CASE III.

(For notes of this case I am indebted to Mr. Lloyd-Owen.)

E. S. was thrown off his bicycle and received a slight wound in the region of the left external angular process. He was unconscious for about an hour. Three months later his left vision was little more than perception of light, and that only on the nasal side. The temporal field was lost up to the point of fixation. The optic disc was atrophic, and the retinal arteries smaller than those on the right side.

The right eye was normal and field of vision full.

CASE IV.

H. A. fell off his bicycle and struck his right temple. Six months later his condition was as follows:

Right eye: Atrophy of the optic nerve, with some narrowing of the retinal arteries. Visual field contracted to within 10° of the fixation point on the temporal side. R.V. = $\frac{1}{2}$ c + .50 D.

Left eye: Normal; field of vision full. L.V. = $\frac{1}{2}$ c + .50 D.

CASE V.

E. C., a miner, was struck by a "coal tub" on the left side of forehead and face one month before his admission to the Birmingham Eye Hospital. There was no loss of consciousness; there was some bleeding from each nostril, and the left eye was hidden by swollen and ecchymosed eyelids. Four days later, when the swelling had subsided and he was able to open the lids, he found that the sight of the left eye was defective. On admission there was a large scar involving the outer third of the left eyebrow, and with two other smaller scars, one at the junction of the outer and middle third of the inferior orbital margin and the other on the left side of the bridge of the nose, showed the extent of the injury. The left pupil was very slightly larger than the right, and its reaction to light was very sluggish, but its associated and consensual reflexes were good. There was no interference with the motility of the eye. The optic disc was pale, the pallor being more decided on the temporal side. The temporal field was lost up to within 10° deg. of the point of fixation (vide chart). L.V. = Fingers at 2 metres. The

right pupil was somewhat dilated (about 10 mm. in dull daylight). The direct and associated reflexes were brisk, but the consensual reflex was deficient. The visual field was normal. R.V. = $\frac{1}{2}$. This case being a recent one, is still under observation.

The sequence of events in these cases was as follows:

1. A more or less severe blow in the region of the external angular process of the frontal bone.
2. Sudden impairment of vision on the side of injury.
3. Loss of the greater part of the temporal field of vision on the same side.
4. Absence of ophthalmoscopic changes for the first few weeks, followed by atrophy of the nerve head on the injured side.
5. Central vision may be almost completely restored, but the limitation in the field of vision remains practically and permanently the same.

The nature of the lesion in these cases is very problematical.

The following may be mentioned as possible causes of such changes:

1. Fracture extending through the optic foramen.
2. Laceration of the nerve by a detached and displaced anterior clinoid process or some other spicule of bone.
3. Haemorrhage into the sheath or substance of the optic nerve.
4. A limited contusion of the optic nerve.

I believe it is usual to ascribe unilateral amaurosis resulting from blows on the head to fracture involving the optic foramen. It is hardly conceivable that such a fracture could have occurred in the cases recorded here. The injuries were all comparatively slight, and, judging from some experiments which I have made on the cadaver, quite inadequate to produce a fracture of the optic ring. Notwithstanding the high percentage of fractures involving the optic foramen recorded by von Hölder and others, I am convinced that it is exceptional to find such fractures in the pathological museums in England. Fracture of the ring would presumably cause blindness by laceration of the fibres by the displaced bone or

loss of function in the nerve by pressure of displaced bone or callus. In either case the interference with the nerve function would be greater and more variable than that recorded in the above cases. Further, it is not likely that the ophthalmic artery would escape injury in cases of fracture of the optic ring, and evidence of disturbed circulation would probably be visible in the eye and orbit. A fractured and displaced anterior clinoid process would be more likely to lacerate or compress the temporal rather than the nasal fibres, and perhaps more likely to affect one of the optic tracts than one of the optic nerves.

Haemorrhage into the sheath or substance of the optic nerve is a very likely cause of complete amaurosis following blows on the head. In two cases of extensive fractures of the skull examined by Uthoff haemorrhagic neuroretinitis was found ophthalmoscopically, and *post mortem* the nerve sheaths were found distended with blood, though there was no fracture of the bony optic foramen. Such a haemorrhage would not remain localized to one side of the nerve, and, should the amaurosis not be complete and permanent, the signs and symptoms would vary as the blood became absorbed and the undestroyed fibres resumed their function.

