. Langstein: *Ztschr. f. Kinderh.*, 1913, vii, 193.
4. Ritter: (Abstr.) *Jahrb. f. Kinderh.*, 1913, lxxviii, 613.
5. Frost: *Arch. Pediat.*, 1913, xxx, 608.
6. Reuben: *Arch. Pediat.*, 1914, xxxi, 176.
7. Bamberg: *Ztschr. f. Kinderh.*, 1913, vi, 424.
8. Langstein: *Jahreskurs. f. Aerzt. Fortbild.*, 1912, iii, No. 6.
9. Koller: *Cor.-Bl. f. schweiz. Aerzte*, 1912, xlii, 777.
10. Rosenstern: *Deutsch. med. Wchnschr.*, 1912, xxxviii, 1834.
11. Jones: *Arch. Pediat.*, 1914, xxxi, 24.
12. Hoobler: *Arch. Pediat.*, 1914, xxxi, 171.
13. Talbot: *Boston Med. and Surg. Jour.*, 1913, clxix, 760.
14. Lee: *Arch. Pediat.*, 1913, xxx, 509.
15. Engel: *Monatsch. f. Kinderh.*, 1913, xii, 559.
16. Heydolph: *Jahrb. f. Kinderh.*, 1913, lxxviii, 216.

In all recent publications on infant-feeding the superiority of breast-milk over all artificial foods is more than ever emphasized; and the crusade for the encouragement of breast-feeding continues. The cause of this undoubted superiority is still an unsolved problem. One especial phase of the subject which is greatly discussed is the far greater immunity to infection shown by breast-fed infants. This is emphasized by Kleinschmidt,¹ Czerny,² Langstein,³ Meyer and others. They have shown that all methods of artificial feeding, however successful in other respects, give no immunity against infectious processes. What is the essential cause of the high immunity conferred by breast-milk? The passage of immune bodies from mother to infant in the mother's milk has long been considered a possibility. Czerny² believes that this has not been proved; but believes the cause lies rather in the high fat content of breast-milk. Langstein³ advises feeding all infants who are much exposed to infection on breast-milk.

A theory advocated for some time by German authors is that there is shown but little variation in the breast-milk of different women, or in the same woman under different conditions; that all breast-milk is

good. Langstein says that differences in breast-milk have not been proved; that until they are he will adhere to the idea that all breast-milk is adapted to the child.

Bamberg⁷ studied the composition of the milk of wet-nurses giving very large amounts of milk; also of a few during menstruation. He found no change in the constituents under these two conditions.

Heydolph¹⁶ saw no bad effects in infants after continuance of breast-feeding during mastitis, even though there was pus in the milk.

Ritter,⁴ on the other hand, believes that all breast-milk is not alike, and that the wide variations in fat should be studied. Frost⁵ believes that nervous shock in the mother may cause changes in the breast-milk harmful to the infant, and that under such circumstances all the constituents of the milk may be changed.

Reuben,⁶ in a large experience at milk stations, finds that the breast-milk of most of the women deteriorates or becomes insufficient after the seventh or eighth month; and that the children weaned altogether at that time thrive much better than those given "*allaitement mixte*." Langstein, too, on the ground that after the ninth month the breast-milk contains too little iron, advises weaning and the giving of a small amount of vegetable purée, besides the feedings of milk dilutions.

Jones¹¹ has reviewed the recent statistics as to the ability of mothers to nurse their infants.

Most authors seem agreed that the only stimulus for milk secretion is the normal one of the sucking of the infant; so that in the event of a delayed or insufficient milk secretion, waiting, with a systematic putting of the infant to the breast, are indicated.

Koller⁹ disagrees; he believes that milk secretion is not merely passive, caused by suction on the nipple, but active, depending on the nervous condition of the mother. Rosenstern¹⁰ has shown that in many cases of apparently insufficient milk-supply the fault was in the failure of the infant to suck properly. These cases usually would have been considered cases of insufficient secretion of the mothers; that this was not true was proved by the fact that all the mothers were able to pump off considerable amounts of milk after each feeding. The cases observed were for the most part in very young infants, and the cause he suggests is that previously brought forward by Finkelstein: the possibility of the late development of the sucking reflex in these infants. The most efficient treatment he found to be the substitution of shorter intervals of feeding, three hours instead of four hours. This was continued only two to three weeks, when a return could be made to the longer intervals.

Rosenstern¹⁰ and Langstein⁸ are both averse to any general change in breast-feeding to shorter intervals, although in especial cases, as here, it is indicated; in their opinion the long intervals of feeding have done much to make possible the present increase in prevalence of breast-feeding. Other therapeutic measures advised by Rosenstern in this condition are: a temporary "*allaitement mixte*" which may often be discontinued after ten to twenty days; the giving after each feeding of breast-milk which has been pumped off; the administration of small amounts of pepsin and hydrochloric acid.

Langstein⁸ advises buttermilk for "*allaitement mixte*" if the latter is necessary; and believes that it is unimportant whether the supplementary feeding be given after each nursing, or as separate feedings.

As a method for determining the amount of breast-milk taken by the infant the regular weighing before and after each feeding for two successive days is coming into general use; it is especially recommended by Langstein,⁸ Rosenstern,¹⁰ Jones¹¹ and others. Reuben⁶ considers this method less practical than the weighing of the infant before and after a week on exclusive breast-feeding and noting the gain or loss.

Engel¹⁵ has made an interesting observation relative to the souring of breast-milk. He finds that this depends to a large extent on the fat, and that the cream shows a much higher acidity than the whole milk.

On the subject of the wet-nurse problem, there have been interesting and practical studies by Hoobler, Talbot and Lee. Hoobler¹² reports the results of a successful experiment in the collection of human milk for hospitals, from women who came to the hospital once or twice daily. He believes that it is possible to obtain breast-milk in this way at a moderate price in any hospital, through cooperation with the Social Service Department.

Lee¹⁴ tells of the excellent results which were obtained in a series of foundlings under the care of wet-nurses. Of thirty-one infants, twenty-three developed well; of these many had been extremely atrophic infants.

Talbot¹³ describes the very successful wet-nurse directory established under the supervision of the Massachusetts Babies' Hospital.

ARTIFICIAL FEEDING

General

17. Howland: AM. JOUR. DIS. CHILD., 1913, v, 390.
18. Rosenstern: Ergebn. d. inn. Med. u. Kinderh., 1911, vii, 337.
19. Morse: New York Med. Jour., 1913, xcvi, 477.
20. Lederer: Ztschr. f. Kinderh., 1914, x, 90.
21. Schloss: Ueber Saulings ernährung, Berlin, 1912, Karger.
22. Leopold: Arch. Pediat., 1914, xxxi, 20.
23. Barhdt: Jahrb. f. Kinderh., 1913, lxxviii, 598.

24. Barhdt and Edelstein: *Ztschr. f. Kinderh.*, 1914, x, 303.
25. Langstein: *Jahreskurs f. Aerztl. Fortbild.*, 1913, iv, No. 6.
26. Rulison: *Arch. Pediat.*, 1913, xxx, 762.
27. Phillipson: *Monatschr. f. Kinderh.*, 1913, xii.
28. Reinach: *Ztschr. f. Kinderh., Ref.*, 1914, vii, 397.

Howland¹⁷ considers our guides in infant feeding in regard to the amounts to be given. He criticizes the caloric standard, as the energy quotient of 100 calories pro kg. body-weight was first determined on the basis of calorimetric observations made on children at rest. He has shown that the heat elimination of infants crying or making active movements is 18 to 39 per cent. greater than that of those at rest; so that by this method one cannot learn the total amount of energy that should be furnished the normal growing child. He criticizes also the statistical method, in which the intake of food of normal thriving breast-fed infants has been systematically measured for long periods, on the ground that the composition and hence the caloric value of breast-milk varies greatly.

Rosenstern¹⁸ has made clinical observations on many artificially fed infants, and has found that 100 calories pro kg. of body-weight is sufficient for a normal gain on diets which are poor in fat and rich in sugar; while on those with much fat and low sugar more calories are needed. He advises an increased energy quotient for premature and atrophic infants. Langstein⁸ comes to the same conclusion. The same authors discuss the importance of the various constituents of cow's milk, in the artificial feeding of the infant. The water content is of the first importance, the salts and carbohydrate next, gain in weight and water retention being to a large degree dependent on the salt and sugar content. Rosenstern believes that knowledge of this fact is of great practical importance at the present time, when so many of the therapeutic foods are based on the principle of a reduction of the whey content. The loss in weight of a child changed to a diet poor in salt is the greater the richer the previous diet was in this constituent. A child changed from a diet rich in salt to breast-milk, which is comparatively poor in salt, will show a loss in weight. Carbohydrates are absolutely essential to life. The minimum amount of sugar that it is safe to give varies with different children, but is placed by these authors at 1.5 per cent. Without carbohydrates a gain in weight is impossible. Protein is apparently necessary in smaller percentage than is sugar, as shown by its relatively low content in breast-milk. Fat they believe to be entirely replaceable by carbohydrates; children have been fed on fat-free mixtures for months without symptoms, in case the caloric needs are covered.

Czerny agrees that gain in weight depends on the carbohydrates, but does not agree that it is proven that fat may be entirely replaced

by carbohydrate without harm; Morse¹⁹ and others believe that fat is of great importance, especially to the young infant.

Lederer²⁰ has studied the importance of water to the infant metabolism.

The relation between artificial feeding and a decrease in the immunity to infections has been the subject of considerable study. Czerny² has studied the relation of natural immunity to different foodstuffs. He quotes the animal experiments of Weigert, which showed that those fed on high percentages of fat have the greatest resistance against tuberculosis, while those on high carbohydrates have the least. Czerny has found that children fed on diets rich in fats (including breast-milk) have the greatest resistance to infection, while children on diets rich in carbohydrates, but poor in fat, have the least natural resistance. The latter fact he attributes to the greater water content of the tissues on this diet; a high water content being always associated with low natural immunity. Kleinschmidt¹ studied this subject by observing in animals the effects of different foods on the formation of certain antibodies, such as hemolysins, agglutinins and bacteriocidins. He found that young dogs on diets rich in carbohydrates or fat did not necessarily show any diminution in antibody formation, but that the dogs who acquired disturbances of nutrition on these artificial diets did show a decrease in hemolysins, which returned to normal during convalescence.

Artificial Feeding of the Normal Infant

Morse¹⁹ advises feeding by the percentage method, as thereby greater individualization of cases may be practiced.

