INFANT FEEDING

BY ARTIFICIAL MEANS

From a Photograph kindly sent to the Author especially for this work by Dr. Deshayes of Rouen.

INFANT FEEDING

BY

ARTIFICIAL MEANS

A SCIENTIFIC AND PRACTICAL TREATISE ON THE DIETETICS OF INFANCY

BY

S. H. SADLER

AUTHOR OF 'SUGGESTIONS TO MOTHERS,' 'MANAGEMENT OF CHILDREN,' 'HIGHER EDUCATION,' 'BOTHERS OF MARRIED LIFE,' 'HENRIETTA,' ETC.

THIRD EDITION

WITH A SPECIAL CHAPTER ON THE HISTORY OF INFANT FEEDING BY ARTIFICIAL MEANS IN THE EARLY AGES, ILLUSTRATED WITH COLOURED AND OTHER PLATES AND TWO NEW APPENDICES

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TO THE ESTEEMED MEMORY OF

SIR ANDREW CLARK, LL.D., M.D., F.R.S.,

WHOSE COUNSEL AND KINDLY ENCOURAGEMENT

WERE OF INESTIMABLE VALUE

IN ITS PREPARATION,

I gratefully Dedicate

THIS WORK.

16, CAVENDISH SQUARE. W.

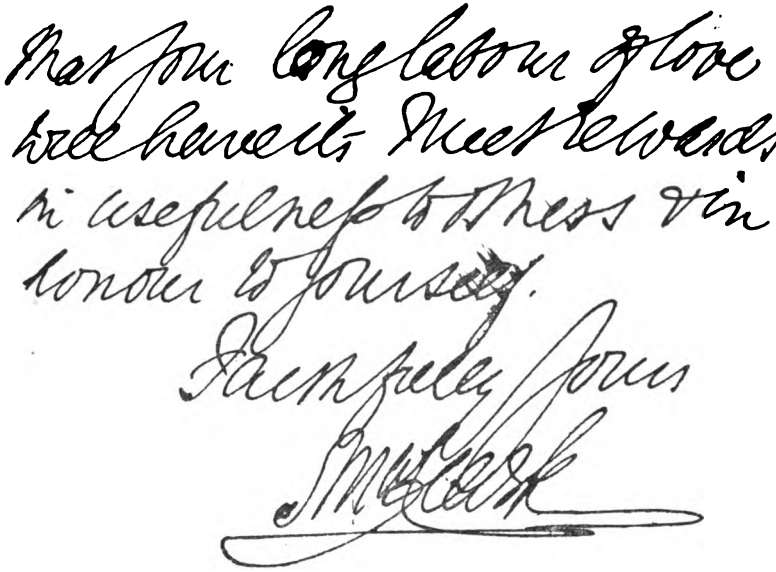
26 Feb: 1892.

Dear Mrs Sadler

I sincerely regret and beg pardon for the delay which has arisen in returning you sheets and for whatever inconvenience this delay may have caused you.

I regret this the more as I find that I am forbidden by the Authorities of my official position from taking the pleasure of complying with your request to write a little preface to your book.

I can now only hope



PREFACE.

In compiling this volume I have classified the various ways of preparing cow's milk for infant feeding, the other animal milks, and the patent foods, so that there may be no difficulty as regards reference. Of the grave responsibility of such a task as I have undertaken I am more than conscious. I have been indebted to many sources for information. I have, however, tried to indicate my chief obligations in the footnotes. My sincere thanks are due to Sir William Roberts for the information as to peptonised milk, rice water, etc., which he so kindly placed at my disposal; to Dr. Pavy for his analysis of rice water; and to Dr. Wynter Blyth for his analysis of condensed milk, and barley water. The most recent medical and scientific advances in the hand-rearing of infants are given. I also give illustrations from original photographs taken in this and other countries.

> Whoever thinks a faultless piece to see
> Thinks what ne'er was nor e'er shall be:
> In every work regard the writer's end,
> Since none can compass more than they intend.
>
> —Pope.

I may remark, however, that I have devoted many years and much study and labour to the perfecting of this book. That such a work as this will supply a want long felt by numerous people, those best able to judge have assured me. Dr. Cheadle writes (page 2 of *Artificial Feeding and Food Disorders of Infants*): "Difficulties connected with this question of the feeding of infants are amongst the most common of the many troubles which beset the ordinary practitioner, and are constant sources of worry, of anxiety, and not unfrequently of discredit"; and adds (page 4): "There is a lack of correct and precise knowledge on this subject, not only amongst students, but amongst medical men in active practice also, and, even more than this, a great deal of positively erroneous belief, and of mistaken practice founded upon it. The main cause of this serious deficiency is to be found, I think, in the fact that the subject is neglected in our medical schools. It is either not taught there, or only in vague generalities and in desultory fashion. No accurate and scientific exposition of it is to be found in the ordinary text-books. The materials of knowledge exist, but they are scattered about in the pages of works on physiology and on hygiene." It has been my endeavour to collect and to put in order this information; to quote from the greatest

scientists and specialists (on each subject) in this and other countries, and not to place on record merely hypothetical or problematical conjecture. In all instances where it has been possible I have preferred to give the exact words of those eminent physicians and scientists who have made infant feeding their especial study, and who have in some instances devoted a lifetime to working out the problems connected with it. I look upon my work as the string which binds a rare nosegay of useful flowers (*i.e.*, facts) together. Dr. Cheadle continues: "When the student enters upon the actual work of his profession, he has no certain data to guide him. He lacks accurate knowledge (1) of the physiological laws which govern the needs and powers of an infant, with their variations in health and disease; and (2) of the exact nutritive value of the various materials adapted for artificial feeding. And so the method followed is too often routine and mere rule of thumb." Now, if this is the case with medical men, how much more is it so with young mothers and nurses who have not the same advantages as doctors, *viz.*,—medical works containing directions as to the feeding of infants, at hand to consult, knowledge imparted by those qualified from experience to give such, the advantage of attending lectures on the subject, and hospital practice. The books

written on the rearing of children for women are of little if any use as to infant feeding; and dealing as they do in "generalities," and giving no precise or reliable information, are of no practical help in this intricate matter. "The physiological laws which govern the needs and powers of an infant, with their variations in health and disease," do not come within my province. This I leave to those more qualified to deal with so profound a subject; but in giving analyses of milks, foods, etc., and how to best prepare and give, I shall, I hope, afford some useful help and guidance to those hand-rearing children. I have pursued my researches as to the feeding of infants abroad as well as in England, and have visited some of the best known hospitals. I give in this book every way that I have been able to find out of successfully meeting the difficulty of feeding delicate and feeble as well as robust infants. It is with some regret that I write the word "Finis" to this work, which in preparing (in the intervals of leisure from increasing cares and duties) has for so long afforded me a never-failing source of unalloyed pleasure.

PREFACE TO THE SECOND EDITION.

I HAVE been asked to add to this edition an epitome of the early history of Infant Feeding by Artificial Means. Before doing so, however, I must express my gratitude to the profession as well as the public for the very great cordiality with which they have received my work. Considering the many difficulties which I have had to contend against in the pursuit of my investigations, the results have been far beyond my expectations.

Thanking my friends in England and abroad for their kindness to me, I commit the present volume to the over-ruling and all-wise dispensation of Providence, in the hope that it may be found even more useful than the last.

I have revised and corrected those parts pointed out to me as needing revision and greater accuracy as to wording.

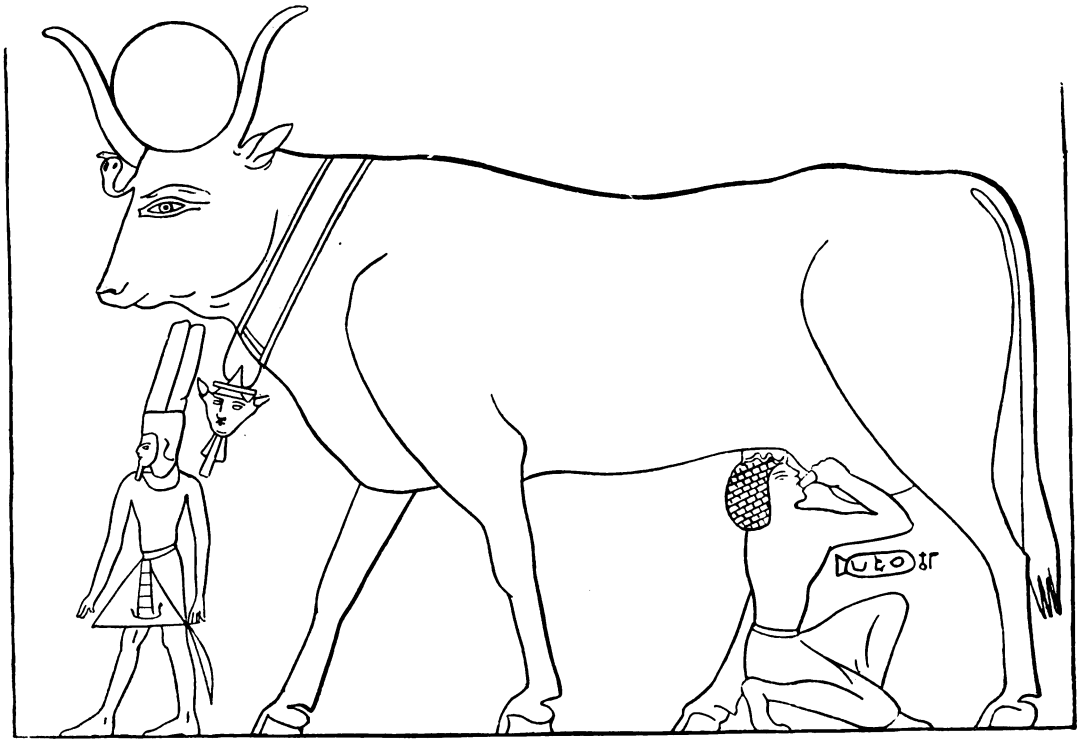
ARTIFICIAL FEEDING OF INFANTS IN THE EARLY AGES.

Was the feeding of infants by artificial means ever practised by the ancients ? To my mind an exceedingly interesting inquiry presents itself when one asks, was hand-rearing of infants known to them, and if so, how was it effected by those clever and

enterprising enough in those early times to set themselves the stupendous task of emulating and rivalling the great mother Nature in her marvellously adapted provision for the early months of infant life? There can be no doubt, the problem of how to rear infants by other means than that appointed by Nature has exercised—sometimes distressfully—the minds of many, both in the ancient world and in modern times.

It would appear that in the oldest nation we know the history of [Egypt] there is no record of the artificial feeding of infants. Professor Flinders Petrie writes to me: "I do not remember any instance of artificial feeding of infants in ancient Egypt nor in modern Egypt. Wet nurses were evidently common from the earliest times;[1] *menat*, a nurse,  written with the determination of a breast, occurs in the oldest inscriptions; and so imbedded was their idea, that the male tutors of the young princes in the eighteenth dynasty are called their *nurses* with the same determination. This makes it difficult to be certain how far a *nurse* was actually a wet nurse or a dry nurse, although the breast occurs in the title." It would seem that whether the early Egyptians ever used artificial means for feeding infants cannot now be determined.

[1] See *Exodus*, chap. ii., v. 7–9.



Queen Hatshepsut nourished by Hatbor as a Sacred Cow.

Being a highly intelligent, civilised and inventive people, they may have resorted to some other mode of feeding their infants when the natural milk failed. Some have thought that the early Egyptians may have fed infants by animal means; but this, too, is unknown. Of this Professor Petrie writes to me: "The only instance of feeding from the animal is probably entirely symbolical". This earliest instance of an illustration of a human being nourished by an animal is the "symbolic scene of Queen Hatshepsut nourished by Hatbor as a sacred cow. In the temple of Deir el Bahri, Thebes, eighteenth dynasty, about 1500 B.C." (*Duemichen, Historische Inschriften*, ii., 31.)

"The royal nurses were persons of great importance in early Egyptian times; the husband of one was chief attendant on the king and keeper of the royal stables, and eventually became king himself, Ay of the eighteenth dynasty, about 1330 B.C." [1] Eastern nations have no memorials of having fed infants artificially. With the Romans it is otherwise.[2] That they did feed infants by artificial means cannot now be doubted. In England, France, the Rhine, and more especially in Italy, numbers of

[1] Flinders Petrie.

[2] Some think the Greeks, also, fed infants by artificial means. Relative to this see *Journal of the British Archæological Association*, vol. xxvi., p. 110.

curious vessels, some being of glass and others of terra-cotta, have been found. Those of terra-cotta offer great differences in the nature of the clay; some are of the same red tone as the aretine ware, and some of these little jars, which have been found, are made of absorbent material so that the lips cannot be pressed against them without adhering; therefore, when used for feeding infants their spouts must have been provided with a calf's teat, or some such thing, as a protection. Some of the vessels found were formerly regarded as oil cruses for putting the oil in the small lamps used by the Romans. The term "tetinæ" has been given to these, and they may be traced back to a very remote era. *The Journal of the British Archæological Association*, vol. xxvi., p. 112, mentions that "in the Roman tetinæ may doubtlessly be traced the archetype of the mediæval feeding-bottles". I cannot find, however, that infant feeding-bottles like those now in use, or even in the slightest degree resembling such, were ever employed till these later years.

All the early Roman feeding-bottles were not only carefully made, but in many instances are of elegant construction, and well adapted for the purposes intended. Dr. Sambon (of Rome) writes to me: "In preparing a work for the Government on the history of medicine in Ancient Italy, I have collected

Early Roman Red Terra-cotta Infant's Feeding Bottle.

face page XVI.

Feeding Bottles found in tombs of children. The smaller one is of glass and was found in a Roman tomb in Paris. The larger one is of earthenware and was found in Rome.

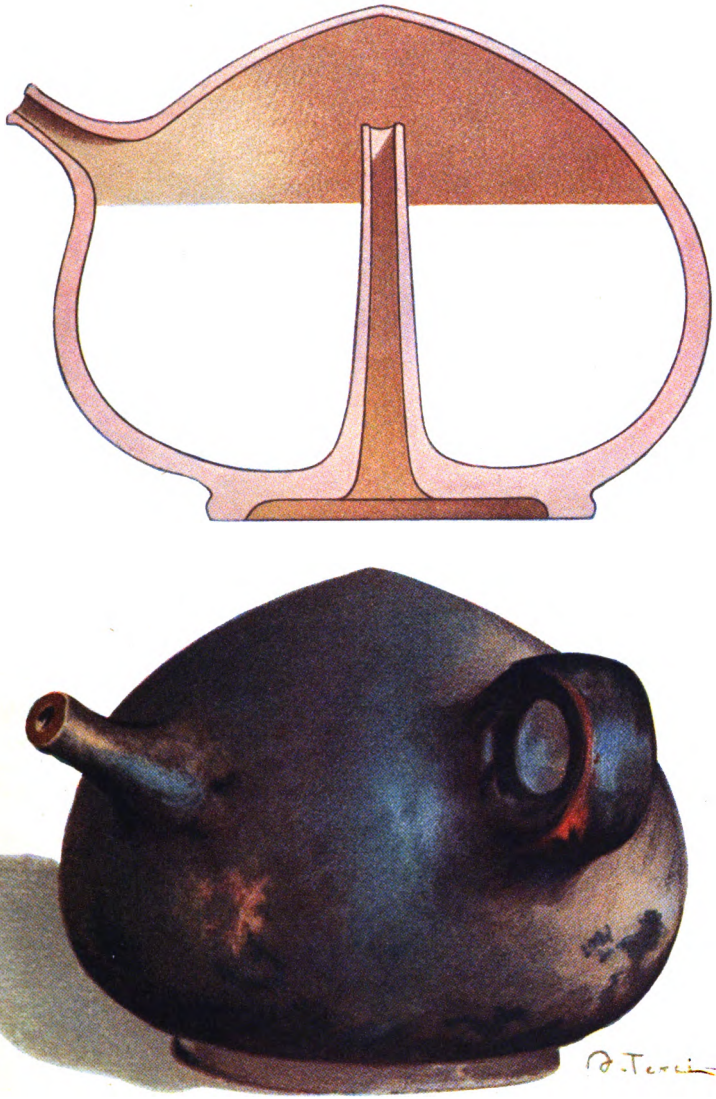
face page XVII.

a large number of most interesting old feeding-bottles for children ; some were found in tombs of children, who died during the period of lactation,[1] others in votive deposits consecrated to healing gods". Dr. Sambon says of these feeding-bottles, "their age varies immensely, and some certainly belong to a very remote epoch (perhaps the fifth or sixth centuries, B.C.). Those of which we have positive information, as determined by coins found with them, can be classed between the first and fifth century, A.D. The shape varies also greatly; generally it is that of a small amphora with a spout, the mouth of the amphora being closed, with the exception of a few holes for the liquid to be poured into the vessel. Others have the shape of an askos, or goat-skin. Some have curious shapes of animals ; but the most interesting are those in the shape of the female breast. They are so constructed that no flies or dust can reach their contents. The milk was introduced by simply inverting the bottle, and pouring it through an open tube ascending within from the middle of the base almost to the apex. This same tube prevented the escape of the milk when the bottle was placed again on its base. The child obtained nourishment by sucking through

[1] Pliny (vii., 16) says it was the custom of most nations not to burn the bodies of children who died before they had cut their teeth.

a spout on the side of the article. On the opposite side is a small round handle. These two appendages give the feeding-bottle the resemblance of a small tea-pot.[1] What positively confirms them to be feeding-bottles is that they have been found in the tombs of very young children. Here they had been certainly placed by mothers, sometimes together with a rattling toy, as the most suitable furniture for the tiny grave. The feeding-bottles replaced the dishes of various food—chicken, eggs, fish, etc., which were constantly placed in the tombs of grown-up people, probably according to their tastes." "In my collection," adds Dr. Sambon, "I have also a tiny feeding-bottle of lead, which had been made to be consecrated as a donarium (gift), probably as a thanksgiving for successful bringing up by artificial means." The title feeding-bottle seems of recent introduction. "As late as the end of the seventeenth century such things were called 'suckling' and 'sucking bottles'. In an edition of Johnson's Dictionary of 1799 there is 'sucking bottle,' and this is defined as 'a bottle which to children supplies the want of a pap'." "In Torriano's Dictionary, Italian and English (London, 1688), s. v. 'Bottle, a sucking-bottle for a child, *vasetto da Bambino*'. In the Cambridge Latin Dic-

[1] The illustrations of ancient Roman feeding-bottles are taken from drawings given by Dr. Sambon.



Ancient Infant's Feeding Bottle with open tube within.

tionary (1693), we have among the barbarous words *alifanus* and *alifans*, a 'sucking-bottle' for children; and in Boyer's French and English Dictionary (London, 1699), a 'sucking-bottle,' *succeron*."[1]

Among the Gauls, Britons, Irish and Welsh, children were not reared by artificial means, but "were put out to nurse at neighbouring farms; and English families in the seventeenth century continued the custom".[2]

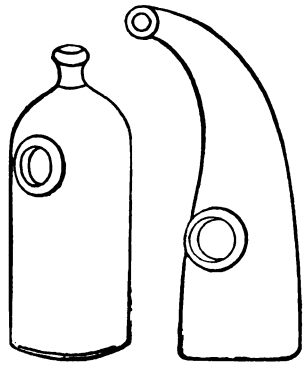
Matthew Paris mentions children being fed on milk.

Mr. Maw writes to me: "The first record of a feeding-bottle that we can trace in our business is in an old list, dated 1832; in a previous list, dated 1830, the earliest in our possession, they are not mentioned at all, and we think, therefore, that in all probability they must have been introduced about that time. These bottles are used," Mr. Maw says, "with a calf's teat or an ordinary piece of wash-leather, in place of a teat. Following upon this," Mr. Maw adds, "in about 1861 we have O'Connell's Patent and Maw's Fountain Feeding Bottles. These were the first of the bottles in the style in which they are best known at the present day."

[1] *Journal of the British Archæological Association*, 1870, p. 113.

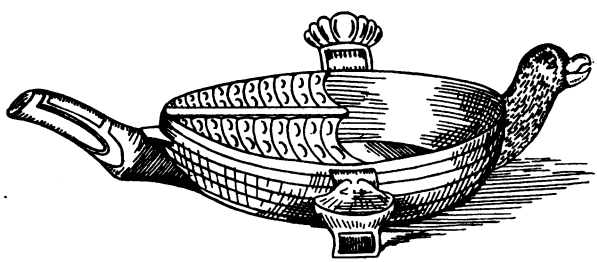
[2] *Encyclopedia of Antiquities* (Fosbroke's), vol. ii., p. 619.

Pap-boats for feeding infants were in use before the introduction of these later feeding-bottles.



Early Infant Feeding Bottles used in England in 1832.

Antiquity teems with mythological stories, and with fables relating to the weighty question of the supply of nutrition to the infant; and from Jupiter



Pap-Boat, Leeds Earthenware, 1760.

sucking the goat to Romulus and Remus with the friendly wolf, we see the efforts of mankind directed to aiding infancy to keep the great gift of life.

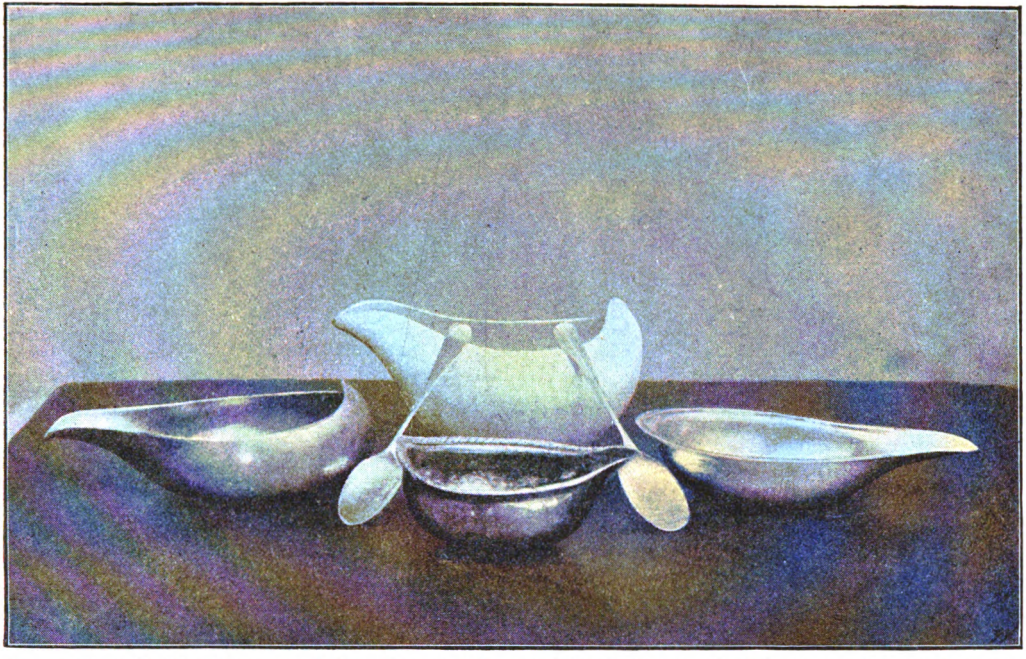
PREFACE TO THE THIRD EDITION

TIME rolls on and the world's ceaseless activities continue. Things of value in one generation are not so considered in another. Give place to the newer ideas is for ever the cry. Books of a technical kind are often rendered useless by further research, greater and more extended inquiry. That this book, on so intricate a subject as the one I have dealt with, is still needed and under the searchlight of modern scientific inquiry is still of value—in fact, as a great scientist recently assured me, *is still the best treatise that has been written on the subject of Infant Feeding by artificial means*—impels me to again present this book for the consideration of those needing such.

