ON THE MORTALITY OF INFANTS IN FOUNDLING INSTITUTIONS, AND GENERALLY, AS INFLUENCED BY THE ABSENCE OF BREAST-MILK.

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PART III.

[*Concluded from page* 311.]

Cream as a Substitute. I have before said (p. 145) that there are some cases in which no wet nurse can be found to suit a child; and in these cases, moreover, milk in its several forms may be tried, but the efforts to bring up that child upon milk will fail altogether. In many of these cases, it is observed that there is a great quantity of acid produced upon the stomach of the child, and the same effect results when that child takes saccharine matters. It is in such instances that the mixture of one part of cream to three of water proves often very beneficial. I have known a child reduced almost to a state of complete atrophy, gradually recover its good looks and strength on this change of diet. Cream in composition contains pretty nearly the same ingredients as milk, except that the casein is diminished, and the fatty matters considerably increased. In this manner, the absence of sugar is compensated for by the excess of fatty matters; and thus the fluid produced is sufficiently rich both as a nutritive and as a calorifient aliment. The addition of water diminishes the density, and makes the mixture more digestible. If to every half-pint of this half an ounce of lime-water be added, the tendency to the formation of acid is removed, the solubility of the casein and the emulsion of the fatty matters are insured, and both these last become more assimilable.

What has been said will suffice on the use of the various kinds of milk in their natural condition. But here I must take up two other points—1. The correction of inferior milks, so as to adapt them for infant purposes; 2. The preparation from strong and rich milk of a compound resembling human milk.

1. *Correction of Inferior Kinds of Milk.* Here I am especially indebted to Dr. Merei of Manchester for the information he has given me, which I have in this paper in great measure incorporated. If we take a tube nine inches long by half an inch wide, graduated in sixteenth parts of an inch, and put into it about two ounces of milk and the same quantity of water, and expose it to a temperature of 50° to 60° Fahr. for about eighteen or twenty-four hours, the cream will be found to have separated, and will be observed as a whiter, more opaque substance, floating on the surface of the milk. If this stratum above the milk amount to seven or eight of the graduated degrees, that milk is essentially good and rich, and contains about six and a half to seven and a half of butter. Medium milk will contain only five or six degrees; the worst kinds, only three degrees; and the inferior qualities supplied to the poor (skim milk), only two degrees. Here, then, is a ready means of measuring quality.

Now, experience has shown that such poor milk causes more gastric disorders than rich milk: nay more, that, to obviate this result, it requires a greater dilution than rich milk, notwithstanding its poverty. Dr. Merei attributes this to the preponderance of casein, which is one of the chief causes of gastric disorder. This casein, it is observed, is both *harder* and *coarser* in cows' than in human milk. This is, no doubt, one cause; but there is another which, I think, applies, and which is mainly due to the dishonesty of milk-dealers. The cowkeeper has already watered his milk, to separate a certain amount of cream from it. The retail milk-keeper has done the same very frequently. The butter has thus been already taken out. Lactic acid has formed, and what butter remains in the milk is scarcely now contained in perfect combination as an emulsion, but is disintegrated, or, as it were, in imperfect mechanical suspension only. The casein is perhaps in the same state.

Dr. Merei's experience in the method he adopts to improve inferior milks seems to point also to this view of the case.

In case of feeble children, with bowels previously deranged, he recommends that, instead of diluting the milk with water, we should add a decoction of arrowroot, made with one teaspoonful of this substance to three-quarters of a pint of water, this quantity to serve for the admixture of the whole day's supply. In more severe cases, the arrowroot may be increased to two teaspoonfuls. This arrowroot is not given as an aliment, but as a softish substance to soothe by its mechanical pressure the irritation of the intestinal mucous membrane. Langenbeck, indeed, believes that, in such cases, the granules of starch intersperse themselves between the particles of casein, and thus in great measure prevent the formation of hard indigestible curds. The mixture Dr. Merei gives consists of three or four pints of this thin decoction of arrowroot to one part of new milk slightly boiled, and in the twenty-four hours amount of food thus prepared he adds about one to two tablespoonfuls of *cream*. Children will digest well from a pint to a pint and a half of this mixture in twenty-four hours, according to age. As they grow older, he increases the proportion of milk, but not of the cream. If an infant be tolerably strong and regular in his bowels, and has to be bottle-fed, under four months of age, a mixture of first rate quality of milk simply with water, in equal proportions, or, after three to four months, one part of water to two of milk, agrees well, if given at a temperature of 90°. For children liable to diarrhœa, a very thin and weak infusion of aniseed tea, instead of water, may be substituted. Where the gripings and diarrhœa are severe, it is well to combine a teaspoonful, three or four times a day, of dill or peppermint water and water in equal parts, with lime water and a trace of opium to allay the irritation. (Extract of private letter.)