The simple dilutions of milk (one-third, one-half, two-thirds) with water or barley water, enriched with carbohydrate, are recommended by various writers: Rulison,²⁶ Philippon,²⁷ Reuben.⁶ They are in general use in Germany, and are becoming widely used in this country. On account of their simplicity they are generally used in feeding at Infant Welfare stations. The relative value of the various sugars is treated below in another connection. The early addition of fruit juices and vegetable purées to the diet (at the seventh or eighth month) has been recommended again by Langstein.²⁵ In the feeding of children from 1 to 3 years of age he urges the reduction of the amount of milk taken, the addition of larger amounts of fruit and vegetables, with meat in the second year, and the avoidance of eggs.

Efforts are being continually made to prepare a diet for normal children superior to the simple milk dilutions; the most important of this class are the Friedenthal milk and the "whey-adapted" milk of Schloss. Both were originated with the purpose of imitating breast-milk as nearly as possible. In both a marked dilution of the salt con-

tent is a principal feature. Friedenthal, according to Bahr^{23, 24} has ignored recent findings as to the dangers of fermentation of lactose, and those of a high fat content, and has simply attempted an imitation of the composition of breast-milk. Schloss, he says, at first used this milk, but not finding it successful, developed from it his own whey-adapted milk, which is in reality entirely different. Friedenthal's milk consists of the following ingredients:

Skimmed milk	330	c.c.
Water	660	c.c.
Lactose	68.9	gm.
"Molkerei" salts	1.89	gm.
Fat (in cream) to.....	4.5	per cent.

The "molkerei salts" consist of two parts KCl, one part K_2HPO_4 and one part KH_2PO_4 . These are added to bring the composition of the mixture in regard to the separate salts as near as possible to that of breast-milk. At first only the cream was pasteurized, the milk being sterilized by centrifuging; but as the bacterial count was found to be very high the milk also was pasteurized during July and August. Bad effects from the milk, even when showing an extremely high count, were not frequent. Bahr²³ believes that this has a bearing on the question of the relation of bacterial contamination of milk to summer diarrhea. In its composition as compared with that of breast-milk it shows equal percentages of fat and lactose, while those of proteid and salt are higher. This diet was given to 150 children; of these eighty-nine were considered in the review. Among these were healthy, new-born, premature and sick infants. The results as to gain in weight, confirmed by the good retention of nitrogen and ash in prolonged metabolism experiments, were very satisfactory. In the healthy children the average weekly gain was 123 gm. No immunity to parenteral infections is conferred by this food, but it is noticed that the infants pass through them with little disturbance of nutrition. Frequently there is vomiting, and the stools are often abnormal, apparently without clinical significance, resembling in this respect the stools of breast-fed infants. Bahr²³ and Edelstein conclude that Friedenthal's theory of the benefits of a food approximating breast-milk in composition has been proved true in practice, and that the food has been shown to be far superior to simple milk dilutions as a food for normal infants.

Langstein²⁵ warmly recommends the Friedenthal milk. Confirmation from other sources has not so far appeared; in a matter of this importance it is to be anxiously awaited.

The "whey-modified milk" of Schloss²¹ is essentially a diet rich in fat and proteid, poor in salt, with the addition of carbohydrates which

are not easily fermented. It resembles the group of substitutes for albumin milk to be later described; but differs in that it was developed in an attempt to imitate breast-milk. To milk diluted with twice the amount of water is added fat, in the form of cream, proteid in that of the preparations "nutrose" or "plasmon;" the carbohydrates added are a very finely ground maize flour and *Nährzucker* (dextrin-maltose). In addition a small amount of potassium chlorid is added. Schloss fed two hundred infants on this food for about a year with very good results; the development, color and stools all being normal.

Leopold²² describes the preparation of this food as recommended by Schloss and reports a series of thirty cases, which were, however, not normal; all had nutritional disturbances. In no case did he see harm from its use. It appeared especially indicated in young infants, while older children often showed no gain.

Reinach²⁸ has also used this food; his results in normal infants were but moderately successful when the food was used alone; when it was used as "*allaitement-mixte*" they were more successful. He, too, saw the weight stationary for long periods; it increased, however, when sugar was added. Of twenty-one cases of sick infants on this feeding, sixteen showed recovery.

ARTIFICIAL FEEDING OF THE SICK INFANT

29. Benfey: *Jahrb. f. Kinderh.*, 1913, lxxvii, 475.
30. Finkelstein and Meyer: *Monatschr. f. Kinderh.*, 1909, viii, 8.
31. Finkelstein and Meyer: *Jahrb. f. Kinderh.*, 1910, lxxi, 525.
32. Finkelstein and Meyer: *München. med. Wchnschr.*, 1911, lviii, 315.
33. Meyer: *Jahrb. f. Kinderh.*, 1913, lxxvii, 85.
34. Wilcox and Hill: *AM. JOUR. DIS. CHILD.*, 1913, v, 297.
35. Hoobler: *AM. JOUR. DIS. CHILD.*, 1913, v, 308.
36. Meyer: *Halbmonatschr. f. soziale Hygiene u. Prakt. Med.*, 1912, No. 9.
37. Nobécourt and Schreiber: *Bull. de la Soc. de Pédiat.*, 1913, xv, No. 7.
38. Ribadeau: *Nourrison*, 1913, i, 162.
39. Beck: *Klin.-therap. Wchnschr.*, 1913, xxv, 740.
40. Heim and John: *Ztschr. f. Kinderh.*, 1912, iv, 1; Heim and John: *Monatschr. f. Kinderh.*, 1913, xi.
41. Frank: *Monatschr. f. Kinderh.*, 1913, xii, 151.
42. Engel: *Deutsch. med. Wchnschr.*, 1913, xxxix, 1251.
43. Engel: *Jahrb. f. Kinderh.*, 1913, lxxviii, 299.
49. Hoobler: *Arch. Pediat.*, 1914, xxxi, 174.
50. Aschenheim: *Monatschr. f. Kinderh.*, 1913, xii, 229.
51. Steinitz and Weigert: *Monatschr. f. Kinderh.*, 1913, xii, 243.

The interest this year has centered about the group of albumin milk and its substitutes. Whey and whey-soup have also been used. There are few new publications on buttermilk or on malt-soup.

ALBUMIN MILK

Albumin milk has now been proved to be of the greatest value as a therapeutic food in the nutritional disturbances of infancy. This is shown not only by its widespread use, but also by the large numbers of substitutes and imitations, descriptions of which have dominated the literature on infant feeding for this year.

Benfey²⁹ gives a careful review of the literature on albumin milk from its introduction in 1909 until April, 1913. Finkelstein and Meyer, he says, in their first publication, described its essential qualities as consisting of a high percentage of proteid, with a moderately high fat content, and a very low percentage of the salts and of milk-sugar. The chief benefits of the food are a reduction of fermentation in the intestine, and a substitution for it of putrefactive changes, leading to the characteristic calcium soap stools. With the cessation of diarrhea a gain in weight is made possible; also an increase in tolerance to all foods occurs.

Finkelstein and Meyer^{30, 31} in their earliest publications, advised its administration at first without carbohydrate; this was to be added later only when the stools became normal. After much clinical observation they have, however, become convinced of the great dangers of too complete and too prolonged withdrawal of carbohydrates, as leading to marked initial losses in weight, with later stationary or gradually falling weight. In their later publications,^{32, 36} therefore, they advise that albumin milk without sugar should not be used; 1 per cent. of sugar should be given at first and this should be rapidly increased to 2 to 3 per cent., and later, if there is no gain in weight, to higher amounts. Benfey adds from his experience at Finkelstein's clinic that there albumin milk with less than 3 per cent. sugar is never used. As explaining this procedure, the authors maintain that in the medium of albumin milk, sugar is tolerated in amounts that cause trouble when given in other media; as sugar is essential for a gain in weight, this is one of the chief advantages of the food.

Benfey reviews, at some length, the results of different observers with albumin milk from the time of its introduction. As the first series of cases were all treated according to the first directions of the originators, that is, with a very late and meager addition of carbohydrates, Benfey believes that they do not give a fair picture of what can be accomplished with this food. The results were, on the whole, favorable, and many authors expressed the opinion that albumin milk is a valuable aid in all nutritional disturbances. The reports from other countries, as from France and America, have been less favorable than those from Germany; there, however, he believes, the fear of giving carbohydrates has persisted longer. In the series from these

sources, in which exact data as to dosage are given, Benfey has found errors in technic, especially in the giving of too little carbohydrate, or in beginning too late, or in withdrawing it a second time. In reports in which no data are given, he assumes that the same errors in technic are at fault. He quotes Finkelstein as saying that no one should express an adverse opinion on albumin milk, who has not followed the later instructions as to dosage. Benfey concludes that the general opinion of the majority of authors is that they can obtain results in certain cases with albumin milk which cannot be achieved with any other form of artificial nourishment. The chief criticisms of the food are:

1. Its costliness, if obtained at a laboratory, and its difficult preparation if it is made in the hospital or home.
2. Its disagreeable taste and appearance.
3. An alleged tendency to cause eczema, and also one to cause rachitis or Barlow's disease, if fed for too long periods.
4. Poor results obtained in disturbances resembling dysentery.

He adds a valuable résumé of the indications for use, and the technic of feeding of albumin milk according to the present status of experience.

Indications for Albumin Milk

Albumin milk he believes to be indicated in all disturbances of infants accompanied by diarrhea, including these disturbances when associated with parenteral infections; also in all nutritional disturbances not reacting to other forms of artificial feeding. This includes true bacterial enteritis, in which Finkelstein has achieved very good results in spite of some adverse criticisms by other writers. Only in "weight disturbance" (*Milchnährschaden* of Czerny) better results are obtained with mixtures rich in carbohydrates, such as malt-soup.

Technic for Use of Albumin Milk

1. In dyspepsia and decomposition: Weak tea only should be given for six hours; then albumin milk at the rate of 300 gm. in twenty-four hours with 3 per cent. *Nährzucker*. In mild cases and in older children even more should be given. The daily amount is then to be rapidly increased without respect to the stools or other symptoms until 180 to 200 gm. per kilogram of body-weight is given in twenty-four hours. After cessation of the diarrhea, the sugar is to be increased to 5 per cent.; when there is no further gain in weight, to 6, 7, or 8 per cent. In children over 3 months flour should be added in the amount of 1 per cent.

In subtoxic cases, or those on the borderline between dyspepsia and intoxication, the amount should be only 150 to 200 gm. for the first

twenty-four hours with 3 per cent. sugar; the increase should then be more gradual, as in intoxication.