In sending this, my beloved literary child, again forth, I will only add that I have thoroughly revised the book and have sought the aid of the greatest scientists of the present day, an aid most willingly accorded.

In this edition I have given the latest and *best proved* ways of preparing cow's milk for infants. I give a special Appendix on *Cow's Milk with Citrate of Soda*, which is now being very largely used in the children's hospitals in England, in America, and elsewhere, and another on *The Modern Use of Asses' Milk in Infant Feeding*.

March, 1909.



Antique Infant Feeding Spoons and Pap-Boats in Silver and Earthenware. Period: George II. and George III.

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Section I.

BRINGING UP BY HAND.

The great desideratum in feeding an infant is that the food should be easy of digestion, easily assimilated, nourishing, and palatable. Whatever food an infant is being brought up upon, if it agrees, and the child gains in strength, and is going on perfectly well in every respect, it is unwise to make a change, even with the idea of giving a better or more nourishing food. The old proverb, "Let well enough alone," is ever best followed; for in trying to better that which is well we very often find the truth of the Italian, "Stava bene, ma, per star meglio, sto quì".[1] Any system tried and proved to be good should never be deviated from. Chaotic efforts and contradictory theories lead to but one result—failure.

"There can be no doubt," writes Dr. Starr,[2] "though the statement is a bold one, and seemingly

[1] "I was well, but, wishing to be better, I am here" (in the grave).

[2] *Dietetics of Infancy and Childhood*, "Annual of Universal Medical Science," vol. iv., p. 254.

contrary to nature, that, taking the average, infants properly brought up by hand are better developed and enjoy more perfect health than those completely breast-fed." Infants can be brought up on a variety of things—cow's, ass's and goat's milk having been tried with apparently equal success.[1] Some of the patent foods are also of utility in the hand-rearing of children.

It is essential for the successful rearing of infants by hand to observe:—

1st. Cleanliness as regards the vessels the food is prepared and given in.

2nd. Exactitude in preparing the food, so that it is *always the same, and always the same heat.*

3rd. Regularity in giving food, and giving it sufficiently sustaining, and in sufficient quantity.

(1) Dr. Bannister says:[2] "Dirt cannot be allowed to exist in a dairy, on account of the loss it causes; and the only vessels where carelessness and indifference continue to linger seem to be the infant's feeding-bottles, which in many cases are neither clean nor sweet. The havoc worked in this way can be read in the faces of those children who have to use these dirty bottles; and emaciated, unhealthy bodies bear testimony to the infant mortality arising from this poisonous source." Milk should not be

[1] See Dr. Brouzet, *Sur l'Education Médecinale des Enfants*, i., p. 165. Also Van Helmont's *Infantis Nutritio.*

[2] *Our Milk, Butter and Cheese Supply.*

allowed to remain in feeding-bottles; they should be washed out, *tube and all, thoroughly after each time* an infant is fed.

Dr. Playfair calls attention to the necessity also of "keeping the feeding-bottle and tubes constantly in water when not in use, so that minute particles of milk may not remain about them and become sour". Dr. Playfair adds: "A neglect of this is one of the most fertile sources of the thrush from which bottle-fed infants often suffer".[1]

Infants' Feeding-bottles.—"If a weak solution of Condy's Fluid were always used, much suffering would be avoided and the life of many a child saved. I may add, I am not acquainted with *any other disinfectant* which can be applied to the same purposes."[2]

"Rinse the bottle out in a pint of water,[3] to which a small teaspoonful of Condy's Fluid has been added. The india-rubber teat, and still more the tube, should, when not in use, be laid in a weak dilution[4] of Condy."[5]

[1] *Science and Practice of Midwifery*, sixth edition, vol. ii., p. 302.

[2] Fredk. T. Prince, M.R.C.S., L.S.A.

[3] "Clean water only must be used; and no soap, carbolic acid, turpentine, or other oxygen-consuming substances added." *Warm water is best.*

[4] About 20 drops to a pint of water.

[5] *The Handbook for Midwives*, by H. Fly Smith, B.A., M.B., Surgeon, Hospital for Women, Soho Square, London.

Condy's Fluid can be made by any one, and costs very little. The following letter I received from Mr. Thomson respecting the making of Condy's Fluid at home:—

"KING'S COLLEGE, LONDON, W.C.,
"*April* 30, 1889.

"DEAR MADAM,—I regret that, being at present in the country, some delay may have taken place in answering your letter of the 27th.

"The strongest Condy's Fluid is made by dissolving 1 part of potassium permanganate in 16 parts of water. This solution may be diluted at will, but as a disinfectant should not be weaker than 1 part of permanganate to 80 to 100 parts water.

"Yours very truly,

"JOHN M. THOMSON."[1]

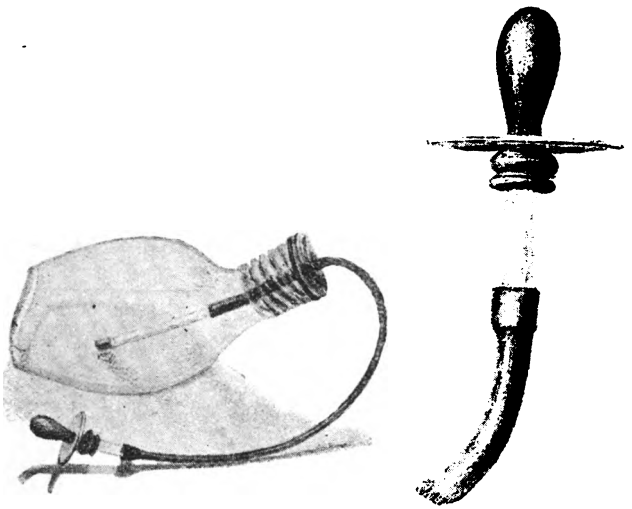
Dr. Playfair writes:[2] "The particular form of bottle used is not of much consequence. Those now commonly employed with a long india-rubber tube attached are preferable to the older forms of flat bottle, as they necessitate strong suction on the part of the infant, thus forcing it to swallow the food more slowly." I have found with *thickened* milk that it is best to place the piece of glass (which

[1] Demonstrator of Chemistry, King's College, London.

[2] *Science and Practice of Midwifery*, sixth edition, vol. ii., p. 25.

is next to the teat of the bottle) in such a way that it will show the milk passing through.

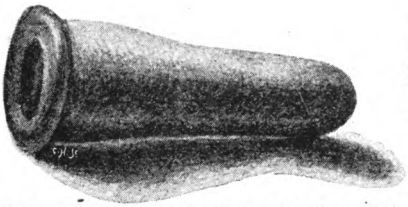
The need for a speciality of any kind being felt, the genius of man is exercised to meet the demand. Teats for infant feeding have undergone much improvement since first designed. The original teat



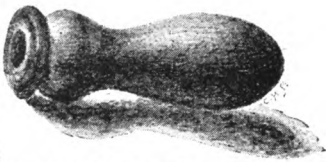
Bottle with Glass placed for Thickened Milk.

invented appears to us now of huge size beside the modern kind. Earlier, the teat from a very young calf was used. Maw, Son & Thompson, Aldersgate Street, E.C., sell teats made especially for infants with a cleft palate and hare lip. Some infants get a habit —when the ivory ring which goes on the mouth is too small—of fixing the ring on the lower lip. This

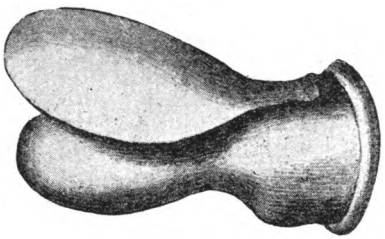
sometimes causes a tenderness. The larger rings have, on the other hand, the disadvantage of continually touching the nose when the child is sucking. The best plan when a ring which will exactly suit the infant cannot be found is to get a larger-sized ring and to cut off a piece of the upper part, filing



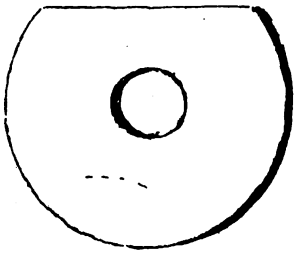
Infant Feeding-bottle Teat—first invented.



Modern Infant Feeding-bottle Teat.



Teat for Cleft Palate.



Ivory Ring.

it down quite smooth. The lower part will then cover the lip, and the upper will not interfere with the nose.

(2) "In preparing artificial food, *measurement* is most necessary. The food should be prescribed in stated doses, and should be measured with an

ordinary graduated glass measure, kept scrupulously clean. Tablespoons may be used; but it is time, in this scientific age, that measurements should reach to the lowest strata of society."[1]

Dr. West writes:[2] "Attention must be paid to the temperature of the food when given to the infant, which ought to be as nearly as possible the same as that of the mother's milk, namely, 90° to 95° F.; and in all cases in which care is needed a thermometer should be employed in order to ensure the food being always given at the same temperature".

(3) "To limit and feed a baby by a precise rule, *without regard to its own manifestations of its requirements* —a child, who in the earlier two or three years of life gains half the height and weight it will acquire in all its life—is absurd folly."[3] Although Mr. Quain makes this remark, however, he does not—as he is very careful elsewhere to express—mean that there is to be no rule or regulation in infant feeding. On the contrary, he urges "the great necessity for method with the diet of infants," as "feeding at too short intervals interferes with the due action of and deranges the digestive apparatus, producing ultimately in the child sleeplessness, consequent

[1] Angel Money, *Disease in Children*, second edition, p. 29.

[2] *Diseases of Infancy and Childhood*, pp. 337, 338.

[3] Richard Quain, F.R.S., *Health in Youth*, "Trans. of the Royal Society," 1848.

irritability—other and graver mischief speedily following ".[1]

Speaking of the prevalent custom of forcing food on infants during the first week of life, Dr. Starr says:[2] "As a rule infants are overfed, so far as quantity is concerned; and this opens the very interesting question of the normal capacity of the stomach at different ages. Rotch[3] has recently written an important paper upon the subject. He states that, by actual measurement, the stomach of an infant five days old holds 25 c.c., or six and a quarter fluid drachms, a quantity very far short of that usually forced upon the babe during the first week. During the first four weeks infants generally require from twelve and a half to sixteen fluid ounces of food; in the second and third months, about twenty-four fluid ounces; and, from this time to the twelfth month, from two to two and a half or even three pints. After the twelfth month the quantity depends upon whether additions be made to the diet, or milk food be used exclusively. When the daily amount reaches three pints the limit of the capacity of the stomach is usually attained; and the greater demand for nutriment, as growth advances

[1] Richard Quain, F.R.S., *Health in Youth*, "Trans. of the Royal Society," 1848.

[2] *Dietetics of Infancy and Childhood*, "Annual of Universal Medical Science," vol. iv., pp. 260, 261.

[3] *Arch. of Pediatrics.*

month by month, must be met by adding to the strength of the food rather than by increasing its bulk."

Of the increase of food with infants and young babies, Dr. Starr adds: "There is thus a very rapid growth during the first two months of life; while in the third, fourth, and fifth months the increase is slight. Guided by these data, the quantity of food should be rapidly augmented during the first six or eight weeks of life, and then held at the same quantity up to the fifth or sixth month; another considerable increase is also demanded between the sixth and the tenth months. . . . These two factors, strength and quantity, are intimately associated throughout the whole period of infancy, and in the earlier months a mere increase in the latter is not always sufficient to maintain the balance of nutrition."[1]

[1] It is well to weigh an infant at intervals if there is any doubt about the assimilation of its food. Dr. Starr gives the following table as the average rate of gain—

Birth	7	pounds.
1 Month	7¾	„
2 Month	9½	„
3 „	11	„
4 „	12½	„
5 „	14	„
6 „	15	„
7 „	16	„
8 „	17	„
9 „	18	„
10 „	19	„
11 „	20	„
12 „	21	„

(*Hygiene of the Nursery*, second edition, p. 25).

Dr. Starr gives as the

GENERAL RULES FOR FEEDING.[1]

AGE.	Intervals of Feeding.	Average Amount at each Feeding.	Average Amount in 24 Hours.
1 week	2 hours	1 ounce	10 ounces
1-6 weeks	2½ ,,	1½ to 2 ounces	12 to 16 ounces
6-12 weeks, and possibly to 5 or 6 months	3 ,,	3 to 4 ounces	18 to 24 ounces
At 6 months	3 ,,	6 ounces	36 ounces
At 10 months	3 ,,	8 ounces	40 ounces

Dr. Cheadle writes:[2] "There must be considerable variation in quantity according to the capacity and constitution of the child. This mere question of quantity in great measure settles itself. If the child gets too much it is sick. If too little, it is restless and crying with hunger. Remember, if the proportions of food are right, the quantity may be easily adjusted, beginning as a standard for the first month with 1½ oz. to 2 oz. every two hours or every two hours and a half."[3]

[1] *Dietetics of Infancy and Childhood*, "Annual of Universal Medical Science," vol. iv., p. 261.

[2] *Artificial Feeding and Food Disorders of Infants*, p. 37.

[3] "Depression of the fontanelle shows general debility and the need of food or stimulants" (Starr, *Hygiene of the Nursery*, second edition, p. 23).

Nurse with Infant Feeding from Bottle.

Dr. Goodhart says:[1] "As regards quantity, it has been estimated that the mother supplies to her baby a pint of milk in the twenty-four hours in the first week or two, and that this quantity gradually increases until, in the later months of lactation, about three pints is reached. Some such quantity, therefore, distributed over regular intervals, should be the daily allowance to a child from birth onwards. But infants vary much in respect of the quantity which they will digest. Some are habitually small feeders. Therefore, provided that the child grows, that its flesh is firm, and it is happy, there should be no absolute insistence upon a fixed minimum."

Dr. Goodhart mentions[2] that "after nine months" a child should have five meals a day. "At this time of life," writes Dr. Goodhart, "it should have five meals during the day." The hours Dr. Goodhart names for feeding are "eight, eleven, two, five, and eleven P.M.". Dr. Goodhart adds: "There is no objection to a night meal of a teacupful of milk about three A.M., if it be wakeful".

The three ways of hand-feeding infants as practised by Europeans are:—

1st. By means of a bottle.—The most general way in England.

[1] *Diseases of Children* second edition, p. 26.

[2] *Ibid.*, p. 29

Dr. Playfair writes of this practice:[1] "The nurse should be strictly cautioned against the common practice of placing the bottle beside the infant in its cradle and allowing it to suck to repletion, a practice which leads to over-distension of the stomach and consequent dyspepsia. The child should be raised in the arms at the proper time, have its food administered, and then be replaced in the cradle to sleep."

A baby should always be fed at once, and *always with a fresh-made* bottle of milk. Some infants are fed constantly with left milk, which has been put by the fire; and it is this which upsets the stomach.

Dr. Playfair observes:[2] "Particular attention should be paid to preparing the food *fresh for every meal*".

Dr. Cheadle says:[3] "The merest trace of sour milk or other food will set up fermentation in a whole bottleful. Sometimes, I believe, the decomposition is started by keeping the food during the night gently heated in food-warmers. This favours fermentation."

Leaving off the feeding-bottle must be a matter settled by individual experience.

[1] *Science and Practice of Midwifery*, sixth edition, vol. ii., p. 303.

[2] *Ibid.*, p. 302.

[3] *Artificial Feeding and Food Disorders of Infants*, p. 116.

Nurse with Infant Feeding with Teaspoon.

Dr. Ellis remarks:[1] "Until a child is eighteen months or even two years old, it should be fed by suction, not by the spoon, and milk diet is adapted for it throughout this period".

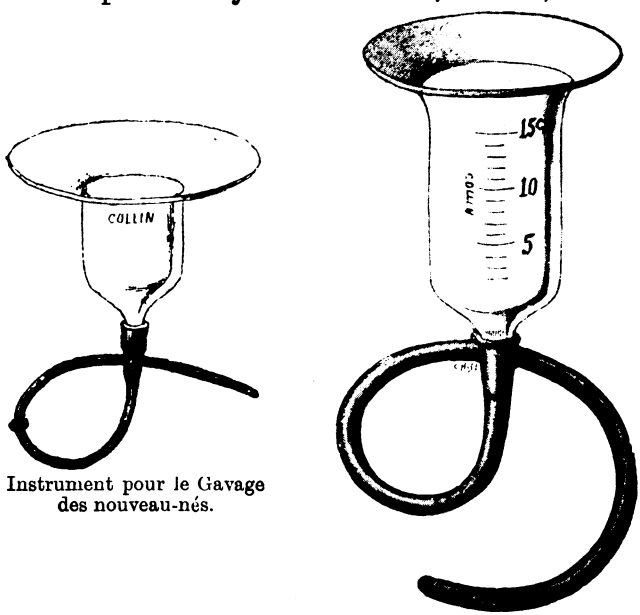
2nd. By a teaspoon.—Largely practised in France.

Some infants when born are too feeble to suck from a bottle; feeding with a spoon is then necessary, but it should be done very carefully, and the child should not be crying at the time it is fed, nor should it be hurried or forced to swallow. An infant, if properly fed from a spoon, will take the food, if it is nice, perfectly well; but it must be given quietly and slowly, and the child should be allowed to suck the food down. When the child becomes stronger spoon-feeding should be discontinued.

Burdach writes:[2] "It is remarkable that suction is the only faculty for the prehension of food which the child possesses at birth, and even this is soon lost if not practised. The jaws are not so constructed as to permit active movements, nor the gums to bear pressure. The hard palate is but little developed, although the cavity of the mouth is sufficiently wide. The mouth is, therefore, merely an organ of transmission and suction. The lips are large, and the tongue and pharynx, uvula, and soft palate are well developed to secure these ends."

[1] *Disease in Childhood*, p. 140. [2] *Physiologie*, p. 434.

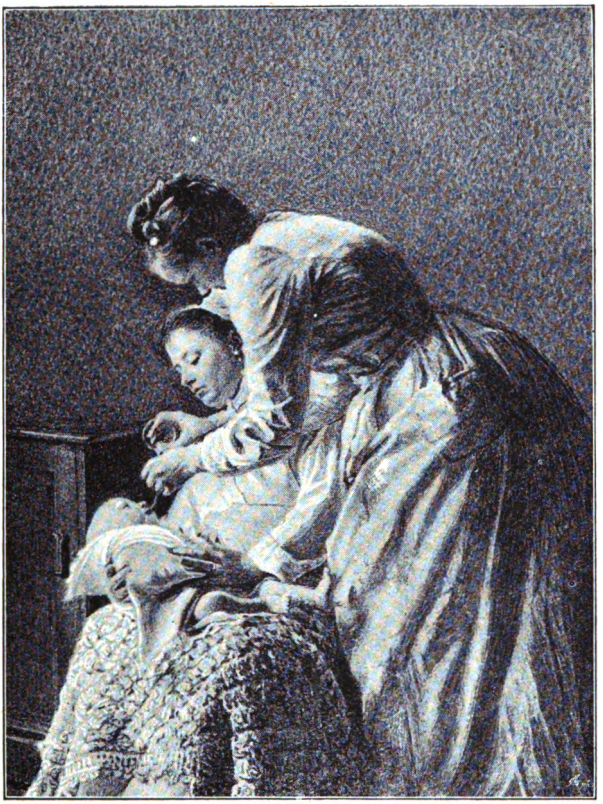
3rd. By means of "gavage".—This way of feeding infants is in use in France only, so far as I know. It is easily learnt, but cannot be performed by an uninstructed person. It is of great service in the case of prematurely born or weakly infants, whose



Instrument pour le Gavage des nouveau-nés.

power of suction is feeble. The illustration is from a photograph taken at the "Maternité de Paris". Belluzzi[1] appears to have been the first to try "gavage".

[1] C. Belluzzi, *Intorno al parto prematuro*, "Bullettino delle Scienze Mediche di Bologna," série v., vol. xviii., Ottob., 1874, p. 257.



Gavage.

"À Paris on trouve instruments pour le gavage des nouveau-nés chez tous les fabricants d'instruments de chirurgie et chez tous les herboristes," so writes Professor Tarnier; and adds: "Avec ces appareils rien n'est plus aisé que de gaver un enfant: celui-ci étant placé sur les genoux de la personne que va procéder au gavage, la tête légèrement soulevée, la sonde est mouillée, puis introduite jusqu'à la base de la langue, et l'enfant, par des mouvements instinctifs de déglutition, la fait pénétrer jusqu'à l'entrée de l'œsophage; on pousse alors doucement la sonde pour lui faire parcourir toute la longueur de l'œsophage, où elle chemine très facilement. Après un trajet de 15 centimètres environ, y compris la bouche et l'œsophage, l'extrémité de cette sonde arrive dans l'estomac. On serre la sonde entre deux doigts et on verse le liquide alimentaire dans la cupule; quand on cesse de pincer la sonde, le lait pénètre par sa pesanteur dans l'estomac et la cupule se vide ainsi que la sonde qui lui fait suite. Une profonde inspiration de l'enfant facilite la descente du liquide. Puis on retire la sonde, mais il faut le faire par un mouvement assez rapide car, si l'on procédait lentement, le liquide alimentaire suivrait la sonde et serait rejeté par régurgitation." [1]

[1] Tarnier, *Académie de Médecine*, Séance du 21 Juillet, 1885.

ALLAITEMENT DES ENFANTS NÉS AVANT TERME. GAVAGE.

"Une autre question d'une très haute importance est celle qui a trait à l'allaitement des enfants nés avant terme; cet allaitement étant difficile à bien diriger, nous devons dire quelles sont les précautions et les soins particuliers qu'il réclame.