The above has been very generally the plan upon which I have acted in these cases, with two exceptions. The ease now-a-days of giving cod-liver oil to infants, and its cheapness as compared with cream, have led me usually to prefer the former, which doubtless acts in the same way as cream in supplying an oily but highly assimilable combustive aliment. Also, I have usually combined sugar, because existing in cows' milk in smaller quantity than in human milk.

2. *Preparation from Rich or Strong Milk of a Compound resembling Human Milk.* My attention has been called to this especially by Mr. Harry W. Lobb, a gentleman who for some time past has closely studied the subject. In page 133 in his little work on *Hygiene*, he gives us the following method of preparing Professor Falkland's milk for infants. I subjoin it here in full.

One-third of a pint of new milk is allowed to stand until the cream has settled; the latter is removed, and to the blue milk thus obtained about a square inch of rennet is to be added, and the milk vessel placed in warm water. In about five minutes, the curd will have separated; and the rennet, which may again be repeatedly used, being removed, the whey is carefully poured off, and immediately heated to boiling, to prevent its becoming sour. A further quantity of curd separates, and must be removed by straining through calico. In one-quarter of a pint of this hot whey is to be dissolved three-eighths of an ounce of milk sugar; and this solution, along with the cream removed from the one-third of a pint of milk, must be added to half a pint of new milk. This will constitute the food for an infant of from five to eight months old for twelve hours; or, more correctly speaking, it will be one-half of the quantity required for twenty-four hours. It is absolutely necessary that a fresh quantity should be prepared every twelve hours; and it is scarcely necessary to add, that the strictest cleanliness in all the vessels used is indispensable.

The above is a very ingenious process, but it is open to objection in one or two particulars.

a. Messrs. Parmentier and Deyeux have shown that there is a disadvantage in boiling milk. When eight pounds of milk obtained from cows fed on grass, cabbage, potatoes, and maize, respectively, were distilled, eight ounces of a colourless fluid were obtained. That from those fed on grass was aromatic; on cabbage, offensive; on maize and potatoes, quite inodorous. Hence they infer that, if this volatile principle constitutes in any way one of milk's constituent parts, it must be wrong to deprive milk of it, or to expose it to those circumstances which favour its separation. Experience with infants has also shown me, that boiled milk is seldom so well borne as milk simply warmed by the addition of hot water.

b. The objection has been made by Mr. Lobb, that in Dr. Falkland's process scarcely enough casein is removed. That gentleman has another method of preparing this artificial human milk, which he calls *mincasea*, which I here subjoin.

"Half a pint of new milk is set aside for the cream to separate, which latter is removed; and to the blue milk half a teaspoonful of prepared rennet is added; this is placed over the fire, and heated until the curd has separated, when it is broken up with a spoon, and the whey poured off. In winter, three drachms of powdered sugar of milk is added to this warm whey; and the whole is mixed with half a pint of new milk. In sum-

mer three drachms and a half of sugar of milk are added, and with the new milk are all boiled together."

There is another formula given by Mr. Turner, a homœopathic chemist, of Manchester. Although I disbelieve the dogma of homœopathy, I am not above taking a lesson from an adversary. His formula is very simple. "Dissolve one ounce of sugar of milk in three-quarters of a pint of boiling water, and mix with an equal quantity of good fresh cows' milk." This process is simpler than Professor Falkland's and Mr. Lobb's, and, as such, I prefer it, and would fain recommend it, except that I should prefer water of a temperature of 160° Fahr. to the boiling water. The most ignorant nurse might prepare it easily in any part of the country where good milk can be procured.

The disadvantage which applies to this process in towns, as I before stated, is the difficulty which attends the procuring of good milk. The same objection applies to many other places, as on board a ship. Something like a substitute may be found, however, in the employment of desiccated milks, to which if water in proper proportions is added, a milk presenting all the peculiarities of good rich milk is produced. Two of these kinds are known in London—Moore's Patent Concentrated Milk, and Grimsdale's Patent Desiccated Milk. In a communication received from Mr. Moore, through a late friend, that gentleman stated that his milk could be manufactured at 1*s.* 4*d.* per lb., which would be equal to one gallon of pure milk. The milk is, I understand, merely evaporated at a temperature under the boiling point. It appears to possess many advantages.