We are therefore forced to the conclusion that, in the cases recorded here, the lesion must be one of limited contusion of the nasal fibres of the optic nerve by *contrecoup*. The nerve on the side of the injury is driven against the inner boundary of the optic foramen, whilst the nerve on the opposite side is driven against the outer wall of its foramen. That the nerve on the opposite side does not get bruised is in the main due to the protection given to it by the ophthalmic artery which winds round its outer side from below.

Assuming such an immediate cause for the symptoms mentioned, the course and prognosis of the cases can easily be deduced. A certain number of fibres are permanently destroyed (functionally) at the time of the accident. The more centrally-placed fibres are not so extensively damaged and partly recover their function, as shown by the improvement in central vision. The atrophy of the nerve is apparently not progressive and no increase in the limitation of the field need be feared.

Generally speaking, we may expect a considerable improvement of central vision in those cases in which there is a fair central vision immediately after the accident, but little or no change for the better or for worse in the field of vision.

These cases should be treated on the plan adopted for concussion of the brain—that is, rest and quiet in a darkened room, light diet, and aperients for a week or two, and avoidance of work and mental excitement for a further period of two or three weeks.

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THE SUBSTITUTE FEEDING IN INFANTS.*

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THE diet of all young mammals is milk, and the constituents of which all milks are composed, though varying in percentage strength, are practically the same. Milk is an emulsion of fat containing solids in solution, and is composed of proteid, fats, sugars, salts, and water. It is sterile, and has of course the temperature of the human body. Its average composition varies only within narrow limits, and is readily determined.

Any food, therefore, we prescribe to take the place of the natural mother's milk should as nearly as possible have its composition and properties. Any foods not conforming to this standard must be rejected.

The composition of human milk may be taken to be as follows:

1. Proteid, 1.5 per cent.:

Composed of:

- (a) Lactalbumen (0.8 to 1 per cent.), soluble form of albumen not curdled by acids coagulating 165° F.
- (b) Caseinogen (0.4 per cent.), insoluble form of albumen; forms a thick curd with rennin and acids; not coagulated by heat.
- (c) Lactoglobulin, soluble, only a trace.
- (d) Nitrogenous extractives.

* Read before the West Hants and Dorset Branch of the British Medical Association at Blandford on May 17th, 1905.

2. Fat (4 per cent.) in emulsion.
3. Sugar (7 per cent.).
4. Salts (2 per cent.).
5. Water (87 to 88 per cent.).

Human milk is alkaline and sterile, its temperature that of the human body (roughly just under 100° F.); its specific gravity fairly constant at 103°, and it is antiscorbutic.

It is not definitely known what the particular property of living food which prevents scurvy may be. Some have thought the absence of certain combinations of potassium salts, others the presence of some poison of the nature of a ptomaine in artificially-prepared foods. Certain it is that fresh foods prevent and artificially-prepared foods frequently cause scurvy, and this fact must be steadily borne in mind.

Before proceeding further let us examine the result of excess or deficiency of each of the foregoing classes of food on the infant.

A. Protein.—Excess: Constipated; dyspepsia; motions dry, hard, and friable. Child restless, irritable. Urticarial and papular eruptions. Urine acid and micturition frequent. A pink stain of urates on napkin. Deficiency: Interrupted growth. Child pale, flabby, feeble, soft muscles; want of vigour.

B. Fat.—Excess: Sickness immediately following feed. Diarrhoea with loose acid stools of a bright golden colour, which irritate buttocks and cause eczema. Deficiency: Constipation. Anaemia. Want of energy. Later deficient formation of bone. Rickets.

C. Sugar.—Excess: Large, heavy, flabby child. Pale and anaemic. Want of fat is commonly associated in patent foods with excess of sugar, and rickets results. Deficiency: Infant poor and thin. Want of bodily heat and vitality.

Mineral Salts.—Important, as probably there is no cell life without earthy phosphates. Excess of lime salts constipating.

Destruction of the freshness of food, as in prolonged and careful sterilization, leads to scurvy.

Fat is present in all milks; both cows' and human milk contain a large and stable proportion of it (4 per cent.). Landois and Sterling (vol. i, p. 481) give the following estimate of the fat requirement of a working man, wife, and child:

1. Child under 1½ years of age	...	30 to 45 grms. daily.
2. Adult woman, moderate work	...	44 grms.
3. Adult man in work	...	56 grms.