"Les recherches entreprises depuis longtemps par M. Tarnier sur ce sujet l'ont conduit à la pratique suivante dont il a donné communication à l'Académie de Médecine, le 21 Juillet, 1885.

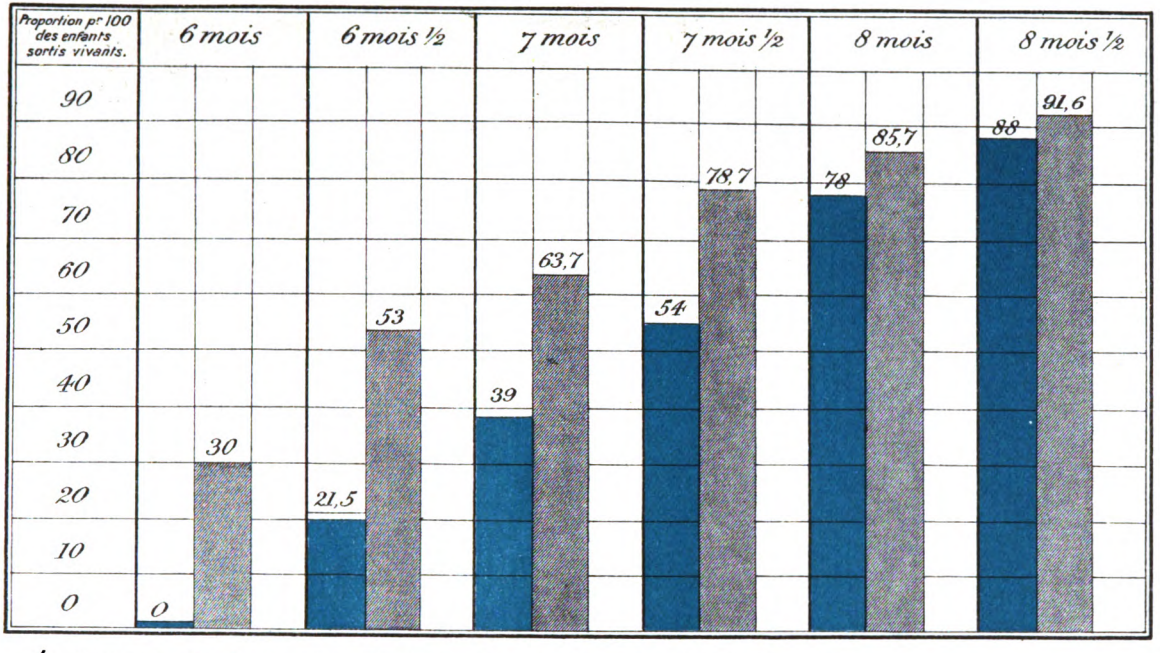
"Dès le premier jour, on essayera de mettre les enfants au sein de leur mère ou d'une nourrice;[1] s'ils sont trop faibles ou refusent de teter, on pourra leur faire couler du lait dans la bouche, et celui de femme, donné pur, sans aucun coupage, est préférable à tous les autres. Quand le lait de femme fera défaut, on le remplacera par du lait d'ânesse, non bouilli, que l'on coupera par moitié avec de l'eau distillée; on ajoutera trois grammes de sucre pour 100 grammes d'eau. Si on n'avait à sa disposition ni lait de femme, ni lait d'ânesse, on y suppléerait tant bien que mal par un mélange fait avec un quart

[1] Dr. Deshayes, of Rouen, whose paper, "The Hygiene of the New-born Child," was one of those read at the International Congress of Hygiene and Demography, held in London in 1891, writes to me, that in the case of healthy vigorous infants, and those born at the full time, "L'allaitement artificiel ne doit être commencé que le lendemain de la naissance ou plus tôt".

Tableau B. *Statistique des enfants nes avant terme et sortis vivants de la Maternite de Paris.*

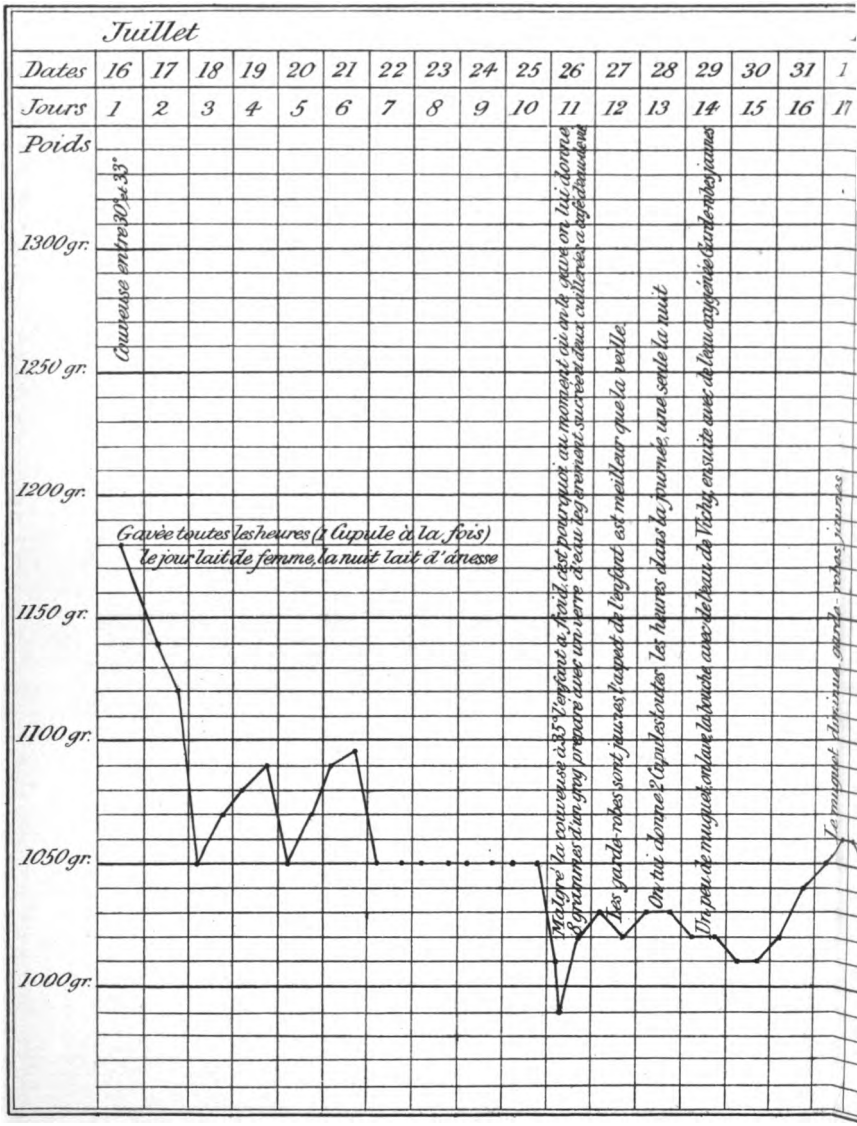
Avant la couveuse: du 21 Novembre 1876 au 21 Novembre 1881.

Depuis la couveuse: du 21 Novembre 1881 au 21 Novembre 1886. La colonne grisée ne comprend que les enfants mis dans la couveuse. 1-



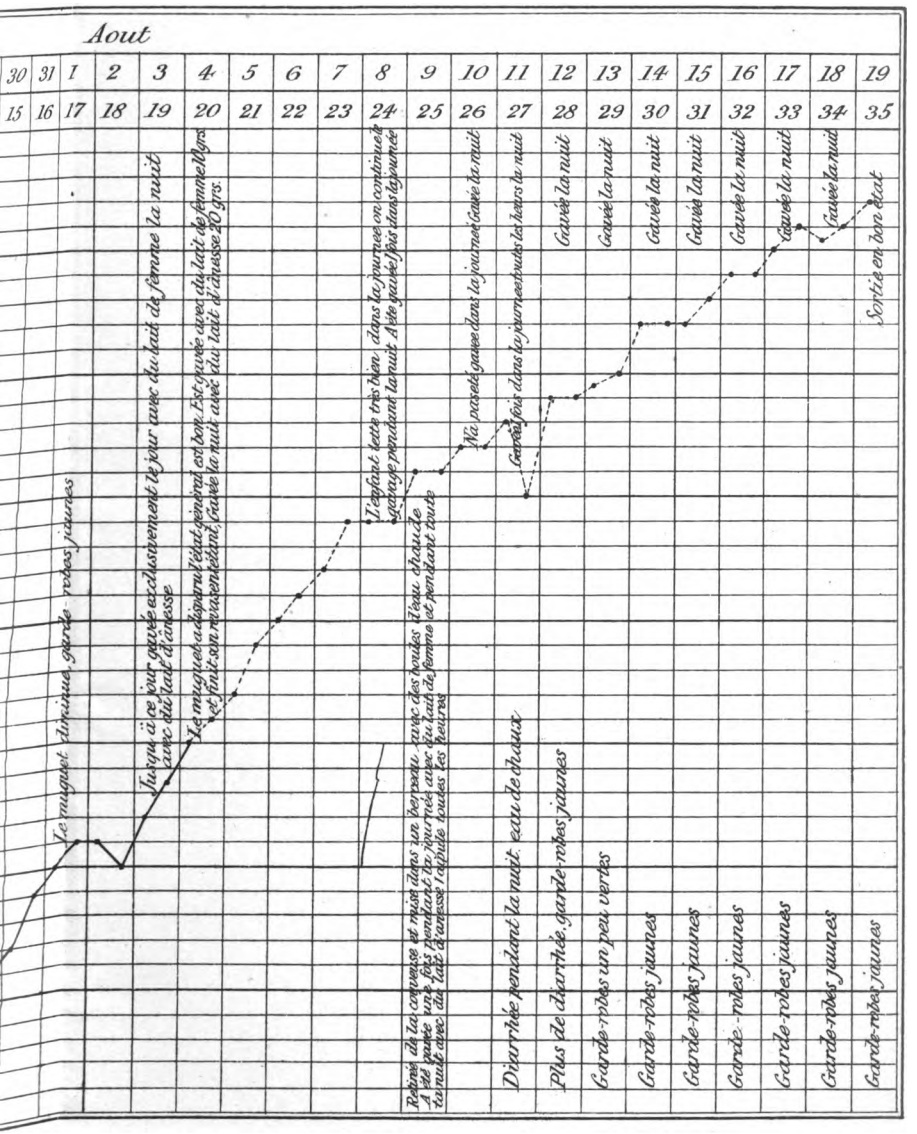
1- *Extrait du livre de M. M. Tarnier, Chantreuil et Budin.*

This Diagram was sent especially for this work by M. Brown-Séquard, of the Academy of Sciences Paris –



Gavage.

CONGENITALE (*Terme 6 mois*) Couveuse et Gavage



Gavage mixte

Du Livre de MM. Tarnier, Chantreuil et Budin.

de lait de vache et trois quarts d'eau sucrée dans la proportion que nous avons indiquée plus haut. Mais ici, le lait de vache bouilli vaut mieux, à ce qu'il nous a semblé, que le lait cru, et celui que l'on fait cuire au bain-marie, en vase clos, serait même préférable à celui qui a bouilli à l'air libre. Voici donc comment il faudrait procéder: on verserait le mélange de lait de vache et d'eau sucrée dans un vase appelé *marmite américaine*, et on mettrait le tout dans un bain-marie d'eau bouillante, où on le laisserait

MARMITE

PETITE MARMITE

pendant une demi-heure. Dès que la marmite serait retirée de l'eau bouillante, on décanterait le liquide afin de ne pas lui laisser prendre un goût métallique.

"Quel que soit le lait employé, on le donne à l'enfant avec une petite cuiller. Quand l'enfant est très petit, 8 grammes de liquide suffisent pour un repas, mais cette quantité sera portée de 10 à 15 grammes si l'enfant est moins chétif. Les repas seront au moins de 12 en 24 heures.

"Il arrive souvent que l'enfant né avant terme boit fort mal : il bave et rejette ainsi la plus grande partie du lait qu'on lui présente. L'alimentation est alors insuffisante, l'enfant dépérit et diminue rapidement de poids. C'est dans ces circonstances qu'on peut songer à l'alimenter avec une sonde.

"Depuis le 22 Mars, 1884, M. Tarnier pratique le gavage[1] chez les nouveau-nés qui ne peuvent ni teter, ni boire à la cuiller.

"Le nombre de repas et la quantité de lait ingéré doivent varier avec l'âge et les forces de l'enfant, aussi bien au début que pendant le cours de l'allaitement par le gavage. On peut formuler, en règle générale, que les repas seront d'autant plus nombreux que la quantité de lait ingérée à chaque gavage sera plus petite et que l'enfant sera plus jeune et plus faible. Huit grammes de lait toutes les heures suffisent pour un gavage lorsque l'enfant est très petit et qu'il est né loin du terme de la grossesse."[2]

"Avec des gavages trop copieux, il se produit un phénomène très curieux : l'enfant augmente rapidement de volume et de poids ; mais cette augmentation est due à un œdème considérable de tout le corps de l'enfant. Comme cet œdème disparaît avec une alimentation plus modérée, on peut l'expliquer par une *hypernutrition*. Mais si, au lieu de diminuer la quantité du liquide alimentaire, on la maintenait, et surtout si on l'augmentait, on ne tarderait pas à observer

[1] Thèse de Berthod, Paris, 1887, p. 65. [2] Tarnier.

des indigestions, et les enfants succomberaient avec de la gastrite et de l'entérite: là est le danger le plus grand.

"Lorsque le nouveau-né semble être un peu plus fort, on alterne le gavage avec l'allaitement au sein (gavage mixte).

"Quand l'enfant né avant terme est devenu assez fort pour teter, pour peu qu'il faiblisse et que sa nutrition reste en souffrance, il devient utile, indépendamment des tetées, de le gaver encore trois ou quatre fois par jour; c'est ce que Tarnier appelle le *gavage de renfort*, parce qu'il entretient chez l'enfant la vigueur nécessaire pour bien teter et bien digérer.

"Avec ces différentes combinaisons on peut arriver progressivement à la suppression du gavage, sauf à y revenir à la moindre apparition d'un trouble des fonctions digestives.

"Quoique l'application du gavage soit de date récente, on peut considérer, d'après les résultats favorables obtenus à la Maternité, dans quelques autres hôpitaux et même en ville, que cette méthode d'allaitement est nettement indiquée chez l'enfant né avant terme, faible ou chétif, lorsqu'il n'a pas la sensation de la faim ou qu'il manque de forces pour la satisfaire.

"C'est grâce à l'emploi de la couveuse et du gavage, qu'on est parvenu, dans ces dernières années, á élever des enfants qui n'avaient pas plus de six mois ou de six mois et quelques jours de vie intra-utérine.

"Les résultats obtenus sont donc remarquables et la méthode est appelée à rendre de grands services."[1]

The relation of warmth to digestion and the value of continuous heat in the case of prematurely born and feeble infants have been long recognised by scientists.[2] Some few years back the eminent French obstetrician, Professor Tarnier, convinced of the benefit of *sustained heat* for the prematurely born, introduced, at the Maternité, Boulevard Porte-Royal, Paris, his now well-known "couveuse," to try and save the lives of feeble infants, and those born "in less than the due time". The "couveuse," employed by M. Tarnier, and represented in my illustration, is very simple in use, is cheap, and not bulky.[3] "It consists of a wooden box, 25 inches long, 14 inches broad, and 20 inches high, outside measurement. The wood is 1 inch thick, and may

[1] P. Berthod, *La Couveuse et le Gavage à la Maternité de Paris.* Thèse de Paris, 1887.

[2] The usefulness of warmth in its relation to *early life* was understood by the ancient Egyptians. The hatching of eggs by artificial heat was known to and practised by these wonderful people thousands of years ago; and "the Egyptian incubators of to-day," the United States Consul-General (Cardwell) at Cairo writes (*Egg Industry of Egypt*, "Consular Reports"), "are but similar to those used by them in those ages".

[3] "Cette couveuse se compose tout simplement d'une caisse en bois, longue de 65 centimètres, large de 36 centimètres, haute de 50 centimètres (dimensions extérieures), l'épaisseur des parois étant de 25 millimètres. Mais rien n'empêche de faire une couveuse ayant des dimensions un peu plus grandes" (M. Auvard, *Archives de Tocologie*, Paris, Octobre, 1883).

Couveuse.

be coated with felt or padded inside. This box is divided into two parts by a board, some 4 inches shorter than the box, and placed at a height of 6 inches from the bottom. In the lower compartment are two lateral openings, fitted with sliding doors: one, which can never be completely closed, gives passage to the air; the other is for the introduction of the stone bottles containing hot water, called in Paris *moines*, which are employed to heat the apparatus. The upper compartment, covered by a closely fitted glass lid, receives the infant, and at one end is an orifice, furnished with a chimney and a revolving ventilator, through which the air escapes. In the opening that separates the two compartments is hung a thermometer, with a wet sponge to moisten the air. The air enters at the bottom, passes over the bottles of hot water, rises into the upper compartment, passes over the whole length of the infant, and so out at the orifice at the end. The hot-water bottles hold each somewhat above a pint, and five of them may be placed in the incubator; but it is usually found that four are sufficient to maintain a temperature of 88 degrees to 89½ degrees F., the temperature of the room being 62 degrees to 66 degrees. The heating is continued by changing one of the bottles about every two hours; and with this system there is no danger of over-heating. This incubator is so simple that any carpenter can make it, and cheap enough to be

within the reach of all but the most destitute."[1] The infants placed in incubators at the Maternité, if they are sufficiently strong, are fed by wet nurses, if not with ass's milk; if, however, an infant is too feeble for this, they feed it by means of "gavage". The operations of feeding, washing, and dressing the infant are performed in the room at the ordinary temperature. These infants do not seem to be more sensitive than other infants, and exposure to the air for a short time does them no harm. The infant in the incubator is dressed in ordinary swaddling clothes. The results obtained at the Maternité from the use of the "couveuse" have been very satisfactory. The authorities at the Maternité thus write: "Quels sont les résultats fournis par la couveuse? Voici les statistiques de la Maternité qui ont été données par M. Tarnier dans son cours du semestre d'été fait à la Faculté de Médecine, en 1886.

Poids des Enfants.	Nombre des Enfants mis dans la Couveuse.	Nombre des Enfants qui ont vécu.	Nombre des Enfants qui ont succombé.	Mortalité pour 100.
De 1000 à 1500 ...	40	12	28	70
De 1501 à 2000 ...	131	96	35	26·7
De 2001 à 2500 ...	112	101	11	9·8

"A la Maternité, avant l'introduction de la couveuse, les enfants d'un poids inférieur à 2000

[1] *Bulletin de Thérapeutique.*

grammes mouraient dans une proportion de 66 pour 100 (Auvard); depuis l'emploi de la couveuse, cette proportion est de 36, 8 pour 100."

The treatment of the infants is thus adverted to:

"Toutes les heures ou toutes les deux heures, suivant les cas, on enlève le couvercle et on retire pendant quelques instants l'enfant de la couveuse afin de l'alimenter et de faire rapidement sa toilette. Il ne doit rester exposé à l'air de la chambre que le temps strictement nécessaire. On pouvait penser que l'enfant ainsi retiré de temps en temps de la couveuse s'enrhumerait facilement, mais l'expérience a prouvé qu'il n'en est rien.

"Combien de jours faut-il laisser les enfants dans la couveuse? Cela est très variable. Habituellement cette incubation artificielle est continuée pendant une ou deux semaines; cependant nous l'avons quelquefois prolongée pendant 40 jours.

"Le moment où l'on doit définitivement retirer l'enfant de son appareil à incubation est subordonne à son état.

"Il reste volontiers dans la couveuse où il dort presque continuellement? Il est donc bon de l'y laisser séjourner. Certains enfants en devenant plus vigoureux crient chaque fois qu'on les remet dans la couveuse et se taisent quand on les en retire; il faut tenir compte de cette indication, sauf à les replacer dans l'appareil s'ils venaient à s'affaiblir.

"Avant de faire définitivement sortir l'enfant de sa

couveuse et de le coucher dans un berceau ordinaire, la seule précaution à prendre est de laisser la température de l'appareil tomber progressivement au même degré ou à peu près que celui de l'air ambiant.

"Le séjour dans la couveuse exerce, sur les enfants nés avant terme, une action bienfaisante, qui est prouvée pars les excellents résultats obtenus à la Maternité, dans d'autres hôpitaux et en ville, par toutes les personnes qui en ont surveillé, avec soin.

"Disons quelques mots des soins particuliers que réclame l'enfant placé dans une couveuse. D'abord, faut-il l'emmaillotter? Cela nous paraît préférable; on constate, en effet, que sous les vêtements et sous les langes, la température est plus élevée de deux ou trois degrés que celle de l'air de la couveuse: elle y est par exemple de 32° ou 33°, quand le thermomètre placé dans l'appareil marque 30° centigrades."

In London the "couveuse," under the name of the "thermostatic nurse,"[1] is in use at most of the lying-in hospitals.

UNSUITABLE FOOD.

Dr. Playfair says:[2] "Much of the mortality following hand-feeding may be traced to unsuitable food".

Dr. Hillier writes:[3] "Unsuitable food is without

[1] Sold by Messrs. Hearson, 235 Regent Street.

[2] *Science and Practice of Midwifery*, sixth edition, vol. ii., p. 299.

[3] *Diseases of Children*, p. 81; Thomas Hillier, M.D., late Physician to the Hospital for Sick Children.

doubt one of the common causes of rickets. The practice of feeding children under six months with all kinds of unsuitable things, especially farinaceous substances imperfectly cooked, often lays the foundation of this disease. These things are sometimes given as a supplement to breast milk, sometimes with cow's milk, and in many cases with scarcely any milk at all."

Dr. Trousseau remarks:[1] "Rickets is never so common as it is in babies weaned ere the teething is forward enough, and brought up on pap, vegetables, or even meat". Dr. Trousseau adds: "Milk is the only proper nourishment for infants, cereals given too soon having a tendency to produce convulsions."

Mr. Gladstone, in his speech at the laying of the first cylinder of the new railway bridge over the river Dee, August 17, 1887, made some very important observations as regards the use of milk. "There is," Mr. Gladstone said,[2] "one matter, however, which I will mention, and that relates to the article of milk. There is not an article of more vital interest to the masses of the population. I read not very long ago a careful production of a medical man who had made a sanitary inquiry into the whole of the environs of Glasgow, and his inquiry was directed to this

[1] *Clinique Médicale*, third edition, vol. iii., p. 484.