The other preparation, Grimsdale's Desiccated Milk, is not in the form of extract, but rather of powder, of the same bluish white colour as milk. This has rather a gritty feel to the finger, and, when put on the tongue, a strong milky taste; and it mixes readily with boiling water. It is then acid or alkaline. From calculation, one ounce of the powder requires 6·4 oz. of boiling water to make it of the same strength as milk. I have no experience of its uses or advantages. The objection to it seems to be, that it needs boiling water for its solution; nor am I aware if it is in its preparation evaporated to the consistence of an extract by heat, above or under 212° Fahr.

Other Substitutes for Milk. Eggs. It would appear natural, from the lessons comparative anatomy and chemistry give us, that where milk could not be procured, *eggs* would afford us a good substitute. Indeed, the egg presents several points of analogy to milk. It is true, we have albumen in the place of casein; but these two substances, for all practical purposes, may be considered as similar. The white of the egg is albumen in a very pure state, with about 22 per cent. of water, and 0·65 per cent. of salts. The yolk, with 52 per cent. of water and 1·52 per cent. of salts, contains as its albuminous compound a substance called *vitelline*, very like albumen in composition, but coloured by an oil containing phosphoric acid, and in its ultimate composition being a little richer in hydrogen and oxygen. Moreover, Barreswill has determined the presence of sugar in the white of egg. It has an alkaline reaction, which is due to the presence of carbonate of soda. The yolk, on the contrary, contains little or no alkali, and its emulsive character is to be ascribed to the presence of a substance very like pancreatic juice. The proportion of white of egg to yolk may be stated as 60·6 to 39·4, and 58·4 to 41·6.

The composition of the white and yolk of egg has been tabulated as follows:—

Composition of Egg (Gobley).

		Yolk.
Water		51.5
Vitelline		15.7
Margarine and Oleine		21.3
Cholesterine		0.4
Phosphorous body	7.2	
Oleic acid	1.2	8.4
Phosphoglyceric acid		
Cerebric substance		0.3
Salts		2.3
		White.
Water		77.15
Albumen		22.2
Salts		0.65

The salts raised to 100 parts contain according to Polack—

	Yolk.	White.
Chloride of potassium	—	42.17
Chloride of sodium	—	14.07
Potass	6.57	16.09
Soda	8.05	1.15
Lime	13.28	2.79
Magnesia	2.11	3.17
Sesquioxide of iron	1.19	.55
Phosphoric acid	66.70	5.79
Carbonic acid	—	11.52
Sulphuric acid	—	1.32
Silica	1.4	2.04

It will at once be seen that, in the large quantity of phosphoric acid, and of chloride of potassium only to a larger extent, egg resembles milk and flesh, and, as such, must possess similar properties in nourishing a child.

I have already alluded to some of the uses of phosphoric acid. The excess of potash salts, of chloride of potassium especially, which, as in muscular flesh and milk, so greatly exceeds in quantity the chloride of sodium, is very remarkable. My friend Dr. Andrew Clark has also informed me that potash salts are always in excess in cell-developments, even when the growths are morbid—a fact of great importance, although often overlooked, as showing that those animal foods which contain an excess of potash salts should be preferred as aliments for growing children.

The white of egg, however, if given, should be given as nearly as possible raw, or, if warm, only heated to 130° Fahr. Beyond this temperature, it coagulates, and then becomes much more difficult of digestion. If the egg be put in boiling water for two minutes only, except a thin external layer of albumen which will have been coagulated, it will be warmed successfully. Cows' milk contains, however, 5·5 of casein, and white of egg 7·7, or with the yolk 4·6. It should, therefore, be diluted; and, with a little sugar of milk added, it would form a very fair substitute for milk.

Bone Soups and Jellies have been recommended as aliments for children. The opinion at present almost universally entertained is, that gelatine, the chief ingredient in such soups, etc., although a nitrogenous substance, is, like hair, innutritious. It is unassimilable in children, as well as in older persons; and it only overloads the blood with nitrogenous products, which render this fluid impure and unfit for the purposes for which it is required. Still, as a medium for the exhibition of wine, or as an emulcent in cases of irritation of the bowels, or for the exhibition of particular remedies, jellies may be useful occasionally, just as we spoke of arrowroot in cases of intestinal irritation.