2. Intoxication: Weak tea only is given for twelve to twenty-four hours; then for twenty-four hours ten feedings of 5 gm. of albumin milk with 3 per cent. sugar, after each of which large amounts of water or tea should be given. The amount should then be increased very gradually by 50 gm. daily, until severe diarrhea stops; after which a more rapid increase should daily be made until the amount of 180 to 200 gm. per kilogram body-weight is reached. At this point at latest, the carbohydrates should be increased; but if meanwhile the fall in weight has not stopped, carbohydrates should be added earlier. In case diminution of the toxic symptoms does not occur, the amount should be increased only to the point of 130 to 150 gm. per kilogram body-weight with 3 per cent. sugar; at this point one should stop until toxic symptoms disappear. An attempt to bring about lessening of the toxic symptoms by a second withdrawal of food is extremely dangerous and often fatal. Benfey warns against the use of albumin milk combined with any other food. It has been much used as "*allaitement mixte*" with human milk; but here he believes the results with buttermilk are better.

The cause of the beneficial results of albumin milk has been considerably discussed, especially in relation to the substitutes. The general result is a change in the predominating bacterial flora of the intestine; bacteria of the fermentative group lose the ascendancy, which is gained by those of the putrefactive group; this condition is far more favorable and permits the formation of soap stools with foul odor. The elements favoring this change are, according to the early publications, the high percentage of proteid, and the low percentage of salt and of milk-sugar.

Stoeltzner⁴⁴ believes that the success of certain substitutes proves that the diminution in salt and sugar, also the large amount of fat, are of minor importance; that the feature of albumin milk essential to its success is the high content of proteid and calcium.

Wilcox and Hill³⁴ report on results with a modification of albumin milk, in whose preparation skimmed milk was used, the fat content consequently being very low. In its administration they did not follow the rules laid down by Finkelstein, as they omitted the preliminary time of hunger or tea diet; did not add sugar at once, but only after an improvement in the stools. They used the albumin milk only as a corrective and only for short periods, as they found that gain in weight followed very slowly or not at all.

Hoobler³⁵ studied the metabolism of children fed on protein milk made in this way, having the following composition: proteid 2.8 per

cent., carbohydrates 2.4 per cent., fat .8 per cent. He found that on this large amount of proteid the nitrogen intake was increased over the normal, and its retention good, being 27 to 35 per cent. He quotes the important findings of Holt and Levene as to the clinical composition of the stools on diets high in protein, showing a decrease in acidity, together with one in the volatile fatty acids, a great increase in the soaps, with an improved retention of the mineral salts and a decrease in the amount of water lost.

G. Meyer³³ reports on the successful use of albumin milk in dispensary work; he favors a slight modification of technic, as follows: Children who are markedly atrophic should be given more than the usual 200 gm. per kilogram body-weight; sugar should not be added in larger amounts than 5 per cent.

Two more unfavorable reports on albumin milk have come recently from France. Nobécourt and Schreiber³⁷ think it illogical to suppress the lactose of the milk and add maltose. They believe the absence of sugar is dangerous. They administered the food in twenty-one cases, with good results in only two.

Ribadeau³⁸ saw bad effects, characterized by a sudden collapse with coma, after the use of albumin milk, even though he had followed exactly directions as to its use.

Beck³⁹ reports a series of 300 cases of nutritional disturbance treated with this food. He believes that there is at present no other artificial food which, in severe sickness, leads to recovery with such rapidity, certainty and frequency as does albumin milk.

SUBSTITUTES FOR ALBUMIN MILK

The faults of albumin milk previously referred to, particularly its expensive and difficult preparation, have limited its usefulness, especially in private practice. Here it is almost excluded except in cities with milk laboratories and among the rich. Its other disadvantages, such as its unattractive appearance and taste and its tendency to clump unless very carefully heated, are of less importance, but are definite drawbacks. Hence many pediatricians have been striving to originate foods without these disadvantages, yet incorporating its essential principles, and giving the same results. Many of these substitutes have been introduced, and for many of them results "at least as good" as those of albumin milk have been claimed; yet I believe until the results are more fully corroborated, those who can obtain albumin milk will continue to use it. To those who are not able to obtain it, one or the other of these simpler substitutes are recommended.

The first modification was that of Heim and John,⁴⁰ who on account of difficulty in obtaining good buttermilk used in its stead

skimmed milk diluted one-half or two-thirds with water, to one liter of which the curd, that is the proteid, fat and calcium, from two-thirds of a liter of whole milk was added after fine subdivision through a sieve. The essential feature is then the substitution of skimmed milk for buttermilk. They give the histories of cases receiving this feeding, with results resembling those of albumin milk.

Frank⁴¹ made comparative metabolism experiments comparing children fed on diluted whole milk with three children fed on milk enriched with casein and fat as above. The conclusions are that on this feeding carbohydrate absorption is good, the retention of nitrogen normal, the fat resorption normal.

Engel^{42, 43} finds that Heim and John's preparation is still too difficult for practical use, as it involves the fine subdivision of the curd through a sieve. This he attempts to avoid by very careful dosage of the lab ferment; by this means he obtains a curd with fine flocculi. He then dilutes the mixture with an equal amount of water, and after the casein flocculi have settled, pours off one-half of the supernatant fluid. He obtains a mixture in which the whey is diluted one-half, while there is a relatively high percentage of proteid, fat and calcium. He advises the use of this casein milk in the same amounts as those advised for albumin milk, with the same additions of sugar.

On comparison of the composition of this diet with that of albumin milk, it is shown that the percentages of proteid and fat are the same, but that those of sugar and calcium are higher in the casein milk. His results, in nine months' use, are, he says, as good as those with albumin milk.

Hoobler⁴⁹ has used a modification in which he employs casein flour. This he adds in the amount of 10 gm. to one pint of fat-free buttermilk and one quart of warm water. In some cases he uses the artificial buttermilk, which contains fat. With this preparation he has attained very good results. Its chief advantages are its cheapness, and ease of preparation, recommending it for private and dispensary practice.

Aschenheim,⁵⁰ led by the importance of calcium in the formation of the firm soap stools, tried adding calcium in the amount of 7 to 10 gm. in 10 per cent. solution to the diet. He gave it in all types of nutritional disturbances, and never saw any unfavorable symptoms; the results were fairly good, but not to be compared with those of albumin milk. The best results were obtained in dyspepsia, the worst in dyspepsia caused by parenteral infections.

Steinitz and Weigert,⁵¹ seeking a diet very poor in fat for use in acute disturbances have used "whey-soup," which is merely whey to which 4 per cent. mondamin is added. They use it with good results in the same way that Stolte used buttermilk with mondamin, giving only one to three feedings daily of this preparation, the other feedings being simple milk dilutions.

STARVATION

Some extremely interesting work is that done chiefly by Finkelstein, Meyer, Rosenstern and Langstein on the subject of the importance of starvation to the infant. A good deal of this work dates back to 1911 and 1912, but has not been reviewed in this journal.

In an excellent review of all the work done on this subject, together with an account of his own clinical observations, Rosenstern¹⁸ says that at the present time the good effects of starvation are so generally accepted that its dangers are neglected. The latter are not important to the healthy infant, but are extremely great to the sick child. In atrophic babies, hunger often leads to a fatal collapse; so that in these cases a tea or water diet should not be given at all, but small amounts of food from the beginning. Also in overfed children, especially those previously on a high percentage of carbohydrates, starvation will sometimes lead to an extreme and even dangerous loss in weight. Starvation as a therapeutic measure is most successful in acute disturbances, such as dyspepsia and intoxication; it is dangerous in chronic and recurrent affections. When used as a therapeutic measure, the following procedure should be employed: complete hunger for a short space of time, followed by small amounts of food, which are rapidly increased. The opposite procedure, with a gradual diminution in the amount of food given, leads, as he demonstrates by charts, to much greater losses in weight. He warns against this method, as well as against the starving of an infant many times in succession. Langstein⁸ has confirmed and amplified this work.

The qualitative starvation in different foodstuffs is considered by both; water, sugar and salt starvation are the most important and dangerous.

THE NUTRITIONAL DISTURBANCES OF INFANTS

52. Dunn: Boston Med. and Surg. Jour., 1913, clxviii, 161, 168.
53. Finkelstein: Ztschr. f. Kinderh., 1913, vii, 67.
54. Smith: Boston Med. and Surg. Jour., 1913, clxix, 756.
55. Koplik: Arch. Pediat., 1913, xxx, 484.

The majority of American authors believe that our present classifications of the nutritional disturbances are temporary and will soon be changed.^{55, 19} Dunn⁵² classifies them, on an etiological basis, into two chief types:

1. Those caused by foodstuffs: fat, carbohydrates, proteid, salt. Within this main group he includes two sub-groups:

- a* Those caused by abnormal digestion or absorption of several foodstuffs, especially fat and proteid, shown by vomiting and dyspeptic stools, the treatment for which consists in a reduction of these substances.

b A little understood group, characterized by intolerance to salt, fat and milk-sugar; which is best treated with a diet containing little fat and sugar, and much casein.

2. Disturbances caused by bacterial infections. Of these the majority of the causative agents, except dysentery and gas bacilli, are unknown. They are best treated with buttermilk.

Smith⁵⁴ gives a similar classification. Finkelstein⁵⁵ has expanded and modified his former classification, without, however, changing its main features. He considers the introduction of the term "nutritional disturbances" as of value; but thinks that at present too many heterogeneous conditions are included under the term. He divides the "alimentary disorders" into two main classes:

1. Nutritional disturbances due to an error in diet; that is, to an exogenous cause.

2. Nutritional disturbances from endogenous causes, such as essential anomalies of growth and development, and to constitutional diseases, such as rachitis and spasmophilia.

Finkelstein does not believe that these disturbances can best be classified on an etiological basis, as has been done by Czerny; for he shows that in the causation of any disturbance many factors combine as nutrition, infection, constitution, heat, etc., and that rarely has a disturbance but one cause. Hence he uses as a basis for his classification the essential clinical features, using the etiology, however, as a secondary means of differentiation. The group of nutritional disturbances of exogenous cause he divides into (1) dystrophies, or conditions due to faults in diet, without marked disturbances of the gastro-intestinal function. This includes several types of the "*Bilanzstörung*" of his older classification. (2) Alimentary toxicoses, which do show gastro-intestinal and metabolic disturbances, such as diarrhea and marked losses in weight. These include the less and more serious conditions: dyspepsia, decomposition and intoxication. All these may arise from a purely alimentary basis; or from a mixed cause, alimentary and infectious. In disturbances from the latter cause the prognosis is far more serious, as the ability of the organism to secrete digestive juices and ferments is decreased and internal metabolism is attacked. He believes that the colloids in close relation to carbohydrate and salt metabolism are so changed that the salt and water content of the organism is threatened.