From this table we arrive at the startling conclusion that a baby requires almost as much fat as its mother, and two-thirds as much as its father doing his daily work.

This remarkable effect of fat on young animals is well illustrated by the following interesting story, concerning the difficulty experienced until recently in bringing up the young of animals born in the Zoological Gardens: Owing to the unnatural life and surroundings, the mother frequently failed to suckle her offspring. These were then fed on the same variety of food as their parents. Thus the young lions were given lean horseflesh; young bears, biscuits and rice; monkeys, fruits and bananas. All these foods being deficient in fat, all these young animals, irrespective of species, became weak, rickety, and died. On one occasion, after the death of the first of a promising litter of lion cubs, it being quite evident that the others were rapidly following in his footsteps, Mr. Bland-Sutton was consulted. Recognizing the disease to be rickets, and putting his finger on the weak spot in the diet, he suggested that the meat should be continued as before, and that the surroundings should remain *in statu quo*, but that the cubs should daily get an addition of milk, cod-liver oil, and pounded bones. In three months all signs of disease had disappeared.

Rickets can be brought on by a rachitic and cured by an antirachitic, as certainly as scurvy can be caused by a scorbutic and cured by an antiscorbutic diet.

It is to be noted that human milk does not contain starch, and the diastatic ferment is not present in the submaxillary glands or pancreas at all until two months. There is a small amount secreted during the eruption of the teeth, but the function is not properly established until a year old. We must therefore conclude that the infant has no capacity for digesting starch until six months, that it does so then only in small quantity and imperfectly, and that starch is an entirely unsuitable and improper addition to an infant's food during the first six months, and must be given sparingly and with caution any time in the first year.

It is universally acknowledged that breast feeding is the best method of rearing an infant and should invariably be carried out when possible. In the event, however, of its not being possible let us examine the alternatives. They are:

1. *Substitute Feeding:*
 - (a) Wet nursing.
 - (b) Humanized or modified cow's milk.
2. *Artificial Feeding*, or feeding on one of the many manufactured and well-advertised so-called infant foods.

Feeding on Artificial Foods.

There is no time to go largely into this subject, but I think in an hour any of you would be able by investigating the composition of the various proprietary foods to satisfy yourselves that all artificially-manufactured foods as a class are bad; that they do not conform to the scheme we have derived from the analysis of a child's natural food; that, in short, they cause weakness and debility, almost invariably rickets, sometimes scurvy-rickets, and pave the way for deformity, disease, and death.

Proprietary foods are a cloak for ignorance being sufficiently advertised to be in every one's mind. They are also readily obtained and prepared for use, are fairly cheap and being largely formed of sugar can often be assimilated when more proper foods would be rejected. They have one advantage. They are sterile. The damage done by them is so enormous, so many promising young lives are either lost or spoiled by them, so widely can the effect of their use be traced in the want of physique and stamina of the rising generation, that I would urge the medical profession to take this subject up more thoroughly. To sum up the question of feeding on proprietary foods they are inadmissible on the following grounds:

1. They are all deficient in fat, one of the most essential elements of an infant's food.
2. They are not antiscorbutic.
3. They contain as a class too much sugar.
4. They mostly contain foreign elements: Starch, maltose, cane sugar, etc.

Wet Nursing.

Wet nursing is the substitution of one mother's milk for another. It is, with our present facilities for modifying cow's milk, in my opinion seldom or never justifiable. I would reject it on the following grounds:

1. It is inaccurate. The milk of one mother does not necessarily suit the child of another, and although analysis is possible it is not practicable, and we have little chance of modifying the supply to suit our requirements.
2. It is inconvenient, upsets the house. Domestic difficulties are great and misconduct frequent.
3. I know of no examination, however careful and thorough, which will exclude the presence of syphilis in a woman.

Feeding by artificially-prepared proprietary foods being inadmissible and wet nursing inadvisable, we must look round for the milk of some other animal which we can modify to meet our requirements.

Cow's Milk.

Cow's milk is the best, being easily obtained, fairly constant in composition, and containing all the necessary constituents, although not in suitable form and proportion without modification.