The last animal preparations to which I shall allude, as substitutes for milk, are beef-teas; and, of these, I shall speak of two kinds only—Liebig's Beef-Tea, and Hogarth's Essence of Beef. Meat possesses this advantage over vegetable food—in a given weight, it contains more nutritious matter. An essence or extract of meat thus contains, in a still smaller weight, all the nutritive properties essential to the maintenance of life, and, if mixed with a little fat, all the nutritive and combustible properties to be desired. Unfortunately, a complete extract of meat, which could be indissoluble in water, cannot be made, owing to the insolubility of fibrine.

Liebig's Beef-Tea. When flesh is finely lixiviated with cold water, all its soluble matters are removed, and a perfectly tasteless, inodorous residue is left, which, in every case, is white like fish. The solution remaining consists of lactic and inosinic acids, creatine, creatinine, a nitrogenous organic acid, which forms a pellicle on the surface like casein, though differing from it in many other respects. There are several other ingredients not very clearly made out, besides tartrate of potash, phosphates, especially of the alkalies, a little lime, and more magnesia.

It is this solution which is to be evaporated to dryness, and constitutes the best extract of meat. In doing so, however, as the albumen in it coagulates at 133° Fah., and the colouring matter at 158° Fah., and would thus be precipitated, it is advisable to evaporate it in a sand bath, the temperature of which must not exceed 120°; in this manner all the nutritive, combustible, and mineral matter will be retained. To this extract more or less water may be added, according as the strength of the tea is required. It is well to use on these occasions young animals in preference to old. In the former case the albumen will vary from 1 to 2 per cent., while in young it will be as high as from 12 to 14 per cent. The extract prepared by Mr. Roberton, of Manchester, obtained in the form of a dry powder, is the best I am acquainted with. However, except in cases where haste is required, there is scarcely any need of using this extract, since the beef-tea itself, prepared by

lixiviation in water over night, is more easily obtained. This, also, should not be heated above 120° to 130°; never boiled. If more body is required in it, a little flour or fine oatmeal may be added to the tea, so as to thicken it; also to suspend finely divided meat in it. A little lime water added to it will remove any acidity, if this be present in excess.

Hogarth's Extract of Meat Of the composition of this material, I can say nothing; I only speak from experience of its use. I have seen children, who have been reduced to a state of great weakness by feeding them by hand on improper diet, recover almost marvellously under its influence. That which I have used principally is the essence of beef. Its taste is much liked; and five or six teaspoonfuls by day, with a very little water, are well borne by children. Indeed, it is often borne in children affected with exhaustive diarrhœa from weaning, when milk and farinaceous food disagree.

This result may probably explain the success obtained by the administration occasionally of raw meat, which is but a step further in this direction. "In these circumstances", says Dr. West (*Diseases of Children*, p. 498), "there is still one article of food—raw meat—which, strange as it may seem, is often eagerly taken, and always perfectly well digested." Professor Meisse, of St. Petersburg (*Journal für Kinderkrankheiten*, vol. iv, 1845, p. 99), first recommended its employment in children suffering from diarrhœa after weaning; and it has been since then frequently given by other physicians in Germany in cases of long standing diarrhœa. The lean either of beef or mutton very finely shred may be given in quantities at first of not more than two teaspoonfuls four times a-day to children of a year old, and afterwards, if they crave for more, a larger quantity may be allowed. I have seldom found any difficulty in getting children to take it; often, indeed, they are clamorous for it; it does not nauseate if given in small quantities, nor does it ever aggravate the diarrhœa; while, in some instances, it has appeared to have been the only means by which the life of the child has been preserved. With returning convalescence the desire for this food subsides, and the child can without difficulty be replaced on its ordinary diet.

From the foregoing remarks, we may conclude:

1. That maternal warmth and the semi-erect position are essential to a child while it is taking its food. Hence the need of a particular kind of bottle.
2. That asses' milk does not appear from its composition calculated to do good to a child, if persisted in for any length of time.
3. That goats' milk is proved, from experience, to be even in its normal state most efficacious to a child; and that if the goat be properly dieted, it will yield a milk closely resembling human milk.
4. That as in the case of the goats' milk, so in regard to the cow, if the milk be pure and the animal be properly dieted, the same results obtain in both cases; but that *in towns* cows are so shamefully kept and fed, and the milk is so watered, that cows' milk cannot be considered, as a rule, as wholesome food.
5. That to remedy these abuses, stringent laws are imperatively called for.
6. That artificial milks closely resembling human milk may be readily prepared from pure cows' milk; and that these, together with beef-tea and eggs, may occasionally be safely substituted for breast milk.