[2] *Daily News*, Wednesday, August 17, 1887.

point,—the prevalence of what is called rickets among children, and the causes to which this was to be referred. I imagine when we speak of rickets it means that a child is not growing up in a state of health, vigour, and sound and good formation; and wherever this gentleman went from district to district he found that rickets prevailed or was absent in proportion to the use of milk. I am bound to add that he had also a great deal to say for the use of oatmeal, and in that respect he was, in my opinion, quite right; but the main agent was milk, and the want of milk for the masses of the population—aye, for the adult masses of the population—but above all, and far beyond all, for the child masses of the population—is a want the importance of which it is impossible to exaggerate."

It is very difficult to impress English people, especially the lower orders, with the fact that milk contains all that is necessary for life. After recounting how the Arabs live almost entirely on milk, Dr. Geikie says:[1] "In many other parts of the desert milk forms the sole article of diet obtainable by the Bedouin; and I have heard a well-authenticated case of an Arab in the north of Syria who for three years had not tasted either water or solid food". This proves the perfection of milk as a nutriment.

Milk has been described by Dr. Guy[2] as "an

[1] *The Bible and the Holy Land*, vol. i., p. 211.

[2] See paper by Dr. Guy on *Sufficient and Insufficient Dietaries*, "Journal of the Statistical Society," vol. xxvi., p. 241.

emulsion consisting of a certain quantity of solid elements, intimately mixed up with about eight times their weight of water".

Dr. Bannister writes: [1] "As milk is formed for the special purpose of being the sole nourishment during the first period of infantile life, it not only contains the principles absolutely necessary for the growth and maintenance of the body, but these principles are in such a form as to be capable of being easily assimilated by the weak digestive powers of the infant".

Sir William Roberts observes: [2] "Diastasic ferment does not exist in the saliva and pancreatic juice of young sucking animals, except in minute proportions. Its quantity increases when the teeth are cut. In the human infant diastase does not appear to exist in sufficient abundance to digest starchy matters effectively until about the sixth or seventh month. Until this period it is therefore not advisable to administer farinaceous food to infants."

"The attention of M. Guillot having been directed to the changes which the food given to children underwent, and to the excessive mortality among them, he instituted a series of investigations in a number of cases of death, with special reference to the state of the contents of the bowels. He was

[1] *Our Milk, Butter and Cheese Supply.*

[2] *Digestive Ferments*, p. 29. See also *Physiology of Infancy*, in Keating's "Cyclopædia".

struck with the uniform similarity, a jelly-like substance being present in the bowels, and, in some instances, lining both the small and great intestines. This was subjected to the test of the tincture of iodine, which produced an intensely blue colour, thus proving it to be starch."[1]

"Unfortunately, the farinaceous articles of food, which are so often selected on account of their supposed lightness as fit to form the almost exclusive diet of infants, belong to the class of substances that are assimilated with difficulty. . . . In some instances in which children have been fed on an exclusively farinaceous diet, the mucous membrane, even low down in the intestines, has been found covered with a thin coating of starch, which presented the characteristic blue colour when tested with iodine. . . . Providence may have wisely determined that the infant shall for months be dependent on its mother for support, in order that her instinctive feelings may lay the firm foundation of that love which causes her to cling to her little one with a fondness that surpasses all other affection, and which gives her the patience, the gentleness, the untiring energy, that make her the child's best guardian, friend, and teacher, during its early years.

"It is obvious that the more nearly the substitute

[1] *Bulletin de Thérapeutique.* "The presence of starch may be detected in any substance by iodine, which is the most delicate test of it" (*Cabinet Cyclopœdia*, p. 345).

that we select approaches to the character of the mother's milk, the greater will be the prospect of the attempt to rear the infant upon it proving successful. We shall not need any laboured argument to convince us that in the milk of some other animal we shall be likely to find the infant's most appropriate food." [1]

COW'S MILK.

Cow's milk is most used for infants, and in general, when *pure, fresh, and carefully prepared,* is found suitable.

The curd of cow's milk, however, is always an obstacle in infant feeding, and is very often found to disagree unless rendered digestible by the manner of preparing the milk.

Dr. Cheadle writes: [2] "The various forms of milk . . . in respect of easy digestibility of curd appear to rank thus:—

1. Peptonised milk.
2. Cow's milk with barley water.
3. Cow's milk and lime water.
4. Condensed milk.
5. Cow's milk with bicarbonate of soda.
6. Boiled cow's milk.
7. Fresh cow's milk."

[1] West's *Diseases of Infancy and Childhood.*

[2] *Artificial Feeding and Food Disorders of Infants,* p. 51.

But even with every precaution in preparing cow's milk it will sometimes be found not to agree with the infant.

Occasionally in the winter time, cows are fed on food which so affects the milk that it will disagree with the delicate, sensitive stomach of a baby.

"The changing from milk of grass-fed cows to that of hay or stall-fed cows is often attended with serious results to infants. This important matter is not generally understood by mothers and nurses, nor by many physicians. The difference between the various ways of feeding cows, and the difference which must suddenly take place in the character of the milk upon this change of food for cows, cannot be less radical."[1]

Vernois and Becquerel, from their experiments, proved that the milk from cows kept in a city differs considerably from that from cows in the country.

COMPOSITION OF COW'S MILK.[2]

(Vernois and Becquerel.)

	Paris.	Country.
Specific gravity	1033·10	1033·72
Water	869·78	857·80
Solid constituents	130·42	142·20
Butter	33·66	38·85
Casein and extractive matters	53·66	57·00
Sugar	37·07	38·99
Salts	6·03	7·36

[1] *British Medical Journal.* [2] *Chimie Pathologique*, p. 367.

Dr. Bannister writes:[1] "The appearance of milk is so well known that no general description is needed; but when closely examined it is found by chemical tests to be slightly alkaline, or neutral when first drawn from the animal, but by keeping it develops acid, which development is either accelerated or retarded by certain circumstances."

Dr. West writes:[2] "Human milk is alkaline, and even if kept for a considerable time it shows but little tendency to become sour; the milk of animals in perfect health likewise invariably presents an alkaline reaction, and that of cows when at grass forms no exception to this rule. Comparatively slight causes, however, exert a marked influence upon the milk of the cow in this respect; and if the animal be shut up and stall-fed its milk almost constantly acquires a strongly acid property, a fact which of itself is sufficient to account for the symptoms of gastric and intestinal disorder so often produced by it in the case of children brought up in large towns. Unfortunately," adds Dr. West, "there seem to be good reasons for believing that the milk of stall-fed cows often undergoes a deterioration much more serious than the merely becoming acescent, and that changes not infrequently take place in it such as must render it wholly unfit for an infant's food, and calculated only to promote disease.

[1] *Our Milk, Butter and Cheese Supply.*

[2] *Diseases of Infancy and Childhood*, p. 338.

The possibility of their occurrence shows the necessity, when an infant who is brought up by hand fails in health, for making a careful inquiry into the source of the milk with which it is fed, and for examining the fluid, both chemically and under the microscope, before proceeding to prescribe remedies for ailments which may be caused entirely by the unwholesome nature of its food."

Dr. West further observes: "Whenever, therefore, the attempt is made to rear an infant by hand, under circumstances which render it impossible to obtain the milk of cows which are at pasture, it is desirable that the milk should be daily tested." Litmus paper[1] is useful for this purpose. Dr. Wynter Blyth writes to me: "It is a coarse test," but "no other substance is in a handy enough form for popular use. Litmus is a blue colour, obtained from lichens, and very familiar to chemists as an indicator of acids."[2]

Milk given to infants from a cow immediately after calving will often cause diarrhœa, and is in most cases productive of bowel and stomach disturbance.[3]

[1] Can be purchased at all chemists. Cost, threepence a packet.

[2] For interesting information on determining the acidity of milk, see *Di un metodo pratico per determinare il grado di acidita del latte*, A. Pavesi, ed. E. Rotondi, *Gazetta Chimica Italiana*, vol. iv., 1874.

[3] Dr. Armstrong (Newcastle) said, in 1879, when examining milk microscopically, he found evidence that colostrum from

Milk from cows suffering from any complaint, *however slight it may appear*, should especially not be used. "Milk is sometimes unwholesome from the outset, owing to the unhealthy condition of the cow."[1] The investigations recently made prove the extreme necessity for care in the use of cow's milk. In giving cow's milk to infants it should *always* be seen that it is free from sourness. Milk, even if only, as nurses term, "just on the turn," will cause diarrhœa in infants.

In summer the number of deaths from infantile diarrhœa is, as a rule, largely increased. The early spring has also many deaths from this cause, as may be seen by reading the Registrar-General's reports. The common theory of the cause of adult diarrhœa—"eating uncooked fruit in an unripe and over-ripe condition"—cannot be applied to infants; but the solution of a much discussed enigma may be perhaps found in what the cows eat, their state of health, the condition in which they are kept, and the manner in which the milk is sent to London or the customer's house. At a small farm supplying a favourite seaside place with milk (and crowded during the season) I have seen a number of cows

recently calved cows had been added to the milk by dairymen; this had an injurious effect by acting as a purgative on children (*Public Health Reports and Discussions of the International Congress of Hygiene and Demography*, London, August, 1891, p. 138).

[1] Professor A. H. Church, *Food*, p. 139.

kept in a small field, the grass of which, owing to extreme drought, was almost entirely withered away. These animals were fed on various things thrown down in the field for them. *As to water, they had a small, nearly dried-up pond, strongly impregnated with manure* (the percolation from the farm "general heap" going into it), *to drink from;* and this is not the only instance in which I have seen cows kept without having any water fit for them to drink.

At several large farms (in fact, it is often the case) I have seen the only water the cows and horses have had has been more or less contaminated with matter from manure heaps close by, and even contaminated by sewage.[1] As I heard an old cowman say of the cows under his charge, which had a very indifferent and doubtful supply of water: "It don't 'urt the like o' them critters". This, however, is more than open to question, and that milk from cows so kept is likely to be injurious has been clearly demonstrated. "Many a quiet rural village, approached by green lanes, shrouded by tall trees from the full force of the wind and sun, contains within its own bosom the elements of disease and death. We have seen

[1] For the bad effect on milk of cows walking in "putrid matter" see *Foods*, Wynter Blyth, third edition, p. 287. Mr. Smee states "that the milk of cows fed on sewage farms rapidly putrefies" (*Milk in Health and Disease*, A. H. Smee; see also *Journ. Agric. Soc.*, viii., 1872).

many such which on a cursory inspection would be thought to be the residence of Hygeia herself; but on looking a little deeper, we discover the stinking pond—the receptacle of all the filth from man and animals—running over into a ditch which perhaps passes close under the windows of the cottages. Into this pond or stream the drainage from the farm-yards, dead animals, and decaying vegetable matter are carried by every rain."[1] The necessity for pure water for cows is demonstrated by the following: "Issued by the Trustees of the Cork Butter Market. Ten points to be considered in butter-making. Recommended for adoption by Thomas Carroll, M.R.I.A., Superintendent, Agricultural Department, National Education, Ireland, Inspector of Agricultural Schools; and T. A. Forrest, Head Inspector and Chief Superintendent, Cork Butter Market.—1. Keep cow-houses clean. Be sure that cows have pure water to drink, and have the udders perfectly clean by sponging with tepid water before milking."

The way also[2] the milk is brought to London and other large cities and towns—infantile diarrhœa being more fatal in London and large towns—may be at the root of the evil. The following from the *Lancet*, April 29, 1876, still further adduces the necessity for great care as to milk: "Milk brought

[1] William Strange, M.D., *Seven Sources of Health*, p. 53.

[2] See *Observations on London Milk*, Rugg, second edition.

from the country in cans by the night trains is carried by the retailers to their own premises, where it often remains for five or six hours. These premises are often little dirty shops or kitchens close to the rooms in which the families live. There is no security whatever that epidemic disease may not be raging in the place, that vessels contaminated in the worst possible way may not be used to contain the milk, or, except in the places where the Adulteration Act is rigidly enforced, that the milk may not be adulterated with foul water. . . . But the last few years have brought a flood of new light to bear on the peculiarities of milk. We now know, at the cost of many serious epidemics, how peculiarly sensitive to noxious influences is the fluid which forms so important a part of the national food supply. If clothing will spread the infection of fever, so, when once infected, will milk, and that in a far more insidious and extensive manner, for with milk it is impossible to say how widely or how far the disease may be carried. If water will carry the germs of cholera and enteric fever, so will milk, and with milk there is the added danger—not indeed demonstrated, but suspected by many—that the highly complex organic constituents so closely analogous to those of the body, which are present in it, may serve as a pabulum for the development and indefinite multiplication of disease-germs. Recent experience seems to show that milk-spread epi-

demics are particularly virulent, and the observation tallies, though, of course, it cannot be said to establish the last-named theory. The ease with which milk receives and carries infection is illustrated by the absolute and well-known necessity for purity of air and perfect cleanliness in dairy operations."

I was ironically told once that "no doubt it was all right to be careful and to bother about cow's milk twenty years ago; but now, in these days of sanitary inspection, everything is so much better looked after that it is unnecessary". And quite lately I have heard the same said by several. The best comment I can make is the following: "A serious outbreak of typhoid fever is reported from Cheshunt, Herts. The outbreak has been traced to an infected milk supply. Two or three deaths have already resulted, and about thirty persons are suffering from the disease in Prospect Road. The Local Board of Health are taking stringent measures to isolate the disease."[1]

No doubt, when typhoid or any other disease is developed, "stringent measures" are resorted to; but an old adage I learnt in my youth, "Prevention is better than cure," recurs to my mind as being not too old-fashioned and "out of date" to be thought of in these progressive times.

[1] *Daily News*, Friday, September 16, 1887.

ANALYSIS OF COW'S MILK.[1]

	Simon.			Herberger.		Lecanu.	Boussingault.	Chevallier and Henri.	Poggiale (10 cows).	Playfair (9 cows).	Vernois and Becquerel (30 cows).
Water	857	861	823	853·0	862·0	868	874·0	870·2	862·8	—	864·06
Butter	40	38	55	38·9	37·5	36	39·0	31·3	43·8	49·0	36·12
Casein	72	68	67	69·8	67·0	56	34·0	44·8	38·0	41·6	—
Casein and extractive matter	—	—	—	—	—	—	—	—	—	—	38·03
Sugar...	—	—	—	—	—	—	—	—	52·7	—	55·15
Sugar and extractive matter	28	29	51	31·3	26·3	40	53·0	47·7	—	—	—
Fixed salts	62	61	13	7·0	7·2	—	6·0		2·7	—	6·64
Earthy salts	—	—	—	—	—	—	2·2	—		—	—

[1] *Analyst.*

COW'S MILK FOR INFANT FEEDING, AND ITS PREPARATION.

1. *Peptonised Milk.*—Before giving a milk of this description it is well to consult a medical man.

Sir William Roberts writes[1] that "peptonising the milk in no degree spoils its nutritive value". After some extended experiments he, however, came to the conclusion that, "except in extreme cases, when the digestive power is wholly lost or in complete abeyance, it is more advantageous to use a food which has been subjected to partial artificial digestion than food in which the process has been carried out to completion"; and adds:[2] "If the patient possess any digestive power at all, it is better that that power should be kept in exercise, than that it should be permitted to deteriorate still further from total disuse".

This milk can be made at home with "Fairchild's Peptonising Powders," which most chemists keep or will get. The following is an analysis of *ordinary milk* prepared with one of "Fairchild's Powders":—

"*December* 2, 1889.

"MADAM,—Replying to your favour of the 27th ult., the following is the analysis of cow's milk before

[1] *Digestive Ferments*, p. 68. [2] *Ibid.*, p. 69.

and after digestion with one of the peptonising powders (Fairchild):—

	Ordinary parts.
Cow's milk	
Casein, serum albumen	68
Fat	38
Lactose with extractives	30
Salts	6
Water	858
	1000

Digested with peptonising powders for 20 minutes, at 130° F

	Parts.
Casein and alkali-albumen	22
Emulsified fat	38
Peptones (soluble)	62
Lactose	25
Salts	10
Water	858
	1015

No water was added to the milk before digestion.

"The analysis given above is of a fair quality of cow's milk, as supplied by one of the North London dairy companies.

"Yours very respectfully,

"BURROUGHS, WELLCOME & Co."

Dr. Starr writes:[1] "The great advantages of partial peptonisation are that the necessity for lime

[1] *Dietetics of Infancy and Childhood*, "Annual of Universal Medical Science," iv., 269, 270.

water, barley water, and thickening substances, to keep apart the curd, is done away with; and that, when the digestive disturbance requiring a careful preparation of food is removed, an ordinary milk diet can be gradually resumed by regularly diminishing the time artificial digestion is allowed to progress. This changes the casein in a less and less degree, until finally it is taken in its natural form. Instead of the ordinary peptonising process," adds Dr. Starr, "I have for the past year or more employed the 'peptogenic milk powder' prepared by the chemists[1] already referred to. This powder contains a digestive ferment (pancreatin), an alkali (bicarbonate of sodium), and a due proportion of milk sugar.

"The mode of employment is as follows:—

Take of		
Milk - - - -	ʒij	2 ounces (fluid).
Water - - - -	ʒij	2 ounces (fluid).
Cream - - - -	ʒss	½ dram.

"Peptogenic milk powder. Measure provided with each can of powder.

"This mixture is to be heated over a brisk flame to a point that can be comfortably sipped by the preparer (140° to 150° F.), and kept at this heat for six minutes. When properly prepared, the resultant, so-called 'humanised milk,' presents the albuminoids in a minutely coagulable and digestible form, has an alkaline reaction, contains the proper proportion of

[1] Fairchild, Brother, and Foster.

salts, milk sugar, and fat, and has the appearance of human milk.

"Leeds gives the following analysis of this prepared milk:—

Water - - - - - - -	86·2 per cent.
Fat - - - - - - - -	4·5 „
Milk sugar - - - - - -	7 „
Albuminoids - - - - -	2 „
Ash (salts) - - - - - -	0·3 „

"This corresponds very closely with his average analysis of human milk.

"In using this powder, too, one can readily return to a plain milk diet by gradually shortening the time of heating: in other words, by slowly diminishing predigestion."

Dr. Starr further adds:[1] "For an infant of six weeks each meal may consist of:—

Peptonised milk - -	f℥iij	3 ounces (fluid).
Sugar of milk - - -	℥ss	½ dram.
Water - - - -	f℥i	1 ounce (fluid)."

There are several ways of peptonising milk. Dr. Eustace Smith recommends:[2] "Add to each fluid ounce of milk five grains of pure pepsin and four drops of dilute muriatic acid; digest in a water bath, at a temperature of 100° F., until the mixture becomes clear; then neutralise with bicarbonate of sodium; and the milk is ready for use". The other

[1] *Dietetics*, etc., iv., 269.

[2] *Cyclopædia of Practical Medicine.*

way, mentioned by Dr. Starr, which, however, he does not so strongly recommend, is to "peptonise the milk by pancreatin". Dr. Starr writes:[1] "That manufactured under the name of 'extractum pancreatis' by Fairchild, Brother, and Foster has proved most efficient in the author's hands. To accomplish this artificial digestion, put into a clean quart bottle five grains of extractum pancreatis, fifteen grains of bicarbonate of sodium, and four fluid ounces of cool filtered water; shake thoroughly together, and add a pint of fresh cool milk. Place the bottle in water so hot that the whole hand can be held in it for a minute without discomfort, and keep the bottle there for exactly thirty minutes. At the end of that time put the bottle on ice to check further digestion, and keep the milk from spoiling. The fluid obtained, while somewhat less white in colour than milk, does not differ from it in taste; if, however, an acid be added, the casein, instead of being coagulated into large firm curds, takes the form of minute soft flakes, or readily broken-down feathery masses of small size. When the process is carried just to the point described, the casein is only partly converted into peptone; but every succeeding moment of continued warmth lessens the amount of casein until peptonisation is complete. Then the liquid is greyish-yellow in colour, has a distinctly

[1] *Dietetics*, etc., iv., 268.

bitter taste, and shows no coagulation whatever on the addition of an acid.

"This artificial digestion, therefore, may be carried just as far as circumstances indicate, although it is ordinarily best to stop it short of complete conversion, as children object to the markedly bitter taste, and often on account of it absolutely refuse the food. Partial peptonisation, too, is usually sufficient to adapt the milk to ready assimilation. To seize the proper moment for arresting the process, the person conducting it must be told to taste the milk from time to time, and, as soon as the least bitterness is appreciable, to remove the bottle from the hot water and place it upon ice for cooling and use. Such milk may be sweetened with sugar of milk, and given pure or diluted with water. . . . To this cream may be added when desirable, and by diminishing the quantity of water and increasing that of milk the strength of the food may be made greater at any time." Dr. Starr observes: "Although every precaution be taken, the last of a quantity of predigested food is very apt to grow bitter, and if the attendants will take the trouble it is much better to peptonise every meal separately. This is readily done," adds Dr. Starr, "by ordering a number of powders of pancreatin and bicarbonate of sodium, so proportioned that each packet shall contain the proper amount for one bottle of food.

"For example:—

℞ Ext. pancreatis - - - - - gr. ix.
Sodii bicarb. - - - - - gr. xxiv.
M. et ft. chart (waxed papers), No. xij.

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

Dr. Starr remarks:[1] "When infants who are approaching the end of the first year become affected with indigestion it is often sufficient to reduce the strength and quantity of the food to a point compatible with digestive powers. For instance, at eight months the food may be reduced to that proper for a healthy child of six months, or even less. Here, too, predigestion of the food is most serviceable. If a few grains of extractum pancreatis be added to a gobletful of thick well-boiled starch gruel, at a temperature of 100° F., the gelatinous mucilage quickly grows thinner, and soon is transformed into a fluid, the starch having been rendered soluble by the action of the diastase contained in the pancreatin; by still longer contact the hydrated starch is converted into dextrine and sugar. Advantage may be taken of this property to render the foods containing

[1] *Dietetics*, etc., iv., 270.

starch assimilable. Thus to a mixture of barley jelly and milk, *e.g.* :—

Barley jelly - - -	ʒij	2 drams,	
Sugar of milk - - -	ʒj	1 dram,	
Warm milk - - -	f ʒviij	8 ounces	(fluid),

add three grains of extractum pancreatis and five grains of bicarbonate of sodium, and keep warm for half an hour before feeding." Dr. Starr adds : "The same process may be employed with food containing oatmeal, arrowroot, or wheaten flour, with the effect of converting the starchy elements into digestible products, and without materially altering the taste". Dr. Starr further adds: "When the infant has arrived at an age to take meat broths, these too may be readily peptonised when digestion is enfeebled. The recipe for peptonised beef tea, which may be taken for an example, is : To one-quarter of a pound of minced raw beef, entirely free from fat, add one half-pint of cold water; cook over a slow fire, with constant stirring, until it has boiled a few minutes. Then pour off the liquor, and beat or rub the meat to a paste. Put the latter into a jar with one half-pint of cold water, and pour in the liquor previously obtained. Add to this mixture thirty grains of extractum pancreatis and twenty grains of bicarbonate of sodium; shake all well together, and keep at a temperature of about 110° F., stirring occasionally for three hours. Next, boil quickly, strain, and serve as required."