Comparison of human and cow's milk:

	Human Milk.		Cow's Milk.	
Water	...	87-88	...	87-88
Solids	...	12-13	...	12-13
Proteid	...	1.5	...	3.5-4
(Caseinogen, 0.4; lactalbumen, 1.0; lactoglobulin, trace; nitrogenous extractives, 0.6)			(Caseinogen, 3.0-3.5; lactalbumen, 0.4; nitrogenous extractives, 0.7)	
Fat	...	4	...	4
Sugar	...	7	...	4.5
Salts	...	0.2	...	0.6
Reaction	...	Alkaline	...	Acid on delivery.
Micro-organisms	...	Sterile	...	Teeming on delivery.
Coagulation by acid	...	Slight	...	Firm clot.
Coagulation by Rennet	...	None	...	Firm clot (junket).

	Cow's Milk.			Human Milk.	
	Caseinogen.	Lactalbumen.		Caseinogen.	Lactalbumen.
König	2.88	0.53	König	0.59	1.23
Wynter Blyth	3.01	0.75		0.63	1.31
Hoppe-Seyler	3.88	0.77	Hirt	0.63	1.5
	3 to 4	0.3 to 0.5			

The proteid of cow's milk precipitated by gastric juice is less easily dissolved than that of human milk. It is harder and firmer. By diluting cow's milk with water four or five times, the curd obtained on the addition of acetic acid resembles that obtained from human milk treated in the same way. Diluting cow's milk with barley water made thinly, with whey, with a mixture of water and lime water, all tend to give a finer precipitate on the addition of acetic acid.

These facts can be demonstrated in a few minutes with a little cow's and human milk, some lime water, plain water, barley water, and whey. By mixing and diluting in varying proportions and varying ways in half a dozen watch glasses standard mixtures of human milk, cow's milk diluted once, twice, thrice, etc., with water, lime water, and whey and adding a few drops of acetic acid to each glass a precipitate varying in heaviness is thrown down. A comparison of the thickness of curd of the various mixtures is best demonstrated by running a thin layer on ordinary brown paper.

In modifications, therefore, we must remember that the total proteid content of cow's milk is more than twice that of human milk; that this content is made up of an indigestible part, caseinogen, liable to be precipitated in the stomach in a heavy curd, and a more easily digestible part, lactalbumen; and that in cow's milk there is about five times more of the indigestible than the digestible variety, while in human milk the opposite obtains in the proportion of two to one. From this it follows that in diluting cow's milk for the purpose of rendering the proteid of the same strength as human milk, it will be well to keep rather under than over the 1.5 per cent. proteid, and that in weakly children it may be necessary to go as low as 1 per cent. or 0.5 per cent. Should this not be advisable or sufficient we must resort to splitting up the two varieties of proteid and removing excess of the indigestible caseinogen.

The fat globules are smaller in human than cow's milk, and this makes the fat rather more difficult to digest in the latter. Cow's milk contains more salt and less sugar than human milk. There is no evidence that the latter is not the same chemically and physiologically in the two secretions.

We must conclude, therefore, from a comparison of our standard analyses that cow's milk must be diluted at least with an equal part of water, and sometimes with two or three, and even four, times the volume of cow's milk used.

Results of Dilution.

	Human.	Cow's.	Cow's Milk and Water Equal.	Cow's Milk 1 Water 2.	Cow's Milk 1 Water 3.
Proteid ...	1.5	3.54	2.00	1.33	1.00
Fat ...	4.0	4.0	2.00	1.33	1.00
Sugar ...	7.0	4.5	2.25	1.50	1.10
Salts ...	0.2	0.6	0.30	0.20	0.15

The addition of fat is usually effected either by adding a certain amount of a separated and standardized cream, or by allowing milk to stand one, two, three or four hours and using a varying amount of the top portion called cream milk. All the big dairies sell standardized separated creams of which 16 per cent. cream is the most handy and easily obtained.

Holt gives the following table showing the composition of standardized creams:

Composition of Creams.

	Whole Milk.	8 Per Cent. Cream.	12 Per Cent.	16 Per Cent.	20 Per Cent.	40 Per Cent.
Proteid ...	3.5	3.4	3.30	3.2	3.00	2.20
Fat ...	4.0	8.0	12.00	16.0	20.00	40.00
Sugar ...	4.5	4.5	4.20	4.0	3.90	3.00
Salt ...	0.7	0.7	0.65	0.6	0.55	0.45

The advantages of separated creams are that: (1) They have a standard strength which can be depended upon. (2) They are fresher than gravity cream. (3) Hairs, manure, and other foreign bodies are removed.