Etiology

56. Howland: AM. JOUR. DIS. CHILD., 1913, v, 390.

57. Langstein: Jahreskurs. f. Aertzl., Fortbldg., 1913, vii, No. 6.

58. Feer: Jahrb. f. Kinderh., 1913, lxxvii, 1.

59. Jörgensen: Monatschr. f. Kinderh., 1913, xii, 386.

60. Wood: Arch. Pediat., 1914, xxxi, 259.

61. Bendix: Ztschr. f. Kinderh., 1913, vi, 468.
62. Klotz: Ergebn. d. inn. Med. v. Kinderh., 1912, viii, 593.
63. Morse: Jour. Am. Med. Assn., 1913, x, 875.
64. Talbot: Arch. Pediat., 1913, xxx, 244.
65. Southworth: Arch. Pediat., 1913, xxx, 732.
66. Holt and Levene: Med. Klin., 1913, ix, 258.
67. Neuhaus and Schaub: Ztschr. f. Kinderh., 1913, vii, 310.
68. Lust: Jahrb. f. Kinderh., 1913, lxxvii, 383.
69. Calvary: Ergebn. d. inn. Med. u. Kinderh., 1913, x, 699.
70. Hahn: Jahrb. f. Kinderh., 1913, lxxvii, 405.
71. Hess: AM. JOUR. DIS. CHILD., 1913, v, 457.
72. Grulee: Jour. Am. Med. Assn., 1913, lxi, 1022.
73. Gildemeister and Baerthlein: Deutsch. med. Wchnschr., 1913, xxxix, 982.
74. Vaughan: Jour. Am. Med. Assn., 1913, lxi, 1761.
75. Baerthlein and Huwald: Deutsch. med. Wchnschr., 1914, xl, 478.
76. Bauer, Ellenbeck and Fromme: Arch. f. Kinderh., 1913, lxi, 35.
77. Siegel: Arch. f. Kinderh., 1913, lx-lxi, 689.
78. Weihe and Shürer: Ztschr. f. Kinderh., 1914, x, 36.
79. Smith: Boston Med. and Surg. Jour., 1913, clxix, 756.
80. Kendall: Boston Med. and Surg. Jour., 1913, clxix, 741, 749, 754.
81. Vincent: Arch. Pediat., 1914, xxxi, 53.
82. Vincent: AM. JOUR. DIS. CHILD., 1914, vii, 97.
83. Vincent: Am. Jour. Obst., 1913, lxviii, 1204.
84. Keuper: München. med. Wchnschr., 1914, lxi, 474.
85. Bowditch: Arch. Pediat., 1913, xxx, 866.

The views of the different schools of pediatrics as to the etiology of the nutritional disturbances of infants are becoming gradually reconciled, as there has come to be a general agreement that the principal cause may be either one of two general causes: food or bacterial infection. In Germany the chief prominence is given to the influence of the different food elements, together with the predisposing action of certain other factors, such as hot weather and parenteral infections; yet there, too, there has been a great increase in interest in the intestinal infections, especially of the dysentery group. In America, on the other hand, while the influence of the different bacterial infections is still considered of the greatest importance, especially in the etiology of the summer diarrheas, yet there is greater interest than before in the harmful action of the foodstuffs.

Influence of Food and Foodstuffs

Howland⁵⁶ gives a valuable critical review of our present knowledge of the rôle of the different elements—proteid, fat, carbohydrate and salt—in the causation of these disturbances, and shows how on each in turn has fallen the blame. The damaging influence of sugar and salt, now given the principal place as causing the acute disturbances, may, he considers, be exaggerated.

Langstein⁵⁷ and Feer⁵⁸ both believe that separate food elements should no longer be considered the primary causes of the nutritional disturbances, but rather a faulty correlation between them. Lang-

stein believes the ingredient of chief importance in cow's milk is the whey (or salts and sugar in solution). He quotes Meyer's well known "whey exchange" experiment in proof of this. The combination of a high whey content with a high sugar and low proteid percentage causes the greatest number of nutritional disturbances. Increase of the proteid reduces the danger. A high percentage of whey can be tolerated if the sugar is low; of such diets buttermilk is an example. The cause of this is unknown, according to Langstein; two possibilities may be considered: that the whey is injurious to the intestinal wall, and causes a greater permeability for various substances; or that the whey stimulates carbohydrate fermentation.

Feer, on the other hand, thinks the relation between fat and whey is most important; mixtures rich in both fat and whey are harmful, but after removal of the fat they are well borne.

Salts

The rôle of the salts, in combination, as above, with sugar or fat, is at present in Germany placed in the highest position of importance as the damaging substance in cow's milk. Its reduction is the foundation both of the proposed normal foods for infants, such as the Frieden-thal milk and Schloss's whey adapted milk, and of the chief therapeutic foods, such as albumin milk and its substitutes. The chief theory of its harmful action is the second named by Langstein: that it favors acid fermentation by bacteria of carbohydrate if this is present in large amount, with the production of an excess of the low fatty acids and the consequent irritation of the intestine. Large amounts of proteid change the process to one of putrefaction.

Salt fever, or the temperature previously caused by parenteral injections of salt solution, has again been proved by Jörgensen⁵⁹ not to occur, if the water used as diluent for the salt solution be freshly distilled and sterile. This had previously been shown by several observers, among them Samelson and Bendix. Hence a direct fever produced by salt seems excluded. Wood⁶⁰ has reviewed the rôles of the salts in the infant's nutrition.

Carbohydrates

The action of the carbohydrates as related to that of the salts has already been reviewed. Some difference of opinion still exists as to the comparative harmfulness of the different sugars. Lactose is recommended by Morse¹⁹ as the least harmful. The various combinations of maltose with dextrin are most often advised by German authors. Calvary considers lactose as good as cane-sugar. Bendix⁶¹ fed different forms of sugar to thirteen infants in order to determine which caused the least trouble. He found, contrary to the usual findings,

that cane-sugar caused the least fermentation, lactose the most, while maltose held a position midway between the two. Maltose, however, led to a greater gain in weight. He strongly advises the use of cane-sugar on account of its cheapness. Klotz⁶² has found that the various flours vary greatly in their properties but so far the indications for the various flours are not certain.

As to the much discussed "sugar fever," Kleinschmidt⁶⁹ showed that on intravenous injection in rabbits of an isotonic dextrose solution, the diluent of which was freshly distilled water, he obtained no rise of temperature. With an isotonic lactose solution he did, however, obtain a rise of temperature which he believes may be due to bacteria in the milk-sugar.

Fat

The rôle of fats as an exciting cause of the nutritional disturbances is given varying importance by different writers. The point is still unsettled whether acute dyspepsia is or is not caused by fat. Feer, as before shown, believes that fat in a medium containing a high whey percentage may cause acute disturbance. Dunn⁶² believes that there are acute disturbances due to fat, shown by vomiting and dyspeptic stools. Talbot⁶⁴ writes that there is an indigestion due to fat, the symptoms of which may be identical with those of one caused by sugar or protein, so that information as to the cause must be drawn from the vomitus and the stools. The vomitus he describes in these cases as creamy, while the stools macroscopically show soft curds, and microscopically much fat and soap. He adds the description of a staining method by means of which the proportionate amounts of fat, fatty acids and soaps can be determined. The action of fat as tending to induce vomiting and delay of food in the stomach has long been considered well established. The comparison of the gastric mobility with different foods by Ladd¹²⁷ tends rather to show that fat has less effect in the latter direction than casein.

The chief disturbance caused by fat is still considered that chronic condition known as "*Milchnährschaden*," "*Bilanzstörung*," or "weight disturbance." This is reiterated by Finkelstein, Howland, Langstein, Feer and others.

Southworth⁶⁵ calls attention to a closely related symptom, the ammoniacal odor of the diaper in certain infants receiving a large amount of fat. The explanation, he believes, is to be found in the metabolic changes described by Czerny in that condition. The essential change is an increase in acid formation, and the using up to neutralize it of fixed alkalies and of ammonia. The ammonia salts are excreted in the urine, to which they give the characteristic odor. As

the acid may also be neutralized by alkali taken by mouth, he finds that the trouble readily yields on the administration of alkalies while the percentage of fat is reduced. He reports five cases, fed on high percentages of fat, showing an ammoniacal odor of the urine which disappeared on this treatment.

Proteid

Morse¹⁹ does not believe that proteid is entirely harmless, while most of the German writers, among them Langstein, do consider it so. Combé has described a dyspepsia caused by albumin. Holt and Levene⁶⁶ have found that large amounts of casein by mouth can cause a rise in temperature. During the course of experiments in which a "synthetic food" very rich in casein was fed, they observed five times a rise in temperature, which continued until the food was changed, but then subsided to normal. This fever only occurred when 6 per cent. casein had been administered, with very small amounts of milk. Preceding the rise by three or four days and accompanying it, there was in all cases a retention of the chlorids. Other causes for this fever, such as salts, or a possible change in the intestinal flora, the authors believe are excluded. They call attention to the parallelism between this fever and that produced by Vaughan by the parenteral injection of proteins.

The association of anaphylaxis with some of the disturbances caused by cow's milk has always been a field for speculation; but so far the evidence has been very meager and inconclusive. Neuhaus and Schaub⁶⁷ report an interesting case, suggestive in this connection. A healthy child who had previously been breast-fed, but who had probably received small amounts of cow's milk, became very ill when he received a large amount of cow's milk. The symptoms were suggestive of anaphylactic shock, and there were large numbers of eosinophils in the stools. After recovery, a similar attack was induced by feeding casein from cow's milk, while casein from breast-milk and the whey from cow's milk had no effect. Later the child showed perfect tolerance to cow's-milk casein.