Dr. Eustace Smith's receipt for barley jelly is: [1] "Put two tablespoonfuls of *washed* pearl barley with a pint and a half of water, and slowly boil down to a pint; next strain out the barley, and let the liquid settle into a jelly. Two teaspoonfuls of this, dissolved in eight fluid ounces of warmed and sweetened milk, are enough for a single feeding, and such a meal may be allowed twice a day." Benger's "Liquor Pancreaticus" for artificial human milk, and Benger's Food (peptonised—the latter only requires the addition of milk and water and sugar, and peptonises the milk used), are other preparations. These can be obtained at the stores (Army and Navy, Victoria Street, Westminster). And now the manufacturing druggists, such as Savory & Moore, make a preparation of "Peptonised Milk," and "Peptonised Jelly," and also sell "Peptonising Pellets". Of these latter Dr. Goodhart writes: [2] "The process is made even more simple by using the peptonising pellets prepared by Messrs. Savory & Moore. The milk being brought to the requisite heat as before, one pellet is added to the pint: a quarter of an hour is the average time for an adequate change to be accomplished."

[1] *Cyclopædia of Practical Medicine.* This is precisely the same as Dr. Starr gives (*Dietetics*, p. 266).

[2] *Diseases of Children*, second edition, p. 668.

Peptonised Milk (Sir William Roberts).[1]—"A pint of milk is diluted with a quarter of a pint of water, and heated to a temperature of about 140° F. Should no thermometer be at hand, the diluted milk may be divided into two equal portions, one of which is heated to the boiling point and added to the cold portion, when the mixture will be of the required temperature. Two teaspoonfuls of the liquor pancreaticus[2] and ten grains[3] of bicarbonate of soda are then added to the warm milk. The mixture is poured into a covered jug, and the jug is placed in a warm situation under a 'cosy,' in order to keep up the heat. At the end of an hour, or an hour and a half, the product is boiled for two or three minutes. It can then be used like ordinary milk."

Sir William Roberts writes:[4] "I should be glad to see a further trial made of peptonised, or partially peptonised, milk in the gastric and intestinal catarrh of infants. In one severe case of this class a favourable result was immediately obtained; in another case there was greater tolerance of food, and more

[1] Quain's *Dictionary of Medicine.*

[2] A very active extract of pancreas is now prepared on a large scale by Mr. Benger under the name of *Liquor Pancreaticus*, and sent out by Mottershead & Co., chemists, Manchester.

[3] Sir William Roberts writes to me: "The proper quantity of bicarbonate of soda to a pint of milk is twenty grains—but the smaller quantity (ten grains) answers the purpose nearly as well".

[4] *Digestive Ferments*, p. 72.

comfort after it than with the use of simply diluted milk."

Sir William gives: *Preparation of Peptonised Milk in the Cold.*—"The action of pancreatic extract on milk goes on at the ordinary temperature of the air exactly in the same way as at blood heat—except that it is slower, and requires a longer time for completion. The cold method has, however, a convenience and simplicity which recommend it for general use in the sick room. I have accordingly drawn up the following directions for the preparation of peptonised milk at a temperature of 60° to 65° F., which may be regarded as the ordinary degree of warmth maintained in rooms occupied by invalids. In the winter season it will be necessary to slightly warm the ingredients beforehand in order to bring them to the due temperature; but in the warmer seasons the operations can be carried on without any preliminary heating.

"A pint of milk is diluted with half a pint of lime water,[1] or with half a pint of water containing twenty grains of bicarbonate of soda in solution. To this are added three teaspoonfuls of liquor pancreaticus. The mixture is then set aside in a jug or other convenient vessel, for a period of three or four hours. At the expiration of this time the milk is far advanced in the process of digestion, and has developed

[1] "I owe the suggestion to use lime water to Dr. Watkins, of Newton-le-Willows."

a slightly bitter taste. It is now ready for use. It may be used cold, either alone or with soda water, which covers the bitterish taste remarkably well, or it may be warmed and sweetened for administration to infants. If milk, thus prepared, is consumed at the period indicated—that is to say, at the end of three or four hours—it need not undergo any final boiling; it is better, indeed, to use it without boiling, because the half-finished process of digestion will still go on for a time in the stomach. But if milk thus prepared has to be kept much longer, it is advisable to raise it for a moment to the boiling point, so as to bring the action of the ferment to a termination, and thus to prevent those ulterior changes which render the product disagreeable to the palate.

"The process can be regulated with the utmost nicety by occasionally tasting the mixture and watching the development of the bitter flavour—and it can be permanently arrested at any moment by heating the product to the boiling point."[1]

Peptonised Milk Gruel. — "This," writes Sir William Roberts,[2] "is the preparation of which I have had the most experience in the treatment of the sick, and with which I have obtained the most satisfactory results. It may be regarded as an artificially digested bread-and-milk, and as forming by

[1] *Digestive Ferments*, pp. 60, 61. [2] *Ibid.*, pp. 62, 63.

itself a complete and highly nutritious food for weak digestion. It is very readily made. First, a good thick gruel is prepared from any of the farinaceous articles mentioned.[1] The gruel, while still hot, is added to an equal quantity of cold milk. The mixture will have a temperature of about 125° F. (52° C.). To each pint of this mixture, two teaspoonfuls of liquor pancreaticus and twenty grains of bicarbonate of soda are added. It is then set aside in a warm place for two or three hours, and finally raised to the boiling point, and strained. The bitterness of the digested milk is almost completely covered in the peptonised milk gruel; and invalids take this compound, if not with relish, without the least objection.

"Since the first publication of these lectures,[2] peptonised milk gruel has found favour with many practitioners, and has come into considerable use among their patients. I find, however, that some persons fail to peptonise milk gruel so as to make it acceptable to the palate and stomach of the invalid. This is entirely due to allowing the

[1] See p. 54 and p. 60.

[2] *On the Digestive Ferments and the Preparation and Use of Artificially Digested Food*, being the Lumlein Lectures for the year 1880, delivered before the Royal College of Physicians, by Sir William Roberts, M.D., F.R.S., Fellow of the College, Physician to the Manchester Royal Infirmary, Professor of Clinical Medicine to the Owens College. Second edition, revised, with additions.

peptonising process to go on too far. Artificial digestion, like cooking, must be regulated as to its degree; and it is easy to regulate the degree of artificial digestion by the length of time during which the process is allowed to go on. It must be remembered that liquor pancreaticus (and every other form of pancreatic extract) is more or less variable in its activity, just as the fires used in cooking vary in their intensity, and that allowance must be made for this variability. If the liquor pancreaticus is very active the slight bitterness, whereby it is known that the process has been carried far enough, is developed in an hour, or less; but if the preparation is not so active two or three hours may be required to reach the same point. It must further be borne in mind that the warmer the temperature at which the process is carried on the quicker is the action of the ferment. The practical rule for guidance is to allow the process to go on until a perceptible bitterness is developed and not longer. As soon as this point is reached, the milk gruel should be raised to the boiling point, so as to put a stop to further changes."[1]

Peptonised Gruel.—"Gruel may be prepared from any of the numerous farinaceous articles which are in common use—wheaten flour, oatmeal, arrowroot, sago, pearl barley, pea or lentil flour. The gruel should be very well boiled, and made thick and

[1] *Digestive Ferments*, pp. 62, 63.

strong. It is then poured into a covered jug, and allowed to cool to a lukewarm temperature. Liquor pancreaticus is then added in the proportion of two teaspoonfuls to the pint of gruel. At the end of three hours the product is boiled and strained. The action of pancreatic extract on gruel is twofold—the starch of the meal is converted into sugar, and the albuminoid matters are peptonised. The conversion of the starch causes the gruel, however thick it may have been at starting, to become quite thin and watery. The bitter flavour does not appear to be developed in the pancreatic digestion of vegetable proteids, and peptonised gruels are quite devoid of any unpleasant taste. It is difficult to say to what extent the proteids are peptonised in the process of digestion by pancreatic extract. The product, when filtered, gives an abundant reaction of peptone; but there is a considerable amount left of undissolved material. Most of this, no doubt, consists of insoluble vegetable tissue, but it also contains some unliberated amylaceous and albuminous matter. Peptonised gruel is not generally, by itself, an acceptable food for invalids, but in conjunction with peptonised milk (peptonised milk gruel) or as a basis for peptonised soups, jellies, and blancmanges it is likely to prove valuable." [1]

Peptonised Soups, Jellies, and Blancmanges.—"I have sought to give variety to peptonised dishes by pre-

[1] *Digestive Ferments*, p. 61.

paring soups, jellies and blancmanges containing peptonised aliments. In this endeavour I have been assisted by a member of my family, who has succeeded beyond my expectations. She has been able to place on my table, soups, jellies and blancmanges containing a large amount of digested starch and digested proteids, possessing excellent flavour, and which the most delicate palate could not accuse of having been tampered with. Soups were prepared in two ways. The first way was to add what cooks call 'stock' to an equal quantity of peptonised gruel or peptonised milk gruel. A second and better way was to use peptonised gruel, which is quite thin and watery, instead of simple water, for the purpose of extracting shins of beef and other materials employed for the preparation of soup. Jellies were prepared simply by adding the due quantity of gelatin or isinglass to hot peptonised gruel, and flavouring the mixture according to taste. Blancmanges were made by treating peptonised milk in the same way, and then adding cream. In preparing all these dishes it is absolutely necessary to complete the operation of peptonising the gruel or the milk even to the final boiling before adding the stiffening ingredient. For if pancreatic extract be allowed to act on the gelatin, the gelatin itself undergoes a process of digestion, and its power of setting or cooling is utterly abolished."[1]

[1] *Digestive Ferments*, pp. 63, 64.

Peptonised Beef Tea.—"Half a pound of finely minced lean beef is mixed with a pint of water and 20 grains of bicarbonate of soda. This is simmered for two hours. When it has cooled down to a luke-warm temperature, a tablespoonful of the liquor pancreaticus is added. The mixture is then set aside for three hours and occasionally stirred. At the end of this time the liquid portions are decanted and boiled for a few seconds. Beef tea prepared in this way is rich in peptone. It contains about 4·5 per cent. of organic residue, of which more than three-fourths consist of peptone—so that its nutritive value in regard to nitrogenised materials is about equivalent to that of milk. When seasoned with salt it is scarcely distinguishable in taste from ordinary beef tea."[1]

2. *Cow's Milk with Barley Water.*—"Barley and rye," writes Dr. Chambers,[2] "do not appear to possess any distinctive virtues which can give them an interest in the eyes of a medical man. Though useful when other cereals are not to be got, they are inferior to them in solubility and nutritive power." He adds: "Barley is less nutritious than wheat or even oats". Elsewhere it is mentioned:[3] "Pearl barley was once a Dutch import: it is now manufactured in Britain;" and it is added: "A decoction of shelled barley in water was the original *ptisana*, which was so distin-

[1] *Digestive Ferments*, p. 64. [2] *Manual of Diet*, p. 94.
[3] *Cabinet Cyclopœdia*, pp. 52, 54.

guished an article of ancient medicine".[1] Plutarch and Livy say that the Roman generals used to punish the soldiers who behaved with cowardice in the field by giving them barley instead of wheat. Barley is a bad bread corn. "Grossier comme pain d'orge" is a French proverb.

Dr. Starr writes:[2] "Thickening substances—attenuants—act purely mechanically by getting, as it were, between the particles of casein during coagulation, preventing their running together and forming a large compact mass. Of these materials barley water is, perhaps, the best."

Barley water is used as a diluent to cow's milk in infant feeding, because the barley water is found to be of service in aiding the digestion of the milk.

The giving of patent barley *without milk* as a food to infants is to be strongly condemned. It is sometimes tried by those ignorant of infant feeding. "A favourite substitute also for human milk is barley, or, more properly, what is known as *patent* barley. Here, again, we have a flour comparatively poor in nitrogenous material. But, besides this, it contains *dextrine*, a substance which even in the adult is difficult of digestion, and *a fortiori* must be so in an infant. Its starch corpuscles are less soluble in the

[1] *Cabinet Cyclopædia*, pp. 52, 54.

[2] *Dietetics of Infancy and Childhood*, "Annual of Universal Medical Science," p. 263.

gastric juice, the food made with it is slightly acrid and somewhat laxative."[1]

Barley.—"As an article of diet it is said by Pereira to be rather laxative, and Dr. Parkes has noticed its unsuitability in dysenteric cases."[2]

Dr. Goodhart says:[3] "Barley water has also the advantage of acting as a gentle laxative—a very valuable property, inasmuch as many children fed upon cow's milk and water, or cow's milk and lime water, are much troubled with constipation, the motions being very large, lumpy, and hard. Barley water acts most beneficially in many such cases, but its use is to be watched, as infants are very sensitive to the administration of starch in any form; and I have repeatedly known an eczematous eruption to appear upon the buttocks after only one or two meals of milk treated in this way."

"The late Dr. A. T. Thomson recommended barley water and milk, sweetened with a little refined sugar, as a good food for infants brought up by hand;" but added: "It may act upon the bowels".[4]

Dr. Angel Money writes to me of barley water: "A few babies resent even its temporary use, as it

[1] Hassall on *Food.*

[2] *Dictionary of Hygiene*, A. W. Blyth, p. 74.

[3] *Diseases of Children*, p. 24, second edition, 1886.

[4] *Dictionary of Domestic Medicine and Surgery*, twenty-second edition, Dr. Thomson and Dr. Steele, p. 51.

causes in these few wind and colic or restlessness without colic".

In infantile colic, causing pain, brandy is of service. Referring to brandy in ordinary use for infants, Dr. Cheadle writes to me: "The dose would then be a single one, the same as noted in my book;[1] but once only instead of every four hours.

5 drops	- - - - -	1 month old.
10 „	- - - - -	2 months old.
20 „	- - - - -	3 „ „
30 „	- - - - -	4 „ „
60 „	- - - -	over 6 „ „

"Each diluted with 7 parts of water."

I have not given 60 drops before twelve months, and then only in case of severe stomach-ache.

Dr. Cheadle remarks[2] of doses of brandy for infants that "their effect" is "spoilt by over-dilution"; and adds: "It is no use putting 10 drops in a bottleful of food". Dr. Cheadle further adds: "Brandy is an excellent sedative for children, as well as a stimulant. It probably acts favourably also by helping to arrest fermentation."[3] *Brandy should never be given except when absolutely necessary, and never for a continuance except under medical advice.*

The large amount of starch in barley is against its

[1] *Artificial Feeding and Food Disorders of Infants*, p. 125.

[2] *Ibid.*

[3] For brandy and its use in gastro-enteritis and in collapse see *Artificial Feeding and Food Disorders of Infants.*

use, many think, for *very young infants*, and for its continuance as an article of diet in their case. The investigations of M. Guillot, see p. 35, give ground for this opinion.

COMPOSITION OF COMMON PEARL BARLEY.

	In 100 parts.	In 1 lb. oz. gr.
Water	14·6	2·147
Fibrin, etc.	6·2	0·434
Starch, etc.	76·0	12·70
Fat	1·3	0·91
Cellulose	0·8	3·56
Mineral matter	1·1	0·77 [1]

RECEIPTS IN GENERAL USE FOR THE PREPARATION OF BARLEY WATER.

(1st.) Merely boiling the barley water and straining.

(2nd.) Washing the barley first in cold water. Boiling for a few minutes in some water (which is thrown away). Then boiling the barley in some more water; straining.

(3rd.) By pouring boiling water on barley. Letting it stand for some hours; straining.

(1st.) Barley water is prepared as follows: "Two teaspoonfuls of pearl barley to a pint of cold water, boiled down to two-thirds of a pint, and then strained through muslin. A fresh quantity must be prepared at least twice a day." [2]

[1] A. H. Church, *Food*, p. 74.

[2] The Hospital for Sick Children, Great Ormond Street, London, Medical Committee, June, 1888.

(2nd.) "Two and a half ounces of pearl barley are to be well washed in cold water, half a pint of boiling water is then to be poured upon the grain, the whole boiled for a few minutes and the water strained off, a couple of quarts of boiling water must then be poured on, the quantity boiled down one half and strained."[1]

(3rd.) "Barley water is made by pouring boiling water on it, allowing it to stand for two hours, and straining. The quantity generally used is two tablespoonfuls of barley to half a pint of boiling water."[2]

This receipt is sometimes given in England as follows:—

"One tablespoonful of pearl barley, washed in cold water. This water rejected. Then two pints of boiling water poured on and allowed to stand seven hours, and then strained."

Very often barley water is made without washing the barley. The necessity for washing the grain, however, will be apparent from the following:—

"What is called Scotch, French, or pearl barley is merely common barley, which, after being kiln-dried, is deprived of its tunics or bran by a mill: the grains are rounded by trituration, and are thus cut down smaller; they are finally well whitened in

[1] Thomson and Steele's *Domestic Medicine*, p. 50.

[2] *Journ. Pharm. et Chim.*

their own meal. It is said that the bran contains a resin of a purgative and even acrimonious nature; to remove this acrimony is the object of taking off the bran. By long keeping, the decorticated barley becomes mealy on the surface, and the meal is generally musty and sour; hence it is to be washed away when the grain is to be used medicinally or as an article of food."[1] "When barley paste is washed, the milky fluid deposits not only the starch, but also a protein matter, supposed to be insoluble casein."[2]

Having made some investigations into the use of barley water in infant feeding, after some research I came to the conclusion that the manner of preparing barley water might have somewhat to do with its agreeing with infants or not. That the way it is made has to do with the amount of starch it will contain can be seen from the analysis I had made of barley water prepared in the three ways I have given.

ANALYSIS.

"COURT HOUSE, ST. MARYLEBONE, W.,
"*July* 30, 1890.

"This sample was made according to Thomson and Steele's receipt, the barley first washed in cold water, then extracted with boiling water, and

[1] *Cabinet Cyclopædia*, p. 52. [2] Hassall on *Food*.

lastly boiled for 15 minutes with water, 1 pint being concentrated down to two-thirds, and strained.

	Per cent.
Total solids	·65
Starch	·29
Sugar	·04
Albuminoids	·03
Fat	·018
Ash	·025
Water (by difference)	99·35

"The liquid was perfectly neutral.

"A. WYNTER BLYTH."

"COURT HOUSE, ST. MARYLEBONE, W.,
"*July* 17, 1890.

"Analysis of two samples of barley water:—

"No. 1. Made with boiling water only, and strained.

"No. 2. Boiled down to two thirds and strained. (Hospital Receipt.)

	No. 1. × Per cent.	No. 2. Per cent
Water	98·97	99·27
Total solids	1·03	·73
Starch	·53	·39
Sugar	·07	·05
Fat	·02	·02
Albuminoids	·05	·03
Mineral matters	·09	·03

"No. 1 was acid, the acidity being equal to ·024 per cent. of acetic acid. No. 2 was neutral.

"Both contained starch.

"A. WYNTER BLYTH."

Sir William Roberts writes to me of the second receipt. (2nd):—

"The boiling method is very much the better method of preparing barley water. This ensures *full cooking* both of the starchy and of the albuminoid matters of the grain. I think your receipt might be simplified by merely directing that the boiling should be continued for 15 minutes.

"The conversion of starch into dextrine and sugar by boiling is a chemical fact, but to effect this change requires boiling for *many, many* hours."

Squire's *Companion to the British Pharmacopœia*, 1890,[1] p. 243, "directs the boiling to be carried on for 20 minutes. In making the barley water myself I found from a quarter of an hour to 20 minutes reduced the pint to two-thirds." The heat of the fire makes a little difference in the time required. Squire makes mention of "a covered vessel" in boiling barley water.

DECOCTUM HORDEI.

"*Pearl Barley*, 1; wash the barley with cold water, then add to the washed barley distilled water, 15; boil 20 minutes in a covered vessel and strain." As regards the straining of barley water, Dr. Wynter Blyth writes to me as follows:—

"In answer to your inquiry, the starch granules in

[1] Not in the other Pharmacopœias, except the Dutch and French. P. 291 of Squire's *C. B. P.*, 1894.

barley are very fine and will pass through muslin and ordinary filtering material. By boiling barley in water first and then throwing that water away, you, of course, *decrease* the amount of starch, and therefore there would be a difference in the amount. Should you wish to prepare barley water with a very small quantity of starch, the only way is to pour the decoction through a filter made of the best Swedish filtering paper."

Swedish filtering paper can be bought from any pharmaceutical chemist, and be put in an ordinary china funnel.

Remarking on the "Analysis of two samples of barley water," of No. 1, marked ×, Dr. Wynter Blyth writes to me:—

"(1) The acidity would not be noticed in the ordinary way. The barley water neither smelled nor tasted sour.

"(2) Any liquid which contains small or large quantities of starch or sugar, and to which the fermenting germs ever present in the air or in dust gain access, must ferment and become acid.

"(3) The slightest degree of acidity in barley water will soon curdle milk."

"Infusions are very apt to change in hot weather."[1] In infant feeding many prefer to use the patent barley. Of this Professor Church writes:[2] "Patent

[1] Squire's *Companion to the British Pharmacopœia*, 1890, p. 248.

[2] *Foods*, p. 87.

barley is pearl barley ground into flour". Dr. Buck writes:[1] "The prepared commercial barley, which has been previously made ready for use, is characterised by its fineness and whiteness. But these qualities are suspicious characteristics; the less the quantity of the yellowish glutinous outer layers which the barley contains, the less is it to be recommended. The prices of the grain vary in such a manner that adulteration by refining pays very well. I would, therefore, recommend that the barley corn which is employed for infant diet should be ground as thoroughly as possible in a coffee-mill, both in order to diminish the period necessary for cooking it, and also in order to retain the gluten. *It is even preferable, for very young infants, to cook the barley whole for hours*, thereby to burst the outer layers of cells, empty their contents, and then, by straining, to get rid of the larger part of the starch which is found towards the centre. The next best method consists in crushing the whole grains of barley, and not to employ the so-called pearl barley, which is barley minus husk. At a more advanced period of life the latter preparation, with its greater amount of starch, will suffice.