It has been urged against them that the separator breaks up the fat globules causing them to run together into masses difficult to digest, and that they cannot so readily and com-

pletely be mixed with milk as can gravity cream. In practice it will be found that they mix evenly and satisfactorily with milk and their freshness is a great advantage. In small towns, however, separated creams are not always to be obtained, and in the country almost never.

Gärtner has devised a simple method of preparing a substitute for human milk from cow's milk. A quantity of milk is mixed with an equal quantity of sterilized water and placed in a separator arranged to revolve so that the two outgoing streams are equal. The result is separation into two portions, a cream milk and a skim milk portion. His analysis is as follows:

	Proteid.	Fat.
Original milk ...	3.6	3.50
Diluted half ...	1.8	1.75
After separation (cream milk) ...	1.8	3.30
" " (skim milk) ...	1.8	0.20

Cautley devised the following mixture and used it with good results at the Belgrave Hospital for Children.

Take an equal quantity of cow's milk and 9 per cent. solution of lactose. These are placed in a separator revolving so that the two outgoing streams are equal. Separation into cream and skim portion.

Percentage composition is as follows:

	Original Cow's Milk.	Separated.	
		Cream Portion.	Skim Portion.
Proteid ...	4.0	2.00	2.0
Fat ...	3.7	3.50	0.2
Sugar ...	4.4	6.0	6.7
Salts ...	0.7	0.35	3.5

The Above Method Modified for Home Use.

1. Take a pint of good fresh milk.
2. Add a pint 9 per cent. solution of lactose.
3. Strain.
4. Allow to stand one hour in summer; two hours in winter. This should be in a vessel with a tap allowing lower half to be drawn off.
5. Draw off lower half, what remains will resemble in composition human milk.
6. It must be rendered alkaline and sterilized.

N.B.—Lactose readily decomposes, in which case the dilution may be effected by sterilized water, and lactose subsequently added.

Rotch used a tin mixture to hold $3\frac{1}{2}$ drachms milk sugar and made a mixture as follows:

ure as follows :

				Composition.	
20 per cent. cream	...	...	1½ oz.		$\left\{ \begin{array}{l} P = 1.1 \\ F = 4.0 \\ S = 6.2 \\ S = 0.2 \end{array} \right.$
Milk	...	...	1 oz.		
Water	...	...	5 oz.		
Milk sugar	...	...	1 measure		

Boil or steam, and when cool add ½ oz. lime water.

Boil or steam, and when cool add ½ oz. lime water.

Milk Prescription.

In places where there are big dairies and centrifugal cream of standard strength can be obtained, all the necessities for humanizing milk are to hand, and a prescription written as below and sent to the dairy will bring round the required number of feeds of prescribed strength and heated to any temperature desired.

Example.

Caseinogen ...	...	0.4
Lactalbumen (whey proteid) ...	...	1.0
Fat ...	...	3.5
Lactose ...	...	0.7
Lime water ...	...	5.0

Heated to 150° F. Ten feeds, 3 oz.

This, of course, is an excellent method, but it is expensive, and not always available when required, except in certain large towns.

Cream Milk Mixtures.

Gravity cream milk is more generally applicable for home consumption, and although not so scientific or exact, is fairly accurate and a great advance on the simple diluted cow's milk with a lump of sugar added. The milk should come from a good dairy where all precautions are taken and the milk is cooled immediately after being drawn. A graduated porcelain or glass jar is also necessary with a stop-cock at the bottom to allow of the desired portions being withdrawn. The jar should be marked off into $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$. If there is no covering the top may be closed with tissue paper

as jam is done down. Experiments made at the Walker Gordon Farm at Plainsboro' have established the fact that milk kept in a cool place for four hours separates by gravity as much as it does in eight or twelve hours. Two hours is sufficient to give good approximate results.

Holt gives the following percentages of cream after standing four hours: Upper fifth, 15 per cent. fat; upper fourth, 13 per cent. fat; upper third, 10 per cent. fat; upper half, 9 per cent. fat.

The same author gives the following table after standing four hours:

Upper one-third	{ Proteid, 3.3 per cent. Fat, 10 per cent.
Upper half	{ Proteid, 3.3 per cent. Fat, 7 per cent.

It is evident that here we have cream milks obtained by gravity and capable of easy modification to resemble the percentage composition of human milk.

For the first month an infant can rarely digest more than proteid of cow's milk 1 per cent., and will probably not be able to reach 2 per cent. until three months old. It will be necessary to dilute in the early weeks with at least two volumes of water, and such dilution as we have seen dangerously diminishes the proportion of fat and sugar which must be subsequently in some way added up to the required standard.