Hypersensitiveness to cow's milk could not exist without a passage of protein unchanged through the intestinal wall; this has been proved not to occur in the normal infant after the first weeks. That an increased permeability of the gastro-intestinal epithelium for foreign proteid occurs in children with nutritional disturbances has been proved by Hahn and Lust. Lust⁶⁸ fed different forms of foreign proteid to children with such disturbances, and then employed the following tests to determine whether or not the protein had passed through the intestinal wall unchanged: the urine, and in some cases the blood serum, were tested with a serum having a strong precipitation titer for

the protein which had been fed; also guinea-pigs were injected with the urine and after three weeks tested with the homologous protein for sensitization. He also studied the permeability in animals in which a gastro-enteritis had been produced by a strong sugar solution. In the experiments on infants he found that egg albumin passed through the wall nine times out of sixteen cases of acute and chronic nutritional disturbances, while ox serum passed once only out of seventeen cases, the passage being most frequent in acute intestinal disturbances, especially intoxication. The normal protective forces of the organism against the absorption of unchanged protein consist in two things: digestion of the proteid by gastric and pancreatic juices; and the normal resistance of the epithelial cells of the intestine to the passage of the protein. In nutritional disturbances, as the digestive juices are present, the fault must lie in the decreased resistance of these cells. He claims for his method considerable clinical value as a functional test of the condition of the intestine in nutritional disturbances. Hahn⁷⁰ has brought additional evidence to the same point, in his study of the passage of antitoxin bound to heterologous protein. It had been previously shown that the normal infant will absorb antitoxin given orally if bound to a homologous proteid, that is, if present in its mother's milk; but will not absorb it if bound to a heterologous protein, that is, horse serum. Hahn used Römer's test for the presence of antitoxin in the blood of infants to whom he fed horse serum antitoxin. Out of twenty-three cases all showing acute nutritional disturbances, there was in five a passage of antitoxin into the blood.

Vaughan⁷⁴ suggests an interesting possibility as to the cause of infantile diarrhea. He calls attention to the fact that peptone and other decomposition products of proteid cause symptoms of disease, and that "sensitization may result from the absorption of undigested or partially digested proteins from the alimentary tract. Whether or not the summer diarrheas of infancy ever originate in this way is a question to which a positive answer cannot be given. There are some good reasons for suspecting that the lowered vitality of the infant by excessive heat may lead to the absorption of undigested proteins, and in this way cholera infantum and kindred diseases may be induced."

It seems to me not quite clear from these guarded statements, whether the possibility suggested is that of an anaphylaxis to milk, due to the passage of its unchanged proteins into the blood, and the consequent development of hypersensitiveness; or that of an absorption of toxic split products of protein through the intestinal wall. The latter is the possibility spoken of by Grulee⁷² in the discussion to the above paper, and in a further article on the etiology

of ileocolitis. He recalls the fact that it has now been proved that salt and sugar on parenteral injection do not cause fever, thus undermining Finkelstein's theory that it is the abnormal absorption of these substances unchanged that produces the metabolic changes present in the nutritional disturbances. Salt and sugar in large amounts by mouth do, however, cause fever; Grulee suggests the possibility that these substances if given by mouth cause a change in the intestinal mucosa which allows absorption of the toxic products of protein decomposition from the intestine always present there. These may be endotoxins from bacteria, or may be the product of bacterial decomposition of protein. He suggests the intestinal mucus as a source of protein poisons independent of the food. Zahorsky,⁷⁴ in the discussion of Vaughan's paper states his belief that one form of diarrhea at present believed to depend on fermentation of the sugars, may possibly be due to absorption of the toxins mentioned by Vaughan. These theories, connecting the nutritional diseases with the protein toxins and with anaphylaxis are fascinating, but lack clinical and experimental proof; so that at present they remain only in the realm of conjecture.

The casein curds occasionally present in the stools of infants on unboiled milk continue to be the object of study. Hess⁷¹ has studied the site and causes of their formation. He concludes that there are several methods of inhibiting their formation: boiling of the milk (pasteurization does not prevent), the addition of sodium citrate, sodium bicarbonate or calcium citrate. The site of formation is apparently the stomach for he has found that the inside of these curds is never bile-stained; and in addition that a child who regularly passed curds when on unboiled milk no longer passed them when the same food was fed into the duodenum through a duodenal catheter. He found that some children, out of many on the same food, passed them much more frequently than others. He believes them to have little clinical importance, as their presence has no influence on the general development.

Influence of Bacteria

The bacteriological examination of the stools of infants with nutritional disturbances has long been an extremely confused field of research. Many different organisms have been described as occurring in connection with the same clinical symptoms; besides this, there has been lack of correspondence between clinical symptoms and bacteriological findings. From this confusion there has gradually emerged one fairly well defined clinical picture, called by different names: enteritis follicularis, ileo-colitis, dysentery-like diarrhea, etc., and characterized by fever, prostration, diarrhea with blood, mucus and pus in the stools, and a tendency to spread by contagion. In Germany much has been

written this year on this type of diarrhea, and the tendency is to confirm the earlier findings of American authors as to the frequent occurrence of dysentery and pseudo-dysentery organisms in these cases. In America, on the other hand, this clinical syndrome is associated with bacterial infection in general; and other organisms, especially the gas bacillus and the streptococcus, besides the dysentery and pseudo-dysentery bacilli, have been found closely associated with it. One point, not yet settled to my knowledge, is the relative importance and frequency of this type of disturbance in proportion to the entire number of cases of diarrhea which occur.

This form of diarrhea has long been recognized in Germany as an entity, but the tendency has been to consider it as only rarely a specific infection, and more usually merely the result of prolonged injury by food, leading to anatomical changes in the intestine. This theory still prevails in the minds of most of the writers on the subject, as shown by their failure to make direct mention of specific infection as a cause of the disease.

Gildemeister and Baerthlein⁷³ made a systematic examination of the stools of 120 normal infants, and of seventy infants showing diarrheal disturbances. They did not study the cocci nor anaerobic organisms. For the differentiation of dysentery bacilli they used the usual cultural tests. The feces for examination they obtained by inserting a small sterile glass tube with rounded edges into the rectum. Among the seventy sick infants they found dysentery bacilli of the Y-type nine times; paratyphus four times; bacillus enteritidis Gärtner, once. In all the cases in which dysentery bacilli were found the stools were very loose and contained mucus and blood. They did not, however, find the bacilli in all the cases showing these symptoms. Of the 120 normal cases, only two showed dysentery bacilli; the brother of one of these had clinical dysentery. The authors believe that some external factor, such as a change in diet may be necessary to give the organism pathogenic qualities.

They also found proteus, pyocyaneus and coli mutabile bacilli, besides a strain not previously described, more frequently in sick than in normal infants, but decline to draw conclusions.

Baerthlein and Huwald⁷⁵ continued the same study last year, using the same technic. Among seventy-two children they found dysentery bacilli twenty-one times, paratyphus seven times, pyocyaneus twelve times. They also found dysentery bacilli in one normal case. Agglutination of the homologous strain was positive in eleven cases. Few of the strains were of the Flexner group, which they consider rare in Germany. Clinically these twenty-one cases showed fever, prostration, great loss in weight and numerous defecations with blood and mucus.

Siegel⁷⁷ analyzes the clinical symptoms in the eight cases previously reported by Gildemeister and Baerthlein. In all but one there was blood and mucus in the stools. At post mortem the findings were those of enteritis follicularis; in only one was there loss of tissue. He concludes that there is a close relation between Y-dysentery infection and follicular enteritis.

Bauer, Ellenbeck and Fromme⁷⁶ report an epidemic in an asylum, in which the agglutination reactions in especial were studied. Artificially fed children only were attacked; of 29 children on the bottle, 22 showed a positive agglutination reaction for the Y-dysentery organism; of these 11 only had clinical symptoms. In 9 of these 11, dysentery bacilli were found in the stools. The epidemic broke out with great suddenness, all the children but one in one of the wards being affected. The authors conclude that the agglutination reaction is specific; namely, that a positive reaction is only obtained in cases which have or which have had dysentery; a negative reaction under one year does not, however, exclude dysentery. Infants, they find, are very susceptible, and strict isolation should be used.

Weihe and Schürer⁷⁸ give an interesting review of the question of dysentery infection in infants in Germany. They find that the leading text-books make very little mention of it. Two epidemics have been reported by Jehle and Leiner, but for the most part the reports of American investigators have not been corroborated. This they explain in part by the fact that the American authors in their reports did not distinguish between true primary bacterial infection and nutritional disturbances as well as parenteral infections. They also believe that the great labor involved in the study of these cases has deterred many from it. The authors examined the stools of eighty-five children with intestinal disease, twenty-two of whom showed clinical symptoms suggestive of dysentery. In eighteen of these they found pseudo-dysentery bacilli, for the most part of the Y-group. They consider that blood in the stools should always be considered a suspicious symptom, and that all cases showing it should be isolated. Agglutination tests in their cases were negative or at very low dilutions. They believe that all forms of the nutritional disturbances, such as decomposition, intoxication, etc., can be caused by it. At necropsy the cases showed the typical findings of enteritis follicularis.

Keuper⁸⁴ reports an epidemic of twenty cases, also two sporadic cases. In the majority of these the organism of Kruse was found. He insists especially on a long isolation period; that negative bacteriological findings on two successive days are not sufficient to warrant discharge; and that this organism, like the typhoid bacillus, may persist for long periods in the intestinal canal after clinical recovery. He

concludes that, as infants do not form agglutinins with any regularity, the serum test is useless for diagnostic purposes.

American authors have found not only organisms of the dysentery and pseudo-dysentery groups in infectious diarrhea, but also the gas bacillus, and probably the streptococcus; and believe that still others, as yet unknown, are also at times to blame.

Smith⁷⁹ says that the symptoms in all the infectious diarrheas are the same; they are those already described above in the German publications on enteritis follicularis. These infections can only be classified by means of a bacteriological examination of the stools, which is especially necessary as the treatment depends on the causative agent. In the dysentery infections high carbohydrate percentages should be fed with low protein; while in gas bacillus infection the sugar should be greatly increased and high protein percentages should be given. He says that a number of cases not showing the gas bacillus in the stools, did well on this treatment.

Bowditch⁸⁵ reviews the work of the Boston Floating Hospital in the study of the bacteriology of the intestinal diseases of infants for the past three years. He shows that different bacteria have predominated in different years.

Kendall⁸⁰ reports more in detail the same study, and speaks also of this variation from year to year. He believes that less is known of the etiology of summer diarrhea than ever; that previously a disturbance showing blood and pus in the stools was thought always to be caused by the dysentery group, but that it is now known that similar symptoms may be caused by a variety of intestinal bacteria; also that in cases with these symptoms, pathogenic bacteria may be absent.

In 1910 dysentery infections predominated, constituting 75 per cent. of those in which an organism was isolated. The gas bacillus and streptococcus were less frequently found.

In 1911, on the other hand, the streptococcus was present in 78 out of 146 cases; dysentery bacilli in 18, the gas bacillus in 33.