"According to Enzinger's latest investigations and plates, the body of the barley corn immediately adjacent to its covering membrane is composed of large irregular cells, which contain albuminoid

[1] *Hygiene and Public Health*, vol. i., pp. 122, 123.

substance and no starch. Towards the centre are found larger irregularly quadrilateral cells, which contain albumen and a larger quantity of starch. More internally are found even larger cells, which are almost entirely filled with starch. The conclusion to be drawn from this arrangement is, therefore, that the entire barley corn, and not alone its inner part, must be employed as an article of diet."

When barley water is given to infants as a diluent to cow's milk it is used in place of water, and in whatever quantity the water would be added. Barley water for infant use should *always be freshly made.* I have seen infants rendered ill by being given barley water prepared early the day before, kept in the sleeping room all night, and given the next morning.

"*March* 28, 1890.

"MADAM,—In answer to your letter, I have never known barley water, *given fresh*, do a child any harm.

"I am, yours truly,

"EUSTACE SMITH."

3. *Cow's Milk and Lime Water.*—Dr. Gover remarks of lime being necessary for the bone structure of man: "Bone acquires its solidity chiefly from lime in union with phosphoric acid. Analysis of dried

bone shows that it contains from 66 to 70 per cent. of mineral matter, of which about 57 parts are composed of phosphate of lime, eight parts of carbonate of lime, one of fluoride of calcium, and one of phosphate of magnesia." Dr. Gover further adds: "Lime, in the form of phosphate, is present in every tissue; and, as Dr. Pavy remarks, 'its incorporation with the nitrogenous constituent principles is so intimate that much difficulty is experienced in effecting a complete separation without involving the destruction of the compound'. The relation of the organic and mineral principles to each other is so close as to render it possible that the union between them is that of actual chemical combination. It is important to remark that the various salts or mineral nutrients are not mutually replaceable; their distribution is not indiscriminate, but is determinate and fixed. Just as vegetables select from the soil in which they are growing the particular aliment which in each case is essential to their growth and development, whether it be lime, or potash, or silica, so do the individual tissues or fluids of the animal organism select and appropriate those salts which enable them to discharge their specific offices, the due performance of which is necessary to ensure normal development and vigorous life."[1]

[1] *Dietaries in their Physiological, Practical, and Economic Aspects.*

"Bones contain over 10 per cent. of chalk or carbonate of lime, and more than 50 per cent. of another insoluble salt called phosphate of lime. Note.—In human bone the respective percentages are carbonate of lime 11·30, phosphate of lime 53·04."[1] In water there is lime. "Water should likewise contain certain mineral matters dissolved in it; of these the chief is carbonate of lime."[2] Where there is no lime in water it is said to be unwholesome for drinking purposes. "Lime salts . . . generally occur in a moderate and inoffensive amount in the drinking water supplied by springs and rivers."[3]

Dr. Routh mentions:[4] "Wherever children are brought up by hand large quantities of lime water are required"; and adds:[5] "In practice it will be found that two to four teaspoonfuls of lime water to the half-pint will suffice, and even be more than sufficient; but this excess, for the purpose of the growth of the child's bones and teeth, is desirable". Dr. Routh further remarks of phosphate of lime:[6] "This salt, especially when combined with carbonate of lime, is most useful in the process of alimentation. It is on their

[1] Thomas Twining, *Science made Easy*, lecture ix.

[2] Professor A. H. Church, *Food*, p. 11.

[3] Thomas Twining, *Familiar Lessons in Food and Nutrition* p. 110.

[4] *Infant Feeding*, p. 432.

[5] *Ibid.*, p. 451.

[6] *Ibid.*, pp. 282, 283, 432.

combined agency that the solidity of the skeleton depends. Moreover, it is a peculiar property of phosphate of lime to make carbonic acid more soluble in the blood . . . a property never to be lost sight of when it is wished to strengthen a growing child. Its administration, whether in a separate form or in aliment to a growing animal, is thus peculiarly indicated. Deformity of every kind in the skeleton may depend on an insufficient quantity of this salt in the blood." Dr. Routh further adds:[1] "The great use of lime salts in providing material for the muscular and bony structures is a strong reason for giving them in combination with the alimentary matters supplied".

Dr. Playfair writes:[2] "One great drawback in bottle feeding is the tendency of the milk to become acid, and hence to produce diarrhœa. This may be obviated, to a great extent, by adding lime water to each bottle, instead of an equal quantity of water."

Dr. Hillier says, in the treatment of rickets:[3] "The addition of lime water instead of pure water to the milk of London cows will be desirable to prevent acidity".

[1] *Infant Feeding*, pp. 282, 283, 432.

[2] *The Science and Practice of Midwifery*, sixth edition, vol. ii., p. 300.

[3] *Diseases of Children*, p. 100.

It will be seen from the annexed table how far cow's milk differs from human, as to lime.

Cow's Milk. Mean of Two Experiments. (*Hardlen.*)[1]		Human Milk.	
Phosphate of lime	2·87		
Phosphate of magnesia	·53	Carbonate of lime	0·069
Phosphate of peroxide of iron	·07		
Chloride of potassium	1·63	Other salts	0·053
Chloride of sodium	·29		0·098
Soda	·43	Sulphate of soda	0·074
Total salts in 1000 parts of milk	5·82	In 1000 salts,	1·000

Dr. Meigs, writing of lime water,[2] says: "It is a matter of experience, and almost universally acknowledged as true, that it is a most useful adjunct, rendering cow's milk more easy of digestion by the human stomach. The quantity of lime water to be used should be one-fourth of the total by measure. This may seem to many persons an excessive quantity; but when it is understood that if made as ordinarily directed, by agitating water with lime and then filtering, it contains only a very minute amount of lime, it becomes plain that the use of lime water means the administration of a great deal of water and very little solid matter. The great reason for the use of lime water," adds Dr. Meigs, "is that the

[1] Simon's *Chemistry*, ii., 63.

[2] *Milk Analysis and Infant Feeding*, pp. 72, 73.

experience of man has found it good, and that is sufficient reason for its use in the present state of knowledge."

"A useful notion of the relative antacid potency of the several articles in common use as gastric antacids (as sold in the shops) may be obtained from an inspection of the following table. Ten grains of bicarbonate of soda are taken as a standard antacid dose; and the quantities given of the other articles correspond in saturating value to this standard dose. The results were obtained by direct alkalimetrical determinations, and are here shown in round numbers:—

Table of Antacid Equivalents.

10 grains sod. bicarb.	=	2 grains	pot. bicarb.
„ „	=	6 „	creta precipit.
„ „	=	6 „	carb. magnesia.
„ „	=	3 „	calcined magnesia.
„ „	=	6 fluid ounces	lime water.*
„ „	=	2 fluid drachms	liq. potassæ.
„ „	=	1	bismuth lozenge *B.P.*
„ „	=	2½	Wyeth's soda-mint tablets.
„ „	=	5	Vichy lozenges."[1]

Dr. Cheadle writes:[2] "Lime water is extremely effective in moderating coagulation"; and adds: "Lime water may be added in the proportion of 1 part in 12".

[1] From an address by Sir William Roberts at the annual meeting of the British Medical Association, 1889 (*British Medical Journal*, August, 1889).

[2] *Artificial Feeding and Food Disorders of Infants*, p. 58.

Dr. Cheadle writes to me of this :—

"*July* 25, 1890.

"DEAR MADAM,—1 part in 12 would be exactly 2 measured teaspoonfuls (drachms) to 3 measured ounces, the lime water taking the place of an equal quantity of water. I think this quantity, 1 in 12, is perhaps a little under the mark, and a better proportion would be 1 in 8, or 1 measured teaspoonful (1 drachm) to 1 ounce.

"Faithfully yours,

"M. B. CHEADLE."

Dr. Starr writes:[1] "When lime water is constantly employed it becomes quite an item of expense if procured from the drug-shop; this outlay is unnecessary, for it can be made quite as well in the nursery". The following appears to me the most simple and exact as to directions for making: "Lime water (Liquor Calcis of the British Pharmacopœia) is made by adding 2 ounces of freshly slaked lime to a gallon of distilled or boiled water in a stoppered bottle, and shaking well for two or three minutes. After twelve hours the excess of lime will have subsided, and the clear solution can be poured off and kept in well-stoppered or corked bottles."

The freshly slaked lime can be obtained at any

[1] *Dietetics of Infancy and Childhood*, "Annual of Universal Medical Science," iv., p. 262.

chemist's. Lime water should be kept in a well-stoppered bottle; as, if it is not, Dr. Routh says,[1] "it is apt to be decomposed by absorption of the carbonic acid of the air, and becomes converted into chalk,[2] and thus gives rise to constipation of the bowels".

Dr. Routh[3] gives for infants without teeth and under three months:—

Take of Milk and water, of each, four ounces;[4]
Sugar of milk, one drachm;
Lime water, two teaspoonfuls.
Mix.

Under six months:—

Take of Milk, six ounces;
Sugar of milk, one and a half drachm;
Water, two ounces;
Lime water, one tablespoonful.
Mix.

Under nine months:—

Take of Pure milk, half a pint;
Sugar of milk, two drachms;
Lime water, one tablespoonful.
Mix. Temperature 90°.

Dr. Routh adds:[5] "If an infant be under four

[1] *Infant Feeding*, p. 433.

[2] *Lime water.*—"The carbonate or chalk is also an admirable antacid. It is much used in diarrhœa, acting as a desiccant or absorbent, and neutralising acid matters in the intestines" (Drs. Royle and Hedland, *Materia Medica*, p. 126).

[3] *Infant Feeding*, p. 510.

[4] It is advisable to have a measure glass.

[5] *Infant Feeding*, p. 354.

months of age, tolerably strong, and regular in his bowels, and has to be bottle-fed, a mixture of first quality milk with water in equal proportions will suffice; after four months, one part of water to two of milk, if given at a temperature of 90°, agrees well".[1] Dr. Routh remarks of "sugar of milk" that it "will often check diarrhœa, as I have before stated, and I cannot too strongly recommend its employment in preference to ordinary sugar in these cases; and, more than this," continues Dr. Routh, "sugar of milk, as it is usually sold, contains all the salts of milk in solution, and when substituted for the ordinary white sugar it often not only stops excessive purging, but keeps the bowels regular". As regards the nutritive value of "sugar of milk," and for *ordinary use*, Dr. Edward Smith, F.R.S., writes:[2] "But, as the nutritive properties of sugar of milk and ordinary sugar are the same, and as the object of sweetening the milk is more readily effected by the use of ordinary loaf sugar, the latter is, perhaps, preferable".

I have used the following proportions of cow's milk and cream with an excellent result, and have invariably found them agree:—

2 ounces of water (made up of cold *boiled* water and 3 teaspoonfuls of lime water).

4 ounces of cow's milk *unskimmed* (boil the milk before use).

[1] *Infant Feeding*, pp. 449, 450. [2] *Practical Dietary*, p. 124.

1 teaspoonful of sugar of milk.
30 drops of cream.[1]
(Mix, and warm by standing jug in boiling water.)

Dr. Chavasse gives the following receipt for the preparation of cow's milk[2] for infants, the only variation from the usual formula being the addition of salt; what he calls "The Lime Water and Milk Food Formula":—

Take of Fresh milk—the milk of *one cow*—8 tablespoonfuls.
Lime water, 1 tablespoonful.
Hot water, 7 tablespoonfuls.
Loaf sugar, 2 moderate-sized lumps.
Table salt, a small pinch.
Mix.

Dr. Starr remarks of "Chavasse's Milk Food": "This preparation does well for a child of three or

[1] These proportions will agree at about six or seven months according to the digestive powers of the infant. When the child has been strong I have used instead of sugar of milk half a teaspoonful of castor sugar. If the bowels were confined half a teaspoonful of Demerara sugar—this may suffice in one or two bottles. When the child is able to bear it increase the cream to 35 drops. Lime water, 4 teaspoonfuls if the quantity of milk and water is increased to 8 ounces, which is sometimes necessary with the 35 drops of cream (see p. 80). When I have given *pure milk* I have used Dr. Routh's formula. I have found his quantities of milk for different ages agree well. The following I have found answer with the newly-born:—

1 tablespoonful of pure cow's milk *unskimmed* (boiled).

3 tablespoonfuls of hot water. Take out 1 teaspoonful of water and replace by 1 teaspoonful of lime water.

Half a teaspoonful of sugar of milk or castor sugar.

[2] *Counsel to a Mother*, pp. 24, 30.

four months, the total quantity for each meal being from 8 to 12 tablespoonfuls ".

After mentioning several ways of preparing milk for infant use, Dr. Starr says :[1] "Another good food is that recommended by Dr. A. V. Meigs. It consists of a combination of two parts of cream, containing from fourteen to sixteen per cent. of fat, one part average milk, two parts lime water, and three parts sugar water, the latter consisting of seventeen and three-fourths drachms of milk sugar to one pint of water. This makes an alkaline mixture with the percentage of its ingredients closely corresponding to human milk." Dr. Starr gives the age of "six weeks" as the age at which a milk of this description may be borne.

Dr. Meigs[2] gives the measurements for the above as "2 tablespoonfuls of cream, 1 of milk, 2 of lime water, and 3 of the sugar water"; of the latter Dr. Meigs says: "There must be obtained from a reliable druggist packages of pure milk sugar containing seventeen and three-quarters (17¾) drachms each. The contents of one package is to be dissolved in a pint of water, and it is best to have a bottle which will contain just one pint, as there is then no need for further measuring. The contents of one of the sugar packages is put into the bottle,

[1] *Dietetics of Infancy and Childhood*, "Annual of Universal Medical Science," vol. iv., p. 267.

[2] *Milk Analysis and Infant Feeding*, pp. 75, 76.

and when filled with water the sugar soon dissolves, and it is ready for use. The dry sugar keeps indefinitely, but after it is once dissolved it sours if kept more than a day or two in warm weather; it is understood, therefore, that the sugar water must be kept in a cool place, and if it should at any time become sour, which is easily discovered if it is smelled and tasted, it should be thrown out, and after the bottle has been carefully washed with boiling water, the contents of a fresh package dissolved. A milkman must be found who will serve good milk and cream, fresh every day. By good milk is meant ordinary milk, such as is easily procured in most cities, and not rich Jersey milk; and in the same way the cream should be such as is ordinarily used in tea and coffee, and not the very rich cream of fancy cattle. The reason that ordinary milk and cream are recommended is because they are within the reach of almost every one, and not because they are any better than the rich milk of high-bred stock. If Jersey milk was to be used, it would be necessary to analyse specimens, and then make the necessary calculations as to how to dilute it to obtain the desired relative proportions of the proximate principles. When the child is to be fed, the nurse should mix together two (2) tablespoonfuls of cream, one (1) of milk, two (2) of lime water, and three (3) of the sugar water; and then, as soon as the mixture has been warmed, it may be poured into the bottle,

and the food is ready for use. If the infant is healthy, this quantity will not satisfy it after the first few weeks; and then double the quantity must be prepared for each feeding. Twice as many tablespoonfuls of each of the ingredients must be mixed together, making sixteen tablespoonfuls (about half a pint) in all."

I have found with this receipt that the kind of milk and cream used makes a great difference to a child being able to digest the preparation. *A measure glass should be used.*

Dr. Meigs writes[1] that the preparation "was the result of a study of the subject both from a theoretical and practical standpoint. . . . A careful study of the relative composition of human and cow's milk led to the concoction of the food in which the various constituents are mixed as nearly as possible in the same proportions as they exist in human milk."

Dr. Meigs adds:[2] "This food has been quite extensively tested" by him; "and in all instances in which it has been tried thus far, it has proved successful. It has been used where condensed milk had failed, for infants that were partially nursed and partially hand-fed, for entirely artificially-fed

[1] *Milk Analysis and Infant Feeding*, p. 94.

[2] *Ibid.*, p. 95.

children, in cases of disease and of malnutrition; and, as already said, it has seemed to be wonderfully useful and easily digested."

4. *Condensed Milk.*—"Somewhat recently the milk from the rich pastures of Switzerland, Bavaria, Ireland, and England have been preserved by adding to it about a third of its weight of sugar, and then concentrating it *in vacuo* until it acquires the consistence of thin honey. In this state it is run into tins, which are immediately soldered down, and then hermetically sealed . . . so that the concentration of the milk has been to about one-third of its original bulk; and therefore, if it be diluted with twice its bulk of water, it will make a good milk of ordinary strength. Of the sugar in the milk 14 to 18 parts consist of lactose or milk sugar, and the rest is cane sugar: hence the sweetness of the milk."[1]

Dr. Playfair, writing of the feeding of the newly-born, says:[2] "Of late years it has been customary to obviate the difficulties of obtaining good fresh milk by using some of the tinned milks now so easily to be had. These are already sweetened, and sometimes answer well, if not given in too weak a dilution."

"Condensed milk again, if properly diluted,"

[1] Letheby on *Food*, pp. 191, 192.

[2] *Science and Practice of Midwifery*, sixth edition, vol. ii., p. 300.

writes Dr. Cheadle,[1] "is more digestible than fresh unboiled cow's milk. This is due to the fact that the process of heating which it undergoes alters and lessens the coagulability of the casein. Under

Japanese Mother and Child, from a Photograph taken in Japan in 1889.

certain circumstances, where fresh cow's milk does not agree well, or when it cannot be procured fresh and good, as on sea voyages for example, or on long

[1] *Artificial Feeding and Food Disorders of Infants*, pp. 51-58.

journeys, condensed milk may be used." "Condensed milk and Mellin's Food are the best for *long journeys* or *voyages* in early infancy."[1] It is undoubtedly best

Japanese Mother and Child, from a Native Drawing taken in Japan in 1889.

to use fresh cow's milk in infant feeding: but occasions may arise when it may be impossible to

[1] *Disease in Children*, second edition, p. 28.

obtain such. For instance, in Japan, owing to the nature of the grass, cows are not to be found. "One of the many strange things which strike one in Japan is the complete absence of pasture and its products. Milk, butter, cheese, and mutton are unknown except as importations,—the first three in a condensed and tinned state from Europe, the last from the Korea."[1] *I have known several instances in which infants who could not take cow's milk have done very well on condensed milk, and after a time they were able to be put on ordinary cow's milk. If prepared properly, and a good kind, it is a most excellent milk; the only drawback is the large amount of cane sugar in it, which, during teething, will sometimes cause excessive acidity. All children, however, are not affected by it, and at the age when this occurs they are generally in a condition that it is possible to change to fresh cow's milk.

It is well (unless advised otherwise by a doctor) to add lime water to *each bottle* of milk given, in the same proportion as to cow's milk (see p. 81).

The following extract from a paper read at a meeting of the Hawick Pharmaceutical and Chemical Association, December 2, 1884, by Thomas Maben, will show that lime water is a useful adjunct to condensed milk: "Objection is frequently taken

[1] Major-General R. C. W. Reveley Mitford, *Orient and Occident*, p. 175. * Many children in Japan have been successfully reared on Condensed Milk. The babies, see illustration pp. 88–9, were so brought up.

to the use of sweetened condensed milk, and from various standpoints. For example, we are told that the excess of cane sugar decomposes and forms lactic acid, which gives rise to irritation and diarrhœa; but this may readily be obviated by a more or less liberal allowance of lime water, this being particularly necessary during teething time, when the natural tendency is for acid secretions to be formed."[1]

Condensed milk must, like other things, be given with care. Two mistakes are generally made in giving infants condensed milk: too much of the milk is given, or it is not sufficiently diluted with water. The Anglo-Swiss Milk Company write to me: "Experience shows that the mode of employing condensed milk for infants, as practised by different people, varies almost beyond belief; every conceivable manner of using it cannot be right". *Experience* can, of course, alone afford a good guide to the best manner of giving any nutriment to infants. I have, however, found very little variation in infants as regards the quantities of condensed milk which will agree; and I think any one having charge of an infant can soon tell whether the child will bear the milk stronger or not. People are apt to imagine that it is exceedingly easy to bring up an infant on condensed milk, and that it requires no experience, no care—in fact, may be given any-

[1] *British Medical Journal.*

how and in any quantity without harming. This is a great error. I have found the Anglo-Swiss condensed milk prepared at Cham, Switzerland (trade-mark, a milkmaid), a very excellent milk, and have been successful in its use. It is best to get the milk direct from the Anglo-Swiss Milk Company's depôt. If this milk is found too relaxing to the bowels, Nestlé's Swiss milk[1] (not Nestlé's Food) may be found to answer better in this respect. Most chemists now keep this milk, which is favourably spoken of. It may not be generally known that the state of an infant's bowels will indicate whether condensed milk is being given in too great quantity or sufficiently strong.

"Continued constipation[2] is usually an indication that the child will bear a little stronger food."

Dr. Playfair writes:[3] "In the first few weeks of bottle feeding, constipation is very common, and may be effectually remedied by placing as much phosphate of soda as will lie on a threepenny piece

[1] If cream is given with Nestlé's Swiss milk, note would have to be taken as to whether the child could bear it with this milk, and *in the same amount*, as with the "Milkmaid" brand. Nestlé's Swiss milk is a richer milk. "Fat in Anglo-Swiss milk, 8·67—fat in Nestlé's Swiss milk, 8·85" (*Dingler's Polytechnisch. Journal*, bd. 198, § 168).

[2] Continued constipation in general occurs when the diet of an infant is not right as to proportions suited to it.

[3] *Science and Practice of Midwifery*, sixth edition, vol. i., p. 808.

in the bottle two or three times in the twenty-four hours".

Having found phosphate of soda of service, as mentioned by Dr. Playfair in his *Science and Practice of Midwifery*, I was desirous of knowing if it might be used at a later age than that mentioned ("in the first few weeks of bottle feeding"). I therefore wrote to Dr. Playfair on the subject, and received the following reply :—

"*September* 1, 1889.

"There can be no objection to giving the drug mentioned to an older child; but it is not a very good aperient for older children, as the dose would require to be largely increased.[1]

"W. S. PLAYFAIR."

Referring to constipation in young children, Dr. Goodhart writes:[2] "When a few months have passed over, or if the child be brought up by hand, better than all medicines by the mouth is the plan of attempting to modify the diet,[3] or of exciting the lower bowel to expel its contents by an enema.

[1] See *Handbook of Therapeutics*, Ringer (sixth edition, p. 189), on phosphate of soda as a drug.

[2] *Diseases of Children*, second edition, p. 43.

[3] Dr. Angel Money writes (*Disease in Children*, second edition, p. 50) that in some cases of constipation with infants "the artificial food is deficient in fatty matter"; and adds, "a little cream may be added to the infant's food".

With some infants the occasional use of a teaspoonful of Scott's Emulsion in the bottle or alone at bedtime is found effectual in persistent constipation. This is also sometimes found of benefit where citrate of soda is given with the milk, and with a delicate child seems to have a good effect on its health.