Humanized Cow's Milk.

To humanize cow's milk, therefore, we may deduce the following rules:

1. That dilution is necessary to rather below the percentage of proteid in human milk owing to the firm heavy coagulum and indigestibility of the caseinogen of cow's milk.
2. That caseinogen being in high proportion in cow's as compared with human milk, it is necessary in immature infants to diminish this proportion by removing the indigestible caseinogen in whole or part, leaving the soluble and more easily-digestible lactalbumen, or to diminish the quantity by predigestion (peptonization).
3. That this may be done by a combination of whey and cream mixtures.
4. That in diluted cow's milk mixtures fats and sugars are so far diminished that it becomes necessary to increase the fat by addition of cream and sugar by addition of lactose.
5. That acidity must be counteracted by the addition of an alkali.
6. Germs must be killed by heat.

What methods have we for overcoming this indigestibility of cow's milk proteid? They are two.

1. Removal of caseinogen by precipitation and straining. The result is whey, and the soluble lactalbumen remaining is commonly called whey proteid.
2. Partial or complete predigestion—peptonizing.

Whey is obtained by the action of rennin on separated milk. König, from an average of 46 analyses, gives its composition as—proteid 0.86, fat 0.32, sugar 4.79, salts 0.65, water 93.38. Hammersten gives the percentage of proteid as 0.86; White and Ladd as 1.

Whey Cream Mixtures.

By diluting cream with whey, cow's milk can be modified to resemble very closely human milk.

Whey dilutes the caseinogen of cow's milk and renders it more digestible. Whey-cream mixtures yield a fine flocculent precipitate. Fat forms a good emulsion with whey. It is probable that the whey-cream mixture is the best modification of cow's milk possible as an infant food. It should be noted that the rennin ferment is killed at 140° to 150° F. This must be borne in mind, and the ferment destroyed before adding milk, or precipitation occurs and the mixture is spoiled. The following is a simple whey-cream mixture which answers well:

1. Stand a pint of milk in the cool for three hours.
2. Separate the cream by skimming.
3. Divide the milk into two parts.
4. Add a small piece of rennet to one part and strain off the curds, when formed, leaving whey.
5. Heat the whey to destroy ferment in the sterilizing vessel, add the other half of milk and the cream.
6. Heat to temperature of 150° F.
7. Add milk sugar and lime water.

The advantages of whey-cream mixtures may be summarized as follows:

1. Thick curd of casein removed.
2. Soluble and easily-digested lactalbumen retained. This renders the mixture more like human milk.
3. Whey makes a good emulsion with fat.
4. Milk diluted with whey yields a finer curd than if water is used, and is of course much more nourishing.
5. In very sickly or feeble children whey can be used at first by itself, and small proportions of milk or cream slowly added.

Predigestion or Peptonization of Proteids.

This is another method of avoiding the thick, heavy, coagulum of cow's milk. By it the whole or part of the work done by the stomach in digesting proteid is artificially performed outside before the feed is introduced. Functions not used tend to become weakened and eventually atrophied, so that conceivably great harm might be done. If, however, the process of peptonization is only partial, the stomach gets sufficient exercise of function and the general system benefits by the increased amount of nutritive material it obtains.

Predigestion may be effected with pepsin and hydrochloric acid with sodium bicarbonate and a preparation of pancreatic juice.

Rotch's Method.

1. Into a clean glass jar put 4 oz. cold boiled water and 1 gram of sodium bicarbonate.
2. Add $\frac{1}{4}$ gram extract. pancreatis.
3. Add milk XII.
4. Stand in a vessel of water at 107° F. for seven or ten minutes.
5. Cool at once and keep on ice.

The food thus prepared is only slightly different in colour and taste from ordinary milk, and is only partially peptonized. It gives a soft, fine, flocculent curd with acid. Every moment the process is allowed to go on there will be more peptone and less proteid, until the process becomes completed. In the latter case the milk is greyish in colour and disagreeably bitter. It also frequently causes diarrhoea and digestive disturbances. The peptonizing process is arrested by placing the milk on ice, but recommences on removal. It may be stopped and at the same time the milk sterilized by heating to 150° to 160° F. Each feed is best peptonized immediately before it is wanted.