In 1912 the gas bacillus predominated, 53 out of 135 cases showing this, while dysentery was only present in 5 and the streptococcus in 6. The conditions necessary for the development of gas bacilli are: an excess of carbohydrate, and a deficiency of organisms capable of forming lactic acid in sufficient volume to inhibit their growth. The treatment in these infections which is theoretically correct, and which has proved itself of value is:

1. Restriction of carbohydrates.
2. The introduction of lactic acid in buttermilk, or of lactic acid producing organisms.
3. An increase in protein.

He shows that the pathogenic bacteria especially of the dysentery group may be found in normal cases.

Vincent^{81, 82, 83} studied the action of bacteria in the etiology of diarrhea from a new point of view: that of the bacteria growing in raw and in boiled milk. This work has not, so far, been confirmed.

So much for the rôle of bacteria as the direct causes of intestinal disease in infants.

Their secondary rôle, through action on foodstuffs, has long been believed by the German school to be extremely important, especially as regards the fermentation of carbohydrate by certain bacteria, apparently favored by the presence of a high percentage of salts. This view is held without change, and is expressed in most of the publications cited on albumin milk and its substitutes.

Influence of Parenteral Infections on Nutritional Disturbances

86. Meyer, F.: *Hospitalismus*, Berlin, 1913, S. Karger.

87. Meyer, F.: *Ztschr. f. Kinderh.*, 1913, vii, 233.

88. Meyer, F.: *Berl. klin. Wchnschr.*, 1913, I, 775.

89. Müller: *Abstr. in Jahrb. f. Kinderh.*, 1913, lxxiv, 450.

90. Langstein: *Ztschr. f. Kinderh.*, 1913, vii, 193.

91. Chapell and Brown: *AM. JOUR. DIS. CHILD.*, 1914, vii, 380.

92. Triboulet: *Bull. Soc. de Pédiat.*, 1913, xv, 281.

This year great interest has been shown in the marked influence exercised by infections, especially of the respiratory and urinary tract, on the origin and course of the nutritional disturbances in infants.

Meyer^{86, 87, 88} has written a great deal on the subject. "Grippe" is a clinical term which he uses to include infections of the respiratory tract of non-specific etiology, including pharyngitis, coryza, otitis and bronchitis. It is, he thinks, the infection most disturbing to the normal nutritional condition, causing loss of appetite and all types of disturbances: dyspepsia, intoxication and decomposition. Next in importance is pyelocystitis. The younger the infant, the more easily does the disturbance arise; also the diet has an influence, as such disturbances are more frequent on those diets tending in themselves to cause fermentation and diarrhea, such as those with a high sugar and salt percentage. Meyer⁸⁸ found that in dogs in whom severe nasopharyngeal infections were produced, the secretion of gastric juice was greatly reduced. He believes that other secretory activities are also diminished during infections, and that this may explain the close relation between them and disturbances of nutrition.

The importance of respiratory infections or "grippe" in infants' hospitals or asylums as preventing success in feeding cases has long been studied. Heubner pointed out their importance fifteen years ago, and showed that they were an important factor in the general condition called hospitalism. During the present year much work has been

done on the prevention of these infections. Meyer^{86, 87} finds that in infant hospitals and asylums the mortality is greater from respiratory infections than from nutritional disturbances. He finds that no child remaining in a certain infant asylum over one month fails to develop some form of infection, while those remaining longer show, on an average, one such a month. As many children are necessarily admitted with respiratory infections the question of greatest importance is, how to prevent transmission of the infection from one child to another. This involves the question of the usual way in which such infections are carried, whether by contact or by air infection. Though the theory of contact infection is at present most generally accepted, Meyer believes that many things speak for an air transmission, especially of respiratory infections. He used Lesage's fundamental idea that infections are usually air-borne and that currents of air are instrumental in spreading them (Müller⁸⁹), in the construction of an isolation ward. This showed a central aisle with a row on either side of compartments or boxes separated by partitions of glass, or gauze stretched on frames, 6 feet high. The ventilation in the ward was reduced to the minimum consistent with having the air fit for use. Beyond the usual washing of the hands after handling each infant, no measures against contact infection were used; no change of gowns was made except in the case of whooping-cough, measles and varicella cases. Further precautions were the avoidance of much movement and talking in the rooms, and the prevention of infection from physician or nurse if suffering with coryza or bronchitis, by means of their withdrawal from duty or by their wearing a gauze mask. The results were extremely successful; in two wards thus fitted up, 106 infants were treated during the course of a number of months; of these fifty-two were suffering with respiratory infections on entrance. In the two wards there were but two new infections, showing a tremendous reduction in comparison with the number of new infections in the other wards. Twenty cases of whooping-cough and five cases of measles were also treated with no secondary infections; varicella was, however, conveyed five times, confirming the experience of Lesage. The box system also showed itself incapable of preventing the spread of diphtheria bacilli from carriers; these were transmitted fifteen times. Cases of clinical diphtheria were few. The nutritional results were extremely good; of healthy children over 1 month, all gained well. Many children under 1 month on simple milk mixtures thrived, which Meyer believes is rare in infants' hospitals and asylums. Very good results were seen in children who in the other wards had suffered from recurrent infections with consequent disturbances in nutrition; in the boxes, where such infections were avoided, the weight showed an immediate and steady rise.

This article is extremely interesting as suggesting means for the prevention of these hospital infections. It is doubtful, however, whether the method could be used unmodified in the American summer climate.

Chapell and Brown⁹¹ also emphasize the importance of respiratory infections in hospitals; they believe that the spread of contagion both by contact and by air infection should be guarded against. As a prophylaxis against infections of the respiratory passages they have tried a systematic biweekly douching of the posterior nasopharynx with a special syringe. This is so constructed that danger of forcing fluid into the eustachian tubes is avoided. They report a marked reduction in the number of infections in the wards where this douche was used, as compared with the control wards.

Triboulet⁹² is so convinced of the danger to infants of the infections to which they are exposed in hospitals, that he advises the exclusion from infants' hospitals of both normal and atrophic infants. Only infants with acute disturbances should be admitted, their stay should be as short as possible, and they should be isolated in "boxes" to prevent the spread of contagion.

Langstein⁹⁰ also believes that in the course of acute infection, the digestive juices are decreased, and that there is some change in the cells so that the ability to bind water is injured. As a diet in acute infections he warns especially against one rich in carbohydrate and salt and advises one with a high percentage of proteid. Albumin milk is here indicated; if this is not obtainable, he advises a milk mixture with little sugar, and with the addition of some preparation of proteid such as nutrose or plasmon. He criticizes the administration of malt soup in pyelitis; this has been recommended on account of its high alkalinity. He believes that on account of its high percentage of sugar it is very dangerous in acute infections. Two symptoms which are especially difficult to combat in infectious diseases are vomiting and anorexia. Both of these he treats by feeding with a stomach-tube, with good results. Rosenstern¹⁰ treats the anorexia of children with acute infections by the giving of concentrated albumin milk. This can safely be given after the third month; by this means he has succeeded in feeding children with pneumonia, cystitis and pertussis so that there was no loss but even a gain in weight during the infection.

The Influence of Heat on Nutritional Disturbances

93. Rietschel: *Jahrb. f. Kinderh.*, 1913, lxxviii, 312.

94. Schereschewsky: *Arch. Pediat.*, 1913, xxx, 916.

95. Wolff: *Jahrb. f. Kinderh.*, 1913, lxxvii, 569.

96. Zahorsky: *AM. JOUR. DIS. CHILD.*, 1913, vi, 289.

97. Bleyer: *AM. JOUR. DIS. CHILD.*, 1913, vi, 319.

98. Knox: *Arch. Pediat.*, 1913, xxx, 191.

The complicated problem of the relation of hot weather to nutritional disturbances is still a field for controversy.

Rietschel,⁹³ who has written so much on this subject, has given a general review of his own theory. He believes that the action of heat as a cause of summer diarrhea is a direct one (it acts, that is, by a direct injury to the child); not an indirect one through the spoiling or bacterial infection of milk. This direct action may be either an acute heat disturbance, corresponding to a heat stroke in an adult; or a chronic injury of a very complex nature, through which the reaction of the child to injuries, such as those of artificial feeding, infection, etc., is changed. This action he compares to the general lowering of nutritional function observed in cases of parenteral infection; here, too, there may be many factors, such as lowering of the amount and ferment activity of the digestive juices, a lowered tolerance to all foods, a lowered resistance to all infections, or a secondary change in the intestinal flora. The temperature of the house, he reasserts, is all-important, as this may be far higher than the outdoor temperature. Very different clinical pictures may result from the interaction of different factors with heat. Spoiled milk he rejects as an important cause of summer diarrhea, on account of observations in which infants fed on bad milk but with other conditions favorable, developed no symptoms. That spoiled or infected milk causes diarrhea, is merely a theory, and so far absolutely lacks proof, he believes. He admits that dysentery may be transmitted in this way in epidemics, but considers this rare.

Schereschewsky⁹⁴ gives an excellent review of the literature on the relation of heat to infant mortality, with a very complete bibliography. His conclusions coincide, for the most part, with those of Rietschel. He believes, however, that a certain proportion of cases of summer diarrhea is due to specific infections, in the dissemination of which contact and flies are important. He lays great stress on the importance of good housing conditions and of rational hygienic care in the protection of infants against the dangers of hot weather.

Wolff⁹⁵ reports an interesting case which bears on Rietschel's theory that heat alone, without change in the feeding, may cause a diarrhea. A premature infant, fed on albumin milk, was accidentally overheated in an incubator, in which the bottles were too hot. The child's temperature rose to 42 C. and it had bad stools. On removal from the incubator and after a cool bath, the temperature fell to normal and the diarrhea ceased; the feeding had been continued unchanged throughout.

Zahorsky⁹⁶ finds no regional variation in the summer mortality of infants in different parts of the United States, except that a few western cities show remarkably low figures. He finds a higher mortality

in manufacturing cities. He has studied the relations between the mortality and heat curves in St. Louis for several summers and concludes that there is a relation between them which is more marked in spring than in the later summer. He has observed in many cases that very hot weather produces fever in infants; but he does not believe that it produces diarrhea, and believes that the evidence is against Rietschel's theory that the direct action of heat may cause diarrhea. In a foundlings' home under his care the summer mortality has greatly diminished since proper pasteurization and refrigeration of the milk has been instituted. He concludes that one of the chief causes of summer diarrhea is to be sought in the organisms whose virulence and activity may be increased. Bleyer⁹⁷ found no relation between humidity and infant mortality in the course of three summers in St. Louis. He has studied especially the relation between the "heat peaks" and the "mortality peaks" and finds a correspondence in only 22 per cent. of cases.

Knox⁹⁸ ascribes chief importance in the prevention of summer diarrhea to breast-feeding, feeding with pasteurized milk, and to sensible care of the infant.