Friction should also be applied to the abdomen morning and evening, either by the hand alone, or combined with an oily embrocation."

Dr. Angel Money mentions[1] "camphor liniment".

Dr. Starr recommends "warm sweet oil".[2] In hand feeding in cases of continued constipation the occasional use of oatmeal water with the child's milk instead of plain water is of service. *Oatmeal water* only must be used, however; given as food during the early months of life, Dr. Cheadle writes:[3] "Oatmeal or brown flour is irritating and injurious".[4]

Dr. Angel Money gives the following recipe for making oatmeal water:[5] "Two tablespoonfuls of oatmeal should be boiled in a quart of water for four hours and even longer; then strained through muslin; the liquor that filters through is used". "Use in proportion of one-half to two-thirds of milk, sweeten a little, and also add a pinch of salt."[6]

"Glycerinum—Medicinal Properties. Internally is recommended as an *anal* injection for constipation, 15 to 30 minims, or the same diluted with an equal quantity of water."[7] Small syringes are now sold for giving these injections.

[1] *Disease in Children*, second edition, p. 52.

[2] *Hygiene of the Nursery*, p. 260.

[3] *Artificial Feeding and Food Disorders of Infants*, p. 89.

[4] Mellin's Food is useful as a diluent to cow's milk in the case of infants who suffer from constipation.

[5] *Disease in Children*, second edition, p. 27.

[6] *Philadelphia Medical Times*—"Laxative Food".

[7] Squire's *Companion to the British Pharmacopœia*, 1894, p. 277.

Dr. Goodhart says:[1] "For an enema all that is necessary is to take 2 or 3 ounces of warm water and lather into it a little yellow or curd soap, and inject it by means of a caoutchouc-bottle syringe. A dram or two of castor oil may be added to the soap and water if necessary. An enema," Dr. Goodhart further adds, "may be administered every morning, or even twice a day if necessary, and I know no objection to its daily use as long as may be requisite. It is never to be given unnecessarily; but if the bowels do not act spontaneously the action should be ensured by an enema, and this may be done without any fear of inducing such a habit as would require its permanent use."

Dr. Angel Money mentions "olive oil" as being useful with "soap and water" for an injection.[2]

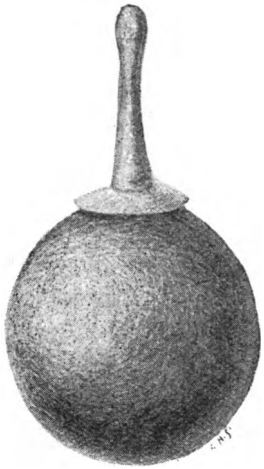
Dr. Starr writes of this:[3] "The quantity of oil or soap to be used must depend upon the quantity of water—2 teaspoonfuls of oil to 8 tablespoonfuls of water being a good proportion, and if soap be employed it is sufficient to stir a bit in the water until suds begin to form". I have found at twelve months, and even up to three years of age, an injection with the bulb syringe effective in ordinary constipation.

[1] *Diseases of Children*, second edition, p. 43.

[2] *Disease in Children*, second edition, p. 51.

[3] *Hygiene of the Nursery*, second edition, p. 258.

Dr. Starr adds:[1] "The laxative enemata must vary in bulk with the age of the child, or, in other words, with the capacity of the rectum; 1 fluid ounce (2 tablespoonfuls) will be sufficient for an infant of six weeks, while from 4 to 6 fluid ounces are required at the age of two years".



Bulb Syringe.

Dr. Angel Money writes:[2] "The *repeated* use of *large enemata* is bad".

"When an enema is administered . . . the patient may . . . be laid . . . on the left side near the edge of the bed, with the knees drawn up. The bone or vulcanite pipe which is introduced into the bowel should be well oiled or greased, and its introduction should be effected with perfect gentleness, not straight up, but in a direction slightly inclined towards the backbone, care being taken that no abrasion or scratching of the parts be occasioned."[3]

"Injections should not be given too warm. Many

[1] *Hygiene of the Nursery*, p. 258.

[2] *Disease in Children*, second edition, p. 51.

[3] *Dictionary of Domestic Medicine and Surgery*, twenty-second edition, Dr. Thomson and Dr. Steele, p. 244.

have an idea that giving an injection very warm increases its efficacy, but this is not so. An injection should never be more than comfortably warm, or it will injure. Where there is a tendency to constipation, *all diet* of a confining nature should be avoided in infant feeding; also *all articles of food which will form into a hard or compact mass in the bowels should not be given.*"

"Diarrhœa may occur from many different causes: as a general rule it is well to treat it as you would treat indigestion; namely, by giving whatever food may be in use, not richer, as often advised, but in the accustomed strength, *or even weaker*, and always reduced in volume."[1]

If the child's bowels are relaxed—if no other cause can be ascertained for their being so—the condensed milk, before preparing, should be reduced in quantity. Sometimes it is sufficient to reduce for a time only.

But there must be no doubt that the milk is being given in too great quantity, and that the diarrhœa does not arise from some other cause. Where there is much or continued diarrhœa, *no delay* should be made in sending for a doctor.

The addition of cream to condensed milk appears to prevent its relaxing the bowels with some infants. Dr. Angel Money writes:[2] "Condensed milk is

[1] *Notes*, Anglo-Swiss Milk Company, p. 67.

[2] *Disease in Children*, second edition, p. 25.

sometimes very valuable. If sweetened condensed milk be used, then half a teaspoonful to three tablespoonfuls are the usual proportions for the first week. This does not contain enough casein or fat, and so the addition of 10 drops of cream is needed." I have found from three weeks to a month an increase to 15 or 20 drops of cream may be made, and from a month to five weeks a further increase from 20 to 25 drops. I have gradually increased the cream by 5 drops till at six weeks I have found 30 drops borne well. If the child cannot digest the cream it will bring it up in small white pieces. The following preparation of "condensed milk, cream and lime water,"[1] of which I give the analysis, I have used with great success from six weeks to three months. When made it comes to about 4 ounces, which I have found the child satisfied with (up to three months) when fed with regularity.

"COURT HOUSE, ST. MARYLEBONE, W.,
"*January* 30, 1891.

"Analysis of a sample of milk received January 28, 1891:—

"The milk was labelled as follows:—

"2 measured teaspoons of condensed milk (Anglo-Swiss 'Milkmaid' brand).

"2 measured teaspoons of lime water.

[1] I have found infants of feeble digestive powers unable to digest even "artificial human milk" do well with this preparation of milk.

"3½ ounces of water (7 tablespoonfuls measured).
"30 drops of cream measured.

"The milk was alkaline; the alkalinity was equal to ·025 per cent. of lime.

Water,	91·210	Water,	91·210
Total Solids,	8·790	Sugar,	6·230
		Albuminoids,	1·630
		Fat,	·695
		Ash,	·235
	100·000		100·00

"A. WYNTER BLYTH."

Dr. Wynter Blyth writes to me: "I do not know the exact amount of concentration of the particular brand; but, taking the analysis as it stands,[1] it would be equal to about 44 parts of milk made up to 100 with water, that is to say, about 5 of water to 4 of milk."

"The milk according to the analysis (I have been told) is not satisfactory as a *permanent* food. It contains 2 per cent. too little fat in spite of cream added (*little more than one-fourth what it should* do, and is *more than* 2 per cent. *deficient* in albuminate—*about one-third what* it should contain)."

Dr. Wynter Blyth writes to me of this: "Sugar in diet may replace fat, so that I do not agree that

[1] I wrote to ask Dr. Blyth how near to ordinary cow's milk and water he considered this preparation of "condensed milk, cream, and lime water".

the small amount of fat makes such a diet unsuitable. Indeed, the success of Mellin's Food gives a practical illustration of my remark; it is a fact that infants are often incapable of assimilating fat, and they vomit up the slightest excess. I should advise you to try the mixture practically before you alter it. If you alter it at all, decrease the lime water by one-half, and add an ounce of *skimmed* milk—that is 2½ ounces of water, 1 ounce of skimmed milk."

I have not tried the addition of skimmed milk,[1] as suggested by Dr. Blyth; but at three months I increased the condensed milk to 2½ measured teaspoonfuls and the lime water to 3 teaspoonfuls (see p. 78), instead of 2, keeping the water at the same quantity and still the same amount (30 drops) of cream. At five months[2] I again made an increase of the condensed milk (with some children it might have to be done earlier), the proportions then being:—

3 teaspoonfuls (measured) of condensed milk.[3]
3 teaspoonfuls of lime water.
30 drops of cream.
4 ounces of water.

With these proportions I gave 6 ounces of milk for each feeding, giving one bottle made as above, and

[1] Skimmed milk *alone*, even if combined with farinaceous food, is not a suitable diet for infants, and if given may cause rickets (see *Artificial Feeding and Food Disorders of Infants*, pp. 158-159).

[2] At six months farinaceous food may be begun.

[3] For proportions of condensed milk at different ages see p. 108.

2 ounces of a second bottle added to it, made in the same proportions, *only with no cream in it.*

I found *no cream in the second bottle* digested best—especially when beginning to give 6 ounces for each feeding. After a time some children might bear a still further *gradual* increase of cream. With one child, I found up to nearly six months she could only digest her meal with the second bottle (from which the extra 2 ounces were taken) made thus:—

2½ (measured) teaspoonfuls of condensed milk.
3 teaspoonfuls of lime water.
No cream.
4 ounces of water.

From six weeks to four months I calculated this child took about 24 to 32 fluid ounces in twenty-four hours, the time for feeding being from two and a half to three hours. At five to six months, from 2½ to 3 pints in twenty-four hours. Dr. Angel Money writes of condensed milk:[1] "The quantity of fluid taken should be[2] about the same as when diluted cow's milk is used, but cow's milk should be tried from time to time in order to displace if possible the condensed milk." I have found from five to six months' children, even if unable to take cow's milk before, will then digest it. Condensed milk with gelatine is sometimes used in infant feeding, but I have found gelatine best given with cow's milk. I give an analysis of condensed milk made in

[1] *Disease in Children*, second edition, p. 26.
[2] See Dr. Starr's *General Rules for Feeding*, p. 10.

the same proportions, except that the water is a little less, as that which I have used from six weeks to three months (see p. 98), only gelatine being used in place of cream.

"COURT HOUSE, ST. MARYLEBONE, W.,
"*February* 21, 1891.

"Analysis of a sample of milk received February 16:—[1]

Per cent.		In 100 parts.
Water, 93 82	Sugars,	1·60
Total Solids, 6·18	Fat,	·89
	Albuminoids,	3·61
	Ash,	·08
100·00	Total Solids,	6·18

"A. WYNTER BLYTH."

I have found in practice that it is better to give cream to young infants in small quantities rather than in two or three large doses. One can give from 1 to 1½ ounces or 2 ounces (according to age and power of digestion) in twenty-four hours by giving cream in drop doses.

When an infant is brought up from the first on condensed milk, but little difficulty is likely to be experienced in putting the child on ordinary cow's milk if it is properly prepared. But in suddenly weaning a child from human milk great watchfulness

[1] "The milk was labelled '2 measured teaspoonfuls of condensed milk (Anglo-Swiss 'Milkmaid' brand), 2 measured teaspoonfuls of lime water, 1 teaspoonful of gelatine jelly, 3 ounces of water'."

and care are necessary; and undoubtedly, when the child is six or seven months old, the milk should be combined with farinaceous or other nourishment. Weaning a child at seven or eight months on condensed milk alone is weaning on insufficient nutriment. It seems to me very surprising that people nursing their children, and those also giving cow's or goat's milk, should, at the age of six or eight months, commence to give some other food in combination, yet should neglect to do so when giving condensed milk. Condensed milk is described by medical men "as a milk not equal to cow's milk in strength" for children over six to eight months; so that, if in the one case additional nutriment is needed, most certainly it is in the other. In fact, *all* doctors say the same: *condensed milk is best given only for the first few months of life*, changing to cow's milk and other food combined with cow's milk later on.

Dr. Starr says[1] of condensed milk: "As a food it does not contain enough nutrient material to supply the wants of a growing baby," and adds: "It is never safe to bring up a child solely on this food".

I have brought up children *weakly at birth* very successfully on condensed milk. One, a delicate, feeble little baby when born, I brought up till fourteen months on it, then changing to "artificial

[1] *Dietetics of Infancy and Childhood*, "Annual of Universal Medical Science," iv., p. 258.

human milk".[1] The delicate little child I refer to,[2] I found, I was obliged to give other very nourishing food as well as the condensed milk at eight months. On consulting a doctor who had long experience with weakly children I was advised to give a small teaspoonful of fresh cream[3] in each bottle of the condensed milk, prepared as usual, and add to this twice a day a dessertspoonful of veal or chicken broth.

I gave three days chicken jelly and the rest veal jelly (see p. 228). A good dessertspoonful of the jelly, put in a cup, and warmed over hot water, and then added to the bottle of milk, prepared as usual, and with the cream in it. Although it sounds rather a mixture, still, when prepared, the child not only did not dislike the taste, but took her bottle with evident liking. After eleven months I gave a tablespoonful of the jellies instead of the dessertspoonful. It was also advised to give, when practicable, gravy taken from *roast* leg of mutton, so that whenever there was this joint we gave *this gravy* in place of the jelly. With a leg of mutton you can obtain, by placing the spoon under the joint when cutting, about a wineglass of gravy, without interfering with the joint, as this, if not caught, runs into

[1] We gave this for a little time, and then gave cow's milk and lime water. We made several attempts to give ordinary cow's milk, but did not succeed till the child was about fifteen months.

[2] She has grown up quite *strong*.

[3] Cream—for proportions at different periods see p. 98.

the dish, and if the cook sends up plenty of gravy in the dish it is not needed. Gravy, taken thus out of the centre of mutton, contains the very essence of the meat.

So much has been said and written lately about underdone beef being injurious that I wrote to Monsieur Pasteur to inquire if it applied to "the *gravy* taken from the centre of *roast* leg of mutton". The following is his reply:—

Institut Pasteur
25, Rue Dutot

Paris, le 4 juin 1890

Il n'y a aucun danger à donner aux enfants le jus du gigot de mouton rôti.

L. Pasteur

If, after standing, there is much grease on the gravy, skim off with a spoon or strain through

muslin. For an infant, gravy is best given mixed with milk.

Dr. Hillier says, in rickets,[1] "when the child is eight or nine months old, the gravy of meat and beef tea should be given, as well as plenty of milk".

"If the child be pale and flabby, some more purely animal food may often be given," observes Dr. Playfair,[2] "twice a day; and great benefit may be derived from a single meal of beef, chicken, or veal tea,[3] especially after the sixth or seventh month."

Dr. Angel Money writes:[4] "If cow's milk cannot be borne by the infant, it is a good plan to let it have, besides the diluted Swiss milk, or with it, a little white of egg or raw meat juice. Half a dram of either may be added to each or every other meal according to the powers of proteid digestion."

Dr. Gover remarks of meat in diet:[5] "The prominence now given to the various meats may, no doubt, be traced partly to the doctrines laid down years ago by Liebig, who, as I have already stated, taught that the nitrogenous constituents of food alone supplied the materials of growth and repair, and gave to animal food the first and most important place in the construction of dietaries."

[1] *Diseases of Children*, p. 100.

[2] *Science and Practice of Midwifery*, sixth edition, vol. ii., p. 393.

[3] See p. 228 for how to prepare.

[4] *Disease in Children*, second edition, p. 26.

[5] *Dietaries in their Physiological, Practical, and Economic Aspects*

To put an infant entirely on meat jellies should never be attempted.

Dr. Bannister writes:[1] "It was at one time thought that nitrogenous compounds ought to be able to sustain life; animals were therefore fed solely on a nitrogenous diet, with the result that they all died. Food free from fat has been tried with a like result; and, without enumerating details, it has been verified by many experimenters, working in different ways, that milk is perfect in its composition for the purpose it is intended to serve, and that no artificial production can be properly substituted for it. The flesh-forming and heat-giving powers of milk are perfect."

In cases of extreme weakness and debility I have found meat jellies very valuable; but for an ordinarily healthy child a better result can be obtained and at less expense by combining some one or other of the farinaceous "foods" with cow's milk (see pp. 201-2.)

I subjoin the directions given by the Anglo-Swiss Milk Company, Cham, Switzerland, for preparing their milk and as to the quantity to be used. These directions are not generally known. I have found the quantities as mentioned by the company agree; but, of course, people must use their own judgment as to keeping exactly to the proportions

[1] *Our Milk, Butter, and Cheese Supply*, by Richard Bannister, F.I.C., F.C.S.

indicated, some children being able to bear a larger quantity of condensed milk than others can; also some being able to bear an increase of the milk at an earlier age than others.

Directions of the Anglo-Swiss Milk Company for preparing Condensed Milk for Infants.

"It should be understood that it would not be practicable for us to give exact directions for employing the condensed milk, for the reason that the amount of nourishment suitable for one child may be too little or too great for another.

"Physicians and nurses must determine the strength or quantity to be given in each individual case; experience enables us, however, to give approximate directions to be followed for infants of average health and strength.

"During the first weeks of infant life the following directions may be observed:—

"For the *first two days* give nothing but sweetened water: for the next five days, ½ teaspoonful of condensed milk with 8 teaspoonfuls of water, every two hours, day and night.

"For the *second week*, ¾ teaspoonful of condensed milk with 12 teaspoonfuls of water, every two hours, day and night.

"*Third week:* 1 teaspoonful of condensed milk with 16 teaspoonfuls of water, every two hours, day and night.

"*Fourth week:* 1¼ teaspoonfuls of condensed milk with 18 teaspoonfuls of water, every two hours, day and night.

"*Second month:* 1½ teaspoonfuls of condensed milk with 21 teaspoonfuls of water, every two hours by day, and two to three hours at night.

"*Third month:* 2 teaspoonfuls of condensed milk to 24 teaspoonfuls of water, every two hours by day, and about once in three hours at night.

"*The spoon used for measuring condensed milk should not be dipped into the tin,* but should be filled by pouring from another spoon.

"If the use of condensed milk exclusively be continued beyond the third month, begin the fourth month with 2 to 2½ teaspoonfuls of condensed milk to 24 teaspoonfuls of water; and gradually, during the fourth month, increase the amount of condensed milk to 3 teaspoonfuls, with 24 to 26 teaspoonfuls of water, or with an amount of water equal to the volume the child will take at one time, and at this age feeding at longer intervals may gradually take place.

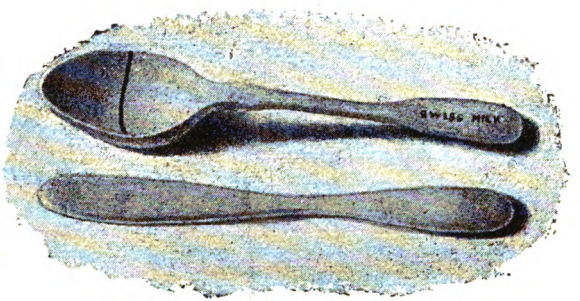
"By the fifth month experience will usually show how to proceed; but condensed milk for any child of any age should never be used richer than 1 part of milk to 7 parts of water."

I have found, even up to twelve months, some children unable to take more than two full teaspoonfuls of condensed milk. In such a case, if the child be in health, cream to each bottle and one of the

digestible "foods" for two or even three meals are necessary. "The directions" added, "with condensed milk notes," are: "All possible care should be taken to keep feeding bottles clean and sweet. *They should be cleansed with hot water immediately after having been used each time.*

"The water used for the milk should be previously boiled[1] and cooled."

Condensed milk should be thoroughly mixed with the water added to it.



Spoon for Condensed Milk and Scraper.

Laking[2] sells an inexpensive china spoon for the use of condensed milk, with which is sold also a piece of china for scraping the milk off the spoon into the vessel in the preparation of it.

It is well to keep a jug or cup (as a measure) into which the quantity of water for the milk *has been accurately measured.*

[1] See p. 138.

[2] China Depôt, 22 Connaught Street, Hyde Park, W.

I think the best plan at night is to place the milk for the night's use (prepared and *boiled*) in a *covered* vessel; it then has only to be warmed. Do not keep it in the "food warmer" (see p. 17).

The general custom has been to merely add hot water to condensed milk. Later research, however, has shown the necessity for boiling this as other milk. At the Sanitary Congress at Portsmouth, Professor Corfield, in discussing scarlet fever, alluded to "the probability of its communication by means of milk, and stated that he had even traced its communication by means of condensed milk, in tins of which, suspected by him to have caused the disease, the micro-organisms of scarlet fever had been found by Dr. Klein".[1]

Of the boiling of condensed milk for infant use Professor Corfield writes to me, "that the best plan is to boil the condensed milk after it has been prepared for the child".

With regard to boiling condensed milk, if it would in any way impair its nutritive value for the child, Professor Corfield writes to me: "I think not".

Much is involved in the question of the requisite dilution of condensed milk for infants.

The Secretary of the Society of Public Analysts, Otto Hehner, 11 Billiter Square, writes,[2] Oct. 19, 1887: "There can be no doubt that the proper use of condensed milk is but ill understood by the

[1] *Times*, Saturday, September 17, 1892. [2] *Analyst*.

majority of those who use it for the feeding of infants. A tin of condensed milk is supposed to be as inexhaustible of milk as the cruse of the widow was of oil. A tin of milk is popularly credited with containing a sufficiency of food for a young child for the space of one week. The fact is, that a tin of condensed milk contains an amount of fresh milk equal to about three pints, and about six ounces of white sugar. To obtain from one tin of condensed milk a fluid of the nourishing value of fresh milk, at most two and a half pints of water should be added, or for infants' feeding double that quantity of water. Instead of this a spoonful of the condensed milk is commonly used to half a pint of water, the result being that children fed with this dilute solution are put upon a starvation diet."

C. Karmrodt writes:[1] "There is no difficulty in finding the percentage of solids in diluted condensed milk, but there is considerable difficulty in knowing to what extent condensed milk ought to be diluted. The Anglo-Swiss label recommends that for infants the milk should be diluted with from 7 to 14 parts of water; the Aventicum says 7 to 10, the Scandinavian 10 to 15, and so on; the idea being that the milk should be used weaker at first and gradually increased in strength."

The following from Mr. Willard, of Cornwall University, New York,[2] is worth noting:—

[1] *Dingler's Polytechnisch. Jour.* [2] *Philadelphia Medical Times.*

"After some tentative experiments we decided to dilute the sweetened condensed milk in the proportion of 1 to 11 of water, and that strength has been adhered to from first to last with excellent results. I have noted the quantity of milk used each day, the average being as nearly as possible eight tins in thirteen days for each child,[1] and from this we calculate the solid nourishment taken every twenty-four hours. As a general rule, nurses give the milk very much stronger than 1 to 11. I know of no instance in the circle of my personal acquaintance where so weak a milk is given, but I do know of several where children of six months were allowed as much as a tin a day. At this rate we need hardly wonder if medical men have sometimes had cause to find fault with its use."

Dr. Cheadle writes:[2] "The mistake commonly made in feeding young infants on condensed milk is that of making the solution too strong at first. The directions on the label state that for infants 7 to 14 parts of water are to be added. But this is far too concentrated for a child at birth or during the first month; at any rate, to begin with.

"I have found by experience that it is not safe to give it, at first, in early infancy, of greater strength than a dilution with 24 parts of water. This, of course, is far too weak—only about one-quarter the

[1] This does not apply to very young infants.

[2] *Artificial Feeding and Food Disorders of Infants*, pp. 58, 59.

strength of human milk—to give sufficient nutriment for long. It must, therefore, be steadily increased until the dilution of 1 in 10 or 1 in 7 is safely reached."

ANALYSES OF CONDENSED MILKS.[1]

Description.	Percentage of				
	Water.	Fat.	Cane and Milk Sugar.	Casein.	Ash.
Swiss	26·70	9·76	51·02	10·20	2·32
English	27·07	8·30	50·79	11·84	2·00
Pure Swiss Milk ...	62·20	10·21	14·89	10·29	2·41
Condensed ...	61·40	11·37	13·37	11·48	2·38
Pure Condensed ...	62·79	10·26	15·86	9·00	2·09
Alpine Milk ...	62·35	11·15	13·14	11·29	2·07

A sample of the preserved milk prepared by the Anglo-Swiss Milk Company furnished, on analysis, the following results:—[2]

	Per cent.
Water - - - - - - -	24·32
Sugar of milk - - - - - -	14·62
Cane sugar - - - - - -	37·18
Fat - - - - - - - -	9·87
Albuminous matter, including casein -	10·98
Mineral matter - - - - - -	2·62
	99·59

Containing 1·69 gr. of nitrogen.

It would appear that the thickness of Swiss milk in the tin is a sign of the milk having been kept

[1] *American Chemist*, 1889. [2] *Lancet*, August 29, 1868.

This I have proved by opening a tin of condensed milk which I had kept three years. The milk was a thick mass, like very thick paste, on opening the tin; but after well stirring, as indicated by the company, it became much smoother and nearly of an ordinary thinness, and on hot water being added made a perfectly sweet milk, although the taste was slightly different to the newer milk. If I may so describe it, the milk had a "cowy" taste, and it was also a little more yellow in colour before adding the water. If condensed milk on opening the tin has any distinct smell, such as a sour or fishy smell, the milk is not fit for use. The following letter was written to me by the Anglo-Swiss Milk Company respecting their condensed milk:—

"MADAM,—Replying to your favour of even date, we beg to say that all our stock of Swiss milk consists of milk newly condensed, and is therefore *more or less thin*. The tendency of condensed milk is to become thicker with age, as you would discover if you were to put aside one of the tins and open it in three or four months' time. It would then appear thicker and richer, but in either case the quantity would be the same. We enclose slips regarding thick and thin milk.

"Yours faithfully,

"P. Pr. Anglo-Swiss Cond. Milk Co., London,

"A. DE MEISS."

Regarding Thick and Thin Condensed Milk.

"Consumers purchasing condensed milk from time to time should not expect to always obtain it of uniform consistency.

"Condensed milk gradually thickens with age. This is a matter entirely beyond the control of the manufacturer.

"Whether condensed milk be newly made and appears thin, or has become thick with age, its quality in either case is precisely the same, provided the milk is sound.

"Milk of considerable age and quite thick may, for one reason, be preferred. Such milk, if still sweet, has withstood a test of its keeping quality; thus proof is established that it has been condensed properly, or that the quality of the milk has suffered no injury in the process of conserving it.

"In case such milk does not dissolve as readily as desired, stir it well before removing it from the tin, and you will be surprised to see how quickly it becomes thinner, and how easily it may then be dissolved. To dissolve the thickest condensed milk without the least inconvenience, first dilute it with a small quantity of water, taking about half as much water as you did milk; stir well together, then gradually add as much water as desired.—Anglo-Swiss Condensed Milk Co., Cham, Switzerland; Paris and New York; and Mark Lane, London."

5. *Cow's Milk with Bicarbonate of Soda.*—* "The preparation of milk and water with the addition of a little bicarbonate of soda, yields a flocculent curd, and might be suitable enough but for the objection to the continued daily ingestion of carbonate of soda. So that we may put that on one side. Like peptonised milk it is often useful for a time, but not suited for permanent feeding. These two may be put out of court at once as regular foods."[1] The following preparation of bicarbonate of soda I have found of service in aiding the digestion of ordinary cow's milk, in the case of an infant with feeble digestive powers, and unable at first to digest the curd with ease. The age at which it has been given was six weeks, and it was used for a month, after which time the stomach seemed to have gained greater power of digestion.

℞

Sodæ Bicarb.,	- - - -	ʒj.
Aq. Distillat.,	- - - -	ac ʒiij.

Mix.

30 drops in each bottle of the food.

6. *Boiled Cow's Milk.*—Sir William Roberts writes:[2] "Milk is consumed by us both cooked and uncooked indifferently; and experiment justifies this indifference, for I found on trial that the digestion of milk by pancreatic extract was not appreciably hastened by previously boiling the milk". According to recent research there are cogent reasons why *all cow's milk* intended for the use of children should be

* For article on *Cow's Milk with Citrate of Soda*, see Appendix A.

[1] Cheadle, *Artificial Feeding and Food Disorders of Infants*, p. 53.

[2] *Digestive Ferments*, p. 52.

boiled. "The fact," writes Dr. Cheadle,[1] "that boiled milk agrees better than fresh milk with children prone to diarrhœa has long been known. . . . The explanation lies partly, no doubt, in the fact that boiling arrests decomposition, which so quickly commences, and that thus development of the irritant products which excite intestinal action is arrested." People speak of boiled milk as being so unpalatable. This will not be found so if the milk is boiled right off over a *quick heat.* Milk is best boiled over a spirit lamp or gas stove. With a coal fire there is always the possibility of its tasting of the smoke or having a burnt flavour. A milk boiler[2] (brown earthenware) is the most suitable vessel to use for boiling milk. When boiled, milk should be poured into an earthenware pan, and be allowed to stand till quite cold.[3]

Earthenware Milk Boiler.

It is the drinking it half warm which makes boiled milk disagreeable to the taste. When milk is boiled it should be put at once in the larder or in a clean place, as milk is quickly infected by any bad odour (see p. 151).

[1] *Artificial Feeding and Food Disorders of Infants*, p. 49.

[2] Sold by the Atmospheric Churn Company, 119 New Bond Street, who sell also cream saucepans and marmites. (Not expensive. There are different sizes.)

[3] Take the scum off just before the milk is required for use, *not sooner*. Stir the milk, and strain it.

The doubt exists in some people's minds as to whether milk, when boiled and allowed to get cold, is not by the scum which forms, and which has to be taken off, deprived of a great deal of its nutritive properties. Those who have studied the question of boiled milk say that it is not. But the thick *leathery* scum rising can be prevented to a great extent, if not altogether, by well stirring the milk occasionally when put in the pan after boiling, till it is cold. It cools in about ten to twenty minutes. If this is done it will be found the milk will have hardly any scum. Mr. Mattieu Williams, F.C.S., in his lectures on the "Scientific Basis of Cookery," Society of Arts, 1884, says: "The loss of albumen as scum is very trivial;" and he urges the necessity of boiling milk. "The cookery of milk," Mr. Williams remarks, "is very simple. The only notable change which occurs is the coagulation of the small quantity of albumen it contains. This is shown by the scum formed on the surface of boiled milk. There is, however, a special reason why the milk supplied to London and other large towns from sources unknown should all be boiled before using it. There is now no further reason to doubt that certain disease germs or species of microbia that disseminate disease are nourished by milk, increase and multiply therein, and may thus be introduced into the blood and produce very serious consequences.

As these microbia are killed by subjecting them to a temperature of 212° (the boiling-point of milk is a little above this), there is little if any danger in milk that has been boiled."

In very hot weather if the vessel containing boiled milk is iced the milk will be more restored to its original flavour. A common practice is to boil milk by placing the milk, in a jug, in a saucepan of hot water on a coal fire. The impression is that it is equally well done as by boiling the milk in the saucepan, and less liable to taste burnt.[1] It is an error, however, as the following, from a discussion on Prof. Percy Frankland's paper on "Some of the Conditions affecting the Distribution of Micro-organisms in the Atmosphere" will show.

"One very important point had been raised by Dr. Carpenter with regard to the killing of organisms by boiling. There were various modes of boiling, and many things which were called boiling were not boiling at all. A scientific man understood by the term that condition of a liquid in which it was passing into a state of gas in such a rapid manner that it caused ebullition, and at the ordinary pressure of the air this took place at the temperature of 212°. If organisms were exposed to

[1] If the saucepan milk is boiled in is first *wetted with cold water*, the milk will not so readily burn. An enamelled saucepan is best to use, when milk is boiled over a coal fire.

this temperature in a moist condition, without exception, as far as they had been investigated, it was fatal to them if carried on for a period of half an hour. There was no reliable instance on record of any organism having endured that temperature for such a time without succumbing; as a matter of fact, a much less period was generally sufficient; but still, in order to be safe, it was better to continue the process for that time. It is frequently recommended that milk, water, and other liquids used for dietetic purposes, should for security's sake be subjected to boiling; but this should be carried out in a rational manner. Milk, for instance, must be really boiled, not, as was generally done, simply by putting it in a jug and placing the latter in a saucepan of boiling water, in which case the temperature of the milk would not approach that of boiling water. He had a case in his mind of a family affected with diphtheria, which was undoubtedly to be traced to the milk. The milk supplied was alleged to have been boiled; but when the matter was fully inquired into it was found that the cook had done it in the way he had just described. She had, however, the audacity to say that the milk in the jug entered into such a rapid state of ebullition that she had frequently seen it spurt from the jug into the fire. He need hardly say that anybody acquainted with the physical properties of

liquids would know that that was absolutely impossible."[1]

Dr. Klein, in a lecture delivered at the Royal Institution, May 27, 1887,[2] was very urgent in insisting on the necessity of *always boiling milk*, and considered boiled milk was perfectly safe for drinking, and as a possible conveyance of "the microbe of scarlet fever," or other infection, was rendered innocuous. Dr. Klein said: "Now the third question, as to the destruction of the contagium in the milk. This, I am glad to say, is very easily carried out. I have found that heating milk up to 85° C., or 185° F. (see p. 139)—that is, considerably under the boiling-point—is perfectly sufficient to completely destroy the vitality of the microbe of scarlet fever."

Dr. Klein added: "Considering the prominent position that milk occupies in every household with children, the possibility of infection with scarlet fever by raw milk deserves careful attention".

The following is from a letter from Edward Seaton, M.D., Lecturer on Public Health, St. Thomas's Hospital:—[3]

"A milk epidemic of scarlet fever has come under the observation of Dr. Russell, the eminent Medical Officer of Health for the city of Glasgow. He adduces evidence on the vital point (namely, the pos-

[1] *Society of Arts Journal*, April 1, 1887.
[2] *Times*, Saturday, May 28, 1887.
[3] *Ibid.*, June 6, 1888.

sibility of milk being infective—*quâ* scarlet fever—without human agency) which will be considered of the highest value, not only because it is that of a very able expert, but because of its entirely independent character." "Dr. Russell has proved," says the *Lancet*, in a leading article of the last number, " with sufficient certainty not only that the milk of a particular dairy was concerned in the causation of a large number of cases of scarlatina, but that a particular section of the milk supply—that received from certain cows—was responsible for the prevalence of this disease. While he was able to exclude the possibility that the milk had become infected by human beings employed in milking or in milk distribution, his attention was specially directed to some cows presenting appearances similar to those described as occurring in the Hendon cows."

On the question of milk scarlatina, Professor Brown says "that up to the end of the year ten different outbreaks of an eruptive disease on the teats of cows were found and investigated ".[1]

Professor Law, the chief of the Cattle Inspection Department in the United States, says of milk from diseased cows being a source of infection to human beings:[2] "Perhaps the most striking case is my experience, in a large public institution, where more

[1] *Times*, Monday, February 13, 1888.

[2] *New York Herald*, August 21, 1888.

than half the dairy cows were tuberculous, a much larger proportion of the human inmates were found to be the victims of this disease than in other similar institutions elsewhere;" and adds: "Milk brought from a greater distance, and which has passed through the process of boiling or condensation, is practically safe, as the germ is destroyed by the heat. It is the fresh milk, and, above all, the warm milk, that is dangerous."

The following relating to tuberculosis from the *Parliamentary Reports* is noteworthy.[1]

"Tuberculous milk was more dangerous than tuberculous meat, because the milk was often taken without being boiled."—Mr. Knowles.

"Consumption was increasing, especially among children; and he thought that it was not altogether extravagant to suppose that the cause of this increase of a tubercular disease was the milk which children drank from tubercular animals."—Dr. Farquharson.

"Children might consume tuberculous milk, and it was a significant fact that when tuberculosis in animals increased, consumption also increased amongst children. There was, in fact, every reason to believe that tuberculous milk was largely responsible for the spread of consumption."—Sir L. Playfair.

"The case of milk stood upon a different footing altogether. There did appear to be a general con-

[1] *Parliamentary Papers.* Eyre & Spottiswoode

sensus of opinion that the consumption of the milk of cows suffering from disease was highly deleterious, especially to children."—Mr. Chaplin, Minister for Agriculture.

"If we couple with the known infectiveness of the milk of tubercular cows the fact that 25 per cent. of all children dying under one year of age are killed by tuberculosis, we shall have additional and cogent reasons for the observance of the precaution which, after recent discoveries with regard to diphtheria, no prudent householder ought to neglect—the precaution, namely, of boiling all milk before it is suffered to be used as an article of food. It should be boiled as soon as it is delivered, suffered to boil for a minute or two, and then put aside to become cold before it is consumed. Where this is a matter of daily routine, exemption from many maladies may fairly be expected as a consequence; and no one who drinks raw milk has any right to wonder if he should become the subject either of tuberculosis or of diphtheria."[1]

A distinguished French medical savant, M. L. Landouzy, as the result of patient study in the Laennec Hospital, and with the authority of his position as professor in the Faculty, member of the Academy of Medicine, writes[2] on tuberculosis as the great cause of mortality among babies, that "to hereditary

[1] *Times*, Monday, November 24, 1890.
[2] *Revue de Médecine*, 1892.

tuberculosis must be assigned only a small portion of the tuberculosis which decimates babyhood". Prevention of tuberculosis in the early years Dr. Landouzy regards as a question of common hygiene, and adds: "Babies, in particular, should be carefully isolated from all chance of contagion".

Docteur Villemin, the great French specialist on tuberculosis, writing to me on the subject of unboiled *versus* boiled milk in relation to tuberculosis, says: "*Tout* le lait pour les enfants doit être bouilli".

"Cats, cows, and poultry are known to be susceptible of diphtheria, and to be capable of communicating it to mankind; cows especially, through the medium of the milk which they furnish when suffering from the malady, independently of dilution, or of infection derived from the persons engaged in the work of distribution. So far as this source of danger is concerned, it would appear to be absolutely under the control of the consumer. The diphtheria microbe holds its life by a precarious tenure, and is certainly unable to resist high temperature, so that the milk which contains it may be rendered innocuous by boiling. Hence, it is a matter of ordinary prudence that all milk should be thoroughly well boiled as soon as it is delivered, and if allowed to cool before it is used it will be found not to have suffered in flavour by the process."[1]

[1] "Diphtheria: its Natural History and Prevention." Being the Milroy Lectures delivered before the Royal College of

The power of infection from microbia in milk is now fully recognised; as regards *cream* it has apparently, however, been more or less overlooked.

As to the destruction of micro-organisms in cream, I received the following reply to a letter I sent to an eminent authority on the subject of bacteria:—

"*December* 21, 1887.

"MADAM,—In answer to your inquiry I beg to say that, though I have not yet made any actual experiments with cream, I think heating it up to 180° Fahrenheit, and keeping it at this temperature for ten minutes, will effectually sterilise cream; by this process its nutritive value will hereby not become impaired.

"Very truly yours,

"E. KLEIN."

I have found it best to boil cream in an *earthenware* (brown) *saucepan* over a spirit lamp. When the cream reaches the desired heat pour into a cup, which place in cold water, and stir the cream till it is cold, when little or no scum will form, and the "nutritive value" of the cream will remain unimpaired.

Earthenware Saucepan for boiling Cream.

Physicians of London, 1891. By R. Thorne Thorne, M.B. Lond., F.R.C.P. Lond., F.R.S., Assistant Medical Officer to her Majesty's Local Government Board, etc.

That illness can be caused by infected cream there is no doubt. "On June 9, 1875, a dinner party was given at a house in South Kensington, twelve guests sitting down to dinner with the host and the hostess, their eldest son and daughter. In the evening these sixteen persons, together with the other son and daughter, and some one hundred and fifty other guests, assembled in the drawing-rooms. On this day the seven servants of the house were reinforced by seven others. Between June 11 and 14 there fell ill of scarlatina, or sore throat, four out of the seven of the family who were in the house on June 9, three of the seven servants, six of the twelve dinner guests, four of the evening guests, one of the occasional servants, and a lady who came to lunch next day (the 10th). Ample and exhaustive inquiry into the antecedent circumstances of scarlatina in the district gave no clue to the outbreak. There was but little scarlatina in the neighbourhood, and, except for the meeting at this particular house, no common centre of infection, or other common local circumstance, to account in any degree for the disease attacking these particular persons. The *only* circumstance that afforded any explanation of the attacks was the *cream* supply, which came exceptionally from a London dairy. Of the family and dinner guests who were afterwards taken ill, all had partaken of *cream* in one form or another, while of those who

were not taken ill a majority had not used *cream* in any form."[1]

Mr. Mattieu Williams observes of butter:[2] "Butter may possibly convey these germs, and I think this subject worthy of further investigation than it has received". In an interesting address delivered at the Epidermological Society by the President, Dr. Thorne Thorne (November 9, 1887), on the Progress of Preventive Medicine during the Victorian Era, Dr. Thorne observed:[3] "Then came Dr. Ballard's discovery of the communication of typhoid through the agency of a milk supply; *frozen creams and ices* were found to act as vehicles of the infection; intermittent water-services led to its distribution; and the potency of the infection was found to be such that, even when present in potable water in quantities that were infinitesimal and altogether beyond the reach of discovery by chemistry or physics, it could, as in the Caterham epidemic, lead to widespread disaster".

Dr. Thorne continued: "The progress of our knowledge in the prevention of scarlet fever, diphtheria, phthisis, and cholera was considerable, and especial prominence was given to Mr. Power's recent

[1] *Reports of Medical Officers of Privy Council and Local Government Board*, 1876, vii., 72.

[2] *Scientific Basis of Cookery*, 1884.

[3] *Times*, Thursday, November 10, 1887.

researches as to the connection which existed between scarlet fever in man and a corresponding disease in milch cows. There was much reason to believe that we were on the verge of *important discoveries as to the dependence of disease in man on affections of the lower animals;* and that these might clear up many points of obscurity attaching to the origin of infection. In scarlet fever Dr. Klein had discovered a definite micro-organism common to man and the cow. Diphtheria was known to have certain relations to an allied animal disease, and many observers believed that *phthisis in man had concern with the use as food of the flesh and milk of tuberculous animals of the bovine tribe.*" [1]

That it is possible for animals to infect human beings with disease, who can now question?

"Last year Dr. Turner presented to the Local Government Board the results of investigations made by him on the relation between diphtheria in man and in the lower animals. These results prove its transmission from animals to man probable.

"In 1882, having found pigeons suffering from a disease in which the windpipe was covered with a membrane resembling that of croup, he communicated the same disease to other pigeons by inoculation with this membrane. Fowls were found suffering in

[1] See "Cause et Nature de la Tuberculose," Villemin, as to the transmissibility of this disease. Also "Le Lait des Vaches Phthisiques," Villemin.

the same manner, and diphtheria followed on the same farms.

"Since then other very surprising facts which have come under Dr. Turner's observation seem to establish a close connection between this ailment in fowls and diphtheria in human beings.

"Still further, chickens and pigs having been inoculated with diphtheritic virus were found to suffer from a disease in every point like that which might be termed 'fowl diphtheria'.

"Dr. Turner has seen swine and horses suffering from a disease similar to the above; but thus far nothing to justify the belief of its having been transmitted to man.

"Cats, however, in several parts of the country, and in a number of households, seem to have been a source of true diphtheria in man; and since attention has been called to it, fresh facts of the kind are now being reported. Genuine diphtheria is believed to have been communicated to cats by inoculation with diphtheritic matter.

"The *Lancet* believes that these facts may form a clue to the origin of those isolated attacks which cannot be attributed either to personal communication or to other ordinarily assigned causes.

"We hardly need suggest that, in view of the above, pet cats and kittens should be kept out of the sick-room of children affected with scarlet fever, and, we may add, with diphtheria also. Indeed, when

these epidemics are prevailing, children should be taught not to pet those of their neighbours."[1]

Sympathy with suffering is a noble emotion; but in the case of a sick animal it is dangerous for young infants, susceptible to every poison, to be near any animal, the emanations (breath, transpiration of skin, etc.) from which may perhaps be poisonous (see p. 126).

There is now no doubt existing in the minds of scientific men that animals can, and do, die of diseases closely allied to those affecting man, and capable of being given to him, as well as diseases not communicable to man.

"Man is liable to receive from the lower animals, and to communicate to them, certain diseases, as hydrophobia, variola, the glanders, etc. Monkeys are liable to many of the same non-contagious diseases as we are; thus Rengger,[2] who carefully observed for a long time the *Cebus Azaræ* in its native land, found it liable to catarrh, with the usual symptoms, and which when often recurrent led to consumption. These monkeys suffered also from apoplexy, inflammation of the bowels, and cataract in the eye. The younger ones when shedding their milk-teeth often died from fever."[3]

[1] *British Medical Journal.*

[2] *Naturgeschichte der Säugethiere von Paraguay*, 1830, s. 50.

[3] Darwin, *Descent of Man*, 2nd edit. (revised), p. 73.

7. *Fresh Cow's Milk.*—The degrees of dilution as given by authorities on infant feeding are very similar.

Dr. West says:[1] "The degree of dilution must vary according to the infant's age".

Dr. Cuibourt, of the French Academy of Medicine, remarks[2] that "cow's milk, with