The advantages of predigestion are:

1. It enables premature, weakly, and dyspeptic infants to take a food they might otherwise reject, and so throws a bridge across a dangerous chasm.
2. It may be used to assist and restore digestion.
3. The partial process gives a fine flocculent curd.
4. The process can be worked on a sliding scale, giving the stomach as much work as it can do, and at the same time building up the tissues with easily-assimilable food.

The disadvantages are:

1. It takes time, and requires intelligence on the part of nurse and mother.
2. Carried to excess it may impair the digestive function.
3. The food is scarcely so palatable, though infants get to like it.
4. Peptones are liable to cause diarrhoea.

As a stop-gap for a month or two it is invaluable.

GENERAL CONCLUSIONS.

I. That mother's milk is the only proper food for an infant, and should be used whenever available.

II. That all forms of proprietary foods are bad and to be avoided.

III. That wet nursing is rarely permissible.

IV. That the proper substitute food for an infant is some form of modified cow's milk.

Also the following special conclusions:

I. That the standard at which we aim in modifying cow's milk is the child's natural food—mother's milk.

II. That careful attention must be paid to each of the constituents—proteid, fat, sugar, salts.

III. That the proteid of cow's milk is less digestible than that of human milk, and requires over-dilution compared with the standard.

IV. That the whole of this indigestible proteid (caseinogen) may be removed, leaving the more easily digestible proteid (lactalbumen) as in whey mixtures, or that the proteid content may be completely or partially peptonized.

V. That cow's milk diluted sufficiently to bring the proteid into line with the standard (that is, from 4 per cent. to 1.5 per cent.) is deficient in fat and sugar, and that these must be subsequently added.

VI. That fat may be added in the form of cream, either separated and of standard strength, or by using gravity creams.

VII. That lactose is the proper sugar to add.

VIII. That cow's milk, although neutral or alkaline when drawn, owing to its certain infection as at present obtained and to the rapid growth of germs it allows, becomes acid, and that this acidity must be neutralized by bicarbonate of soda or lime water.

IX. That human milk is sterile. From this it follows that

we should endeavour by all the means in our power to obtain a supply of sterile cow's milk, and that until this object can be attained—

X. Germs must be killed by some method. The handiest and most generally used being heat.

STERILIZATION.

Cow's milk, though sterile when drawn, soon becomes infected, and as delivered is full of micro-organisms. One authority states that London milk contains more organisms per c.cm. than its sewage.

The aim should be to deliver milk as nearly sterile as possible. Much we may hope will be accomplished in this direction in the future. Cattle should be kept in well built, drained and ventilated stalls. They should be as carefully groomed as a horse, and should be examined by the veterinary surgeon each month, any suspicious animals being at once isolated. The milkers should be made to wear overalls and to thoroughly cleanse their hands before milking; any sickness being immediately reported to a medical man. The water supply must be beyond suspicion and must be regularly analysed, and every care must be taken with the cleansing of all vessels used.

The milk should be cooled as soon as it is withdrawn. Most of the better dairies make some attempt to carry out these requirements, and by compensating freely for illness to man or beast make it advantageous to report anything of the sort. The limit to these precautions is at present the price of milk. We must take things as we find them, and acknowledging the probable presence of large numbers of organisms in any milk we are dealing with, do our best to destroy them. This process we have called sterilization, and to be effective, necessitates boiling for a prolonged period, at least one hour. This was the time adopted by Soxhlet, who introduced boiled milk. He noticed the following disadvantages following its use.

1. That some spores are not destroyed, even by such boiling, and that they may subsequently develop in such numbers as to make the milk dangerous.
2. That the taste becomes unpleasant.
3. Causes constipation.
4. That the soluble albumen (lactalbumen) coagulates at about 160° F., and is lost if removed.
5. That casein is rendered less digestible and is acted on more slowly by pepsin and trypsin.
6. That a harmful change results in the calcium salts.
7. That milk boiled has lost its antiscorbutic properties, and babies fed on it may develop scurvy. Cheadle, who is strongly in favour of boiling milk, admits that many such cases have come under his care and knowledge.
8. It is found that fat is less digestible in boiled than in unboiled milk.

Boiling milk, therefore, as a means of sterilization may not in every case be effective, and frequently does produce untoward effects. The question now naturally presents itself—Have we any alternative? We recognize that milk contains numbers of organisms; that these are injurious and must be got rid of or killed.