The trend of opinion is, then, in regard to the summer hygiene of infants, to lay stress not only on the administration of milk of low bacterial count, but also on all measures to prevent overheating, such as very light clothing, frequent baths, and free circulation of air in houses.

NOTES ON ESPECIAL NUTRITIONAL DISTURBANCES

99. Hirschfeld: *Jahrb. f. Kinderh.*, 1913, lxxviii, Erg. H., 197.
100. Bauer: *Monatschr. f. Kinderh.*, 1913, xii, 510.
101. Hess: *AM. JOUR. DIS. CHILD.*, 1913, v, 298.
102. Helmholtz: *Jour. Am. Med. Assn.*, 1913, lxi, 2188.
103. Langstein: *Jahreskurs f. Aerztli. Fortbildg.*, 1913, iv, No. 6.
104. Frank: *Jahrb. f. Kinderh.*, 1913, lxxvii, 163, 333, 422.
105. Monti: *Wien. med. Wchnschr.*, 1913, lxxiii, 2262.
106. Frank and Stolte: *Jahrb. f. Kinderh.*, 1913, lxxviii, 167.
107. Clock: *Jour. Am. Med. Assn.*, 1913, lxi, 164.
108. Variot, Lavalie and Rousselot: *Bull. Soc. de Pédiat.*, 1913, xv, 337.
109. Sébilleau: *Revue Prat. d'Obstet. et de Gynec.*, 1913, xx.
110. Rosenhaupt: *Deutsch. Med. Wchnschr.*, 1913, xxxix, 752.
111. McClure: *AM. JOUR. DIS. CHILD.*, 1913, vii, 48.
112. Huldshinsky: *Ztschr. f. Kinderh.*, 1913, viii, 363.
113. Aschenheim: *Ztschr. f. Kinderh.*, 1913, viii, 161.
114. Brünig: *Arch. f. Kinderh.*, 1913, lx, 116.
115. Abt: *Jour. Am. Med. Assn.*, 1913, lxi, 1275.
116. Grulee: *Interstate Med. Jour.*, 1913, xx, 41.

Alimentary Intoxication

In intoxication the relation of the symptoms to those of disturbances of the vegetative nervous system has been studied.

Hirschfeld⁹⁹ has used Loewi's test in many cases of intoxication. In the normal individual one drop of one per mille epinephrin solution in the conjunctival sac will cause no mydriasis; in cases showing increase in the tonus of the sympathetic system a dilatation ensues. In ten cases of alimentary intoxication the test was positive. Among the 255 other cases examined, no condition gave the sign with any constancy. She concludes that an increase in the tonus of the sympathetic system is characteristic of alimentary intoxication.

Bauer¹⁰⁰ describes a distention of the lung observed in three cases of severe intoxication in infants, in two of which clinical diagnosis of the condition was proved at necropsy. He believes that this is fairly constant in intoxication, and that it predisposes to pneumonia. He draws attention to the resemblance of this condition to the distention of the lung seen in asthma and in animals after anaphylactic shock and peptone poisoning.

Hess¹⁰¹ has studied the pancreatic secretion of ten infants with acute intoxication, comparing it with that of three control cases with high fever. Material for examination he obtained by means of his duodenal catheter. He found a deficiency of lipase in the cases of intoxication, with a normal secretion of amylase and trypsin; these conditions were not present in the control cases. In cases of atrophy with a total increase in the amount of secretion he also found a diminution in lipase.

Helmholtz¹⁰² in cases of intoxication has used subcutaneous injections of 50 to 200 c.c. daily of a 6 per cent. solution of dextrose in Ringer's solution, on the principle that the dextrose can be used directly as a food. Among the twenty cases reported, not one showed sugar in the urine. Edema was seen rarely. The dietetic treatment was the usual one: tea or water for twelve to twenty-four hours, followed by small quantities of breast milk or albumin milk, which were gradually increased. The patients in the cases reported were, for the most part, in very poor condition on entrance. Advantages seen from the use of the solution were: improvement in the turgor of the skin, in the circulation, and in the mental condition, the coma disappearing more rapidly on this treatment.

Feer⁴⁷ believes that in intoxication albumin milk is sometimes even preferable to breast milk.

Ileocolitis

It has been shown that the etiology of ileocolitis, or "diarrhea from infectious origin" has been the subject of a great deal of study. As to the treatment there have also been many publications. The treatment advised by Kendall⁸⁰ and his coworkers has already been reviewed.

Most German writers believe that in this type of diarrhea alone albumin milk is ineffectual. Benfey (as above) states that Finkelstein, here also, has achieved good results with the food. Langstein¹⁰³ believes that no great advance has been made in the treatment of this condition. He has used albumin milk, also the buttermilk treatment recommended by Schaps, without success.

Frank¹⁰⁴ reports a series of seventy cases of "dysentery-like" diarrhea treated with whey. The cases showed, for the most part, blood and pus in the stools, and were, she believes, of an infectious origin in children already suffering from acute and chronic nutritional disturbances. She recommends the use of a combination of whey with cereal water. This food contains a high percentage of salt and very little carbohydrate; it is easily tolerated and marked losses in weight are prevented by the high salt content. She acknowledges that the treatment seems contradictory to the beliefs at present in force as to the damage caused by a high whey concentration; Feer's⁵⁸ observation, however, of its harmlessness in the absence of sugar and fat, and Langstein's of the same nature, would seem to explain this point. She warns against prolonged starvation in cases which have been fed on a diet rich in carbohydrates. In early cases she advises castor oil and rectal irrigation, with hunger for twenty-four hours, followed on the second day by five feedings of 50 gm. each whey and cereal water, increased on the third day. In mild cases milk may be added in small amounts at this time and gradually increased; in severe cases not till the fifth to eighth day. She warns against tannigen and tannismuth as they frequently induce vomiting, but gives bismuth subnitrate from the sixth to twelfth day. Full histories of the seventy cases are appended.

Monti¹⁰⁵ advises tannismuth in dysentery and infectious diarrhea.

Grulee¹¹⁶ has used a purely proteid diet in these cases with good effect; this consists of the curd of skimmed milk suspended in a 5 per cent. gelatin solution. Previously he used an arrowroot water as a diluent. This diet cannot be continued more than four days to a week. The gelatin water is gradually replaced by buttermilk, and the skimmed milk curds by those from whole milk, the diet then being albumin milk. He uses no drug except occasionally small doses of paregoric. He does not speak of any symptoms of sugar starvation arising on this diet; on theoretical grounds one would expect them.

Mehl-Nährschaden

The symptom complex known by this name has been described again at some length by Langstein.⁸ It is caused by an exclusive diet, long continued, of carbohydrates, and is marked by a hypertonic condition of the muscles, atrophy, and in one type of cases by edema.

Abt¹¹⁵ reviews the literature on this condition, and reports two cases of his own.

Frank and Stolte¹⁰⁶ have made chemical analyses of the liver in cases of this disturbance, and have found a decrease in dry substance and an increase in water as compared with analyses of the liver of control cases. They conclude that the disturbance leads to an increase in water throughout all the tissues, which explains the clinical fact of the very low resistance of these children to infection.

Lactic Acid Bacilli

Clock¹⁰⁷ reports the treatment of 117 cases of all forms of diarrhea with cultures of *B. lactis bulgaricus*. One or two tablets every two or three hours were given in mild cases; in severe ones two or three tablets at the same intervals. The diet varied; in most cases, the previous diet was continued; in some, starvation, followed with small amounts of boiled milk. Good results were shown by gain in weight and a rapid change in the nature of the stools. That this treatment should be successful in all forms alike of nutritional disturbance seems strikingly at variance with all theories in regard to their etiology. Kendall⁸⁰ has shown that in a certain group of infectious diarrheas, those caused by the gas bacillus, the administration of lactic acid bacilli is indicated. Further study and confirmation of Clock's results must be awaited.

Vomiting and Rumination

Variot, Laviolle and Rousselot¹⁰⁸ again recommend the administration of condensed milk with a very high percentage of sugar in cases of continued vomiting in infants. They ascribe its good effects to a change in the casein, making it resemble more closely that of breast milk.

Sébilleau¹⁰⁹ advises the administration in these cases of a tablespoonful of a 1.7 per cent. solution of sodium citrate before each feeding.

In nervous vomiting Rosenhaupt¹¹⁰ recommends anesthetizing the mucous membrane of the stomach. As cocain is too poisonous he advises the use of anaesthesin.

McClure¹¹¹ reports a case where nervous vomiting had reduced an infant to a state of extreme atrophy. Vomiting ceased at once when the child was given a semi-solid diet of one part farina, with six parts of whole milk; recovery ensued.

Rumination associated with uncontrollable vomiting was also successfully treated by Huldshinsky¹¹² with a similar semi-solid gruel.

Cases of rumination have been reported by Aschenheim¹¹³ and by Brünig.¹¹⁴

The Influence of Other Factors on Nutrition

117. Birk: *Monatschr. f. Kinderh.*, 1913, xii, 1.

118. Miller: *Arch. Pediat.*, 1913, xxx, 538.

The influence of psychic factors on the nutritional condition of infants has been suggested as a possibility by Czerny. An unfavorable psychic condition has been suggested as one factor in the condition of hospitalism. Birk¹¹⁷ reports two cases in proof of this theory. He believes that psychic stimulation and happiness are necessary for the nutritional well-being of the infant.

Theories as to the influence of teething are reviewed by Miller.¹¹⁸ The older writers ascribed many morbid symptoms to teething, while the modern tendency is to deny any connection between them. Miller takes a middle position, believing that in teething there is a reflex hypersensitiveness of the intestinal tract.

Anorexia

119. Tobler: *Deutsch. med. Wchnschr.*, 1914, xl, 313.

The importance of anorexia as a symptom most often seen in disturbances secondary to parenteral infections, and also in young infants on the breast, and its treatment, as discussed by Langstein and Rosenstern, has already been reviewed. Rosenstern¹⁰ says that young infants on the bottle sometimes fail to take enough because the food is so much diluted that they cannot drink enough at one feeding if five feedings daily are given. He advises a temporary increase in the number of feedings to eight until the concentration of the food can be increased; then a return to five or six feedings may be made. He considers as another important factor in apparent anorexia, the marked air-swallowing shown by some infants. They stop sucking merely because the stomach feels too full. If such children are raised to a sitting position once or twice during feeding and are allowed to eructate swallowed air, they will afterward take more nourishment.