52, Montagu Square, London, February 1858.

Reviews and Notices.

ON MALFORMATIONS, ETC., OF THE HUMAN HEART. WITH ORIGINAL CASES. By THOMAS B. PEACOCK, M.D., Fellow of the Royal College of Physicians, Assistant-Physician to St. Thomas's Hospital, etc. pp. 143. London: Churchill. 1858.

THIS treatise is a revised reprint of some lectures which were delivered by Dr. PEACOCK at St. Thomas's Hospital, and afterwards published in the *Medical Times and Gazette*. It affords evidence of careful research on the part of the author, who has succeeded in bringing together a large number of instances in which the organ of the circulation was the subject of more or less important malformations.

The subject is treated of under the following heads:—

1. Congenital Misplacements of the Heart.
2. Deficiency of the Pericardium.
3. Malformations of the Heart: including
   - *a.* Malformations dependent on arrest of development at an early period of fœtal life.
   - *b.* Malformations preventing the changes which should ensue after birth.
   - *c.* Malformations which do not interfere with the functions of the heart, but may lay the foundations of disease in after life.
4. Malformations consisting in the Irregular Development of the Primary Vessels.
5. Mode of Formation; Symptoms and Effects; Diagnosis and Medical Management, of Cases of Malformation.

The book is illustrated with eight plates.

1. Of Congenital Misplacement of the Heart, two varieties are mentioned; viz., transposition and exposition. In transposition to the right side, the other viscera are generally, but not always, displaced; sometimes the heart is well formed, sometimes the arteries are displaced relatively to the ventricles. Of *exposition* there are three varieties, viz., *ectopia pectoralis*, with or without defect in the thoracic parietes; *ectopia ventralis*, the heart being protruded through the diaphragm, and sometimes forming, sometimes not forming, an external tumour; and *ectopia cephalica*, in which the heart has been found lying in front of the neck.

2. Deficiency of the Pericardium very generally accompanies congenital displacement; but the investing membrane is sometimes absent when the heart occupies its natural position. Dr. Peacock believes that many alleged cases of absence of pericardium have been incorrectly reported; and that this malformation is rare. There have been, however, authentic instances recorded by Dr. Baillie, M. Breschet, Mr. Curling, and Dr. Baly.

3. In the division *a* of Malformations of the Heart, the first class of cases consists of those in which the heart has been found to consist of two cavities—an auricle and a ventricle. In all these cases, the subjects of the malformations died at most a few days after birth. In some instances, the heart is simply bilocular; in others, it presents various stages of transition from the simple form to that in which it consists of four cavities.

In the next class, of which twelve instances are recorded, there are three cavities—two auricles and a ventricle, either undivided or presenting a rudimentary septum. The aorta and pulmonary artery may have distinct origins; or (but more rarely) the latter may be impervious at the commencement—the blood being sent to the lungs by the aorta through the ductus arteriosus. In one case, the auricles opened into the ventricle by a common aperture. The malformation has been in some cases found to be accompanied with transposition of the origins of the great arterial trunks.

Another class of cases comprises those in which the heart consists of four cavities, one or both of the septa being imperfect. We extract Dr. Peacock's description of the various forms of imperfection which may be here presented.

"When the interventricular septum is only partially defective, the imperfection most generally occurs at the base, where, during fœtal life, the division of the cavities is last effected. In this situation there naturally exists in the fully developed organ a triangular space, in which the ventricles are only separated by the endocardium and fibrous tissue on the left side, and by the lining membrane and a thin layer of muscular substance on the right. This space indicates the point at which, in the turtle, there is a permanent communication between the two aortic ventricles: and it is interposed in man between the base of the left and the sinus of the right ventricle. Laterally it is bounded by the attachments of the right and posterior aortic valves, and its base is formed by the muscular substance of the septum. The dimensions of the space vary with the size of the heart; but ordinarily in the adult, the sides may be estimated at about seven lines, and the base is some-