To sterilize milk completely and certainly it must be boiled more than once for at least an hour. Such prolonged boiling has many serious disadvantages, but in practical feeding we may strike a mean combining as many advantages with as few disadvantages as possible. This mean is generally accepted to be 70° C. (158° F.), kept up for thirty minutes, the process being known as pasteurization. Pasteurization is a loose term, both as regards time and temperature, and in writing a milk prescription in giving directions these should be specified:—Holt considers it to be 167° F.; Freeman considers it to be 155° F.; Leeds considers it to be 157° F.; Vincent considers it to be 150° F.

The advantages of pasteurization are: (1) That micro-organisms are destroyed and rendered harmless; (2) fermentation is stopped; (3) lactalbumen is not coagulated; commences at 161° F.; (4) chemically the milk is little changed; (5) the risks of transmission of disease are reduced to a minimum; (6) it is not so likely to produce scurvy, though Holt says the feeding on milk raised to 167° F. for thirty minutes has done so. Rapid cooling is part of this system, and little chemical change in the milk is said to result.

To our previous conclusions we may add the following, therefore:

1. That some attempt must be made to kill germs always present in large quantities in milk.
2. That boiling does this most effectually and rapidly, is much the easier method, and, in the hands of the poor, often

the only method available, but that certain injurious changes result, to be avoided if possible.

3. That these changes can best be avoided at 70° C. (158° F.) for half an hour (pasteurization).

4. That all infants' food should therefore undergo this process when possible.

THE INCREASE IN THE CONSUMPTION OF ANIMAL FOOD :

A SURVEY OF THE PAST FIFTY YEARS.

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THE question of physical inefficiency or physical deterioration is one which is occupying a prominent place in the minds of medical men at the present time. This subject has recently been investigated by a Departmental Commission, which arrived at the general conclusion that the available facts hardly warrant a definite statement as to the existence of a progressive deterioration in the physique of the nation. The only definite conclusion arrived at was the existence of a deterioration in the teeth of the younger generation. With regard to the general question, there is probably a widespread opinion among medical men that any deterioration which may be proved to exist has a direct relation to the alterations in the dietetic habits of the country in the present and past generations. This point was suggested to the Commission in the remit from the Royal College of Physicians of London, who, in their reply to the official invitation to take part in the investigation, pointed out that, among other factors demanding investigation, the question of the altered diet of the country took a prominent place. This subject does not, however, appear to have been very particularly investigated. The only evidence bearing directly on it was led by Drs. Haig and Hutchison. Dr. Haig pointed out that there had been a great increase in the consumption of meat in recent years, and expressed the opinion that the influence of this increase had been unfavourable to the race. Dr. Hutchison, on the other hand, expressed the opinion that the deficient use of nitrogenous foods at the growing periods of life—especially 10 to 15 years of age—was an important factor in the general malnutrition. It does not appear that any facts were elicited in favour of either view. A study of the available data proves conclusively that in the last fifty years there has been an enormous increase in the consumption of animal food (meat). This is proved by the following figures taken from the Blue Books. By way of introduction, a few words may be said on a cognate subject—namely, the geographical distribution of disease.

The difficulties attendant on the collection of reliable statistics on the geographical distribution of disease almost preclude any definite statement on this point. We have, for the most part, to be content with the general impressions of medical practitioners who have had extensive experience of disease in countries in which the dietetic habits are profoundly different from those prevailing in this country. To illustrate. The writer has been told by more than one practitioner of large experience in medical work in India that appendicitis is almost unknown among the natives of those districts in which the staple article of food is rice; similarly, that chlorosis is extremely rare.

On the other hand, some diseases which are comparatively rare in this country, are much more prevalent in that part of the world, for example, osteomalacia and diabetes. A short time ago a friend of the writer informed him that, as the result of six years' work as a medical missionary, she must have seen and treated over a hundred cases of the former disease; and for the prevalence of diabetes we have the authority of Dr. Crombie, who has suggested that diabetes might appropriately be called the gout of India. These facts are suggestive. They constitute strong evidence in favour of the importance of an experimental inquiry adapted to prove the existence or non-existence of an important relationship between the diet of a country and its prevalent diseases. If it could be shown that there is an important relationship between the diet of the natives of India and the diseases referred to, it is reasonable to think that diet may play an important part in the incidence of other diseases of a more acute nature. In this connexion it is of interest to note that a recent writer in the *Lancet* has suggested that the relative immunity to typhoid fever in the Japanese army may partly