Tobler¹¹⁹ gives many practical points as to the treatment of anorexia; some of them are those already given above. He has seen little effect from *radix gentianae luteae*, which may be administered, as 3 to 6 drops of the "dialysat golaz" in sweetened water a quarter of an hour before feedings. Pepsin in the form of pepsin Grüber, 3 to 5 minims, ten minutes before feedings in combination with small quantities of dilute hydrochloric acid sometimes is effectual; theoretically its use seems irrational. One to 3 drams of Carlsbad or Vichy water ten minutes before meals has also been used. Feeding by gavage in young infants may tide over a dangerous period; in older infants it may be useful for its psychic effect and lead to an increased taking of food.

STERILIZATION OF MILK

- 120. Bradley: *Arch. Pediat.*, 1913, xxx, 579.
- 121. Schlossman: *Arch. f. Kinderh.*, 1913, lx-lxi, 676.
- 122. Grimmer: *Monatschr. f. Kinderh.*, 1913, xii, 657.
- 123. Grimmer: *Monatschr. f. Kinderh.*, 1913, xii, 1.

Opinions are still divided as to the importance to the infant of bacterial infection of milk. In the foregoing pages many opposing views have already been cited on this subject: Rietschel,⁹³ Bahrdt,²⁴ Zahorsky,⁹⁶ etc.

In accordance with the prevailing theories of the etiology of the nutritional disturbances, many German pediatricians minimize the importance to the child of bacterial contamination of milk, while those in America, for the most part, consider it of extreme importance.

Bradley¹²⁰ expresses the latter theory in an article on milk-poisoning. He believes that pasteurization is the best method of sterilization; and advises the process in which the temperature is held at 145 F. for thirty to forty-five minutes. Pasteurization may be easily carried out in the home by the following method: Five quarts of boiling water are set aside for ten minutes; then the milk bottles are set in the water and allowed to remain for forty-five minutes. He believes that milk obtained under proper precautions should not contain more than 10,000 bacteria per cubic centimeter.

Bahrdt²⁴ uses centrifuging as a means of purifying milk; he finds that the pathogenic bacteria can be removed in this way. Cream can not, however, be effectually purified in this manner, nor can milk during the hot months.

Grimmer^{122, 123} gives an extremely complete review of the literature for the past year on all subjects related to milk.

Schlossman¹²¹ writes of successful experiments with Lobeck's method of preparing milk free from bacteria.

BOILED MILK

- 124. Lane-Claypon: *Ergebn. d. inn. Med. u. Kinderh.*, 1913, 635.
- 125. Coit: *Arch. Pediat.*, 1913, xxx, 122.
- 126. Morse: *Boston Med. and Surg. Jour.*, 1913, clxviii, 726.

Lane-Claypon has made an extensive investigation under the British Local Government Board on the effects of heated and super-heated milk on the infant's nutrition. This includes the report of animal experiments, made by different investigators; a report of clinical observations by various authorities on the effect of raw and boiled milk in hospitals; and a careful clinical dispensary investigation in which a series of normal breast-fed children was compared with one of normal children on boiled milk. The conclusions which she draws are these:

1. Additional proof is given that animals and infants develop better on milk of their own species.

2. Development of animals and infants on milk of their own species shows no difference whether the milk is raw or boiled.

3. On milk of a foreign species animals and infants develop slightly better if the milk is boiled.

4. It has by no means been proved that infants develop scurvy from boiled milk alone.

Coit¹²⁵ reviews the work of Lane-Claypon and emphasizes its importance.

Morse^{126, 63} reviews the literature on boiled milk for the past year, also that on different methods of pasteurization of milk.

ROENTGEN RAY

127. Ladd: *AM. JOUR. DIS. CHILD.*, 1913, v, 345.

128. Ladd: *Arch. Pediat.*, 1913, xxx, 740.

129. Pisek and Lewald: *AM. JOUR. DIS. CHILD.*, 1913, vi, 232.

130. Major: *Ztschr. f. Kinderh.*, 1913, viii, 343.

131. De Buys: *AM. JOUR. DIS. CHILD.*, 1913, vi, 334.

Much work has been done on the Roentgen-ray examination of the infant stomach in normal cases and in those showing nutritional disturbances.

Pisek and Lewald¹²⁹ took series of Roentgen-ray pictures of the stomach of normal infants after a bismuth meal at intervals of ten minutes. They found no constant shape for the stomach; the shape apparently does not depend on the amount or character of the food taken, but on the amount of gas. They saw normally a rapid passage of food from the pylorus; in many cases food entered the duodenum one minute after its entrance into the stomach. They found that alkalies exercise a retarding influence on gastric motility; and that food, entering the stomach at different times, does not tend to mix.

Ladd^{127, 128} has written of gastric motility in the infant as studied by the Roentgen ray. He studied fourteen infants; to these he gave 2 drams of bismuth subcarbonate in their feeding. He finds, as do the other writers, an absence of peristalsis in the infant stomach; that some food passes into the duodenum immediately after the feeding is completed, and that the stomach is emptied of the larger amount in one and a half to two and a half hours. A considerable residue then remains for four and a half to seven and a half hours. The bismuth itself does not apparently affect the motility. The effect of different elements of food is studied, but no conclusions are drawn. A large amount of proteid seems to delay the emptying of the stomach, while a moderate amount of fat hastens it.

Major¹³⁰ used barium sulphate instead of bismuth. He believes that information regarding gastric motility cannot be gained when the former substance is used, for it adheres to the walls of the stomach, and gives it the appearance of being full, when in reality there is but a thin layer of barium over the mucous membrane. (He does not say whether the same criticism must be made of studies with bismuth.) His observations as to the normal shape of the stomach agree with those of the other authors. With the infant in a sitting posture he finds the most usual shape that of an inverted retort; in a recumbent position, that of an irregular sack. The gas bubble lies usually in the pyloric region, and is due, he believes, to swallowed air. The respiratory movements of the infant influence greatly the shape and position. Peristalsis is not so marked as in the adult. He too has seen food entering the duodenum immediately after the feeding. The time of complete emptying of the stomach, when no barium is used, is one and a half to two hours. He studied the stomach also in children with nutritional disturbances; in many cases of dyspepsia and in two cases of decomposition. He saw at times a delay in emptying, at times an increase in rate.

De Buys¹³¹ shows that the Roentgen ray may aid the diagnosis between spasm and stenosis in pyloric obstruction. In both, peristaltic waves may be seen. In spasm the stomach may lie in the normal position, and the food is slower to leave the stomach than in the normal case; in stenosis the stomach frequently lies to the left side, and the food leaves the stomach very slowly or not at all. Ladd,¹²⁷ in cases of pyloric stenosis saw peristalsis and a marked dilatation.

PYLORIC OBSTRUCTION

- 132. Koplik: *New York Med. Jour.*, 1913, xcvi, 57.
- 133. Hess: *Deutsch. med. Wchnschr.*, 1913, xxxix, 412.
- 134. Hess: *AM. JOUR. DIS. CHILD.*, 1913, v, 268.
- 135. Hess: *Post Graduate*, 1913, xxviii, 556.
- 136. Hess: *Ztschr. f. Kinderh.*, 1913, ix, 19.
- 137. Putzig: *Therap. Monatschr.*, 1913, xxvii, 25.
- 138. Richter: *Jour. Am. Med. Assn.*, 1914, lxii, 353.
- 139. Keefe: *Am. Jour. Obstetr.*, 1913, lxvii, 383.
- 140. Ibrahim: *Jahrb. f. Kinderh.*, 1913, lxxvii, 199.
- 141. Strauch: *Med. Rec., New York*, 1913, lxxxiv, 386.
- 142. Ramstedt: *Ztschr. f. Chirurg.*, 1912.

The writings on this subject have this year been extremely numerous; many, however, are merely reports of cases.

Koplik distinguishes three groups in cases of obstruction:

1. Pure spasm without a palpable tumor mass, but with explosive vomiting, visible peristalsis and a marked loss in weight.
2. Pylorospasm accompanied by a relative stenosis.
3. Typical hypertrophic stenosis.

He reports ten cases which healed without operative treatment; he makes the observation that peristaltic waves may be observed for a long time during convalescence. He says that the duodenal catheter of Hess may be useful but cannot always be introduced.

Hess^{133, 134, 135} has written several articles on the use of his duodenal catheter in the treatment and diagnosis of pyloric obstruction. He has also used the tube to obtain duodenal contents for examination of the digestive ferments in normal and abnormal children and for bacteriological examination, and in the study of the cases of congenital obstruction of the bile ducts.

Putzig¹³⁷ reports favorably on a case treated with the duodenal catheter, and gives data as to the technic to be used.

As to the operative treatment, much has been written. Richter¹³⁸ reports 22 cases of pyloric obstruction in which operation was performed, with a mortality of 13 per cent. In nineteen of these cases the obstruction was due to stenosis, in three to spasm. A tumor mass was palpated in all but one of these cases previous to operation. In nineteen the operation was a posterior gastro-enterostomy. He believes that in the diagnosis, the Roentgen ray cannot be entirely relied on, as bismuth will pass through the opening even in stenosis.

Keefe¹³⁹ reports cases treated surgically; Ibrahim,¹⁴⁰ Strauch¹⁴¹ and many others, cases recovering on medical treatment.

The operation of Ramstedt^{136, 142} has been much discussed, but the posterior gastro-enterostomy continues to be the most popular in America.

DUODENAL ULCERS

143. Holt: *AM. JOUR. DIS. CHILD.*, 1913, vi, 381.

144. Schmidt: *Berl. klin. Wchnschr.*, 1913, I, 593.

The reports of ninety-one cases of duodenal ulcers in infancy has been reviewed by Holt, who adds four cases of his own. From these he concludes that in the etiology atrophy is the most important predisposing cause. Seventy per cent. of the cases occurred between 6 weeks and 5 months. The ulcers were nearly all situated above the papilla, and showed macroscopically a punched-out appearance; microscopically, an absence of round-cell infiltration. As to the symptoms, in one-third of the cases there were none attributable to the ulcer. Hemorrhage was the only definite symptom; blood in the stools of an atrophic child in the absence of a diarrhea should suggest an ulcer, Holt believes. Collapse, with a concealed hemorrhage, occurred in a certain number of cases. As to diagnosis, he recommends the passage of a duodenal catheter. In one case of his own the presence of blood

in the eye of the tube established the diagnosis. He believes that the danger from this procedure is slight.

Schmidt¹⁴⁴ believes that duodenal ulcer is more common in infancy than has been thought. He found it post mortem in 18 per cent. of a very large number of necropsies on infants. He believes that not only atrophy but all general wasting diseases predispose to ulcer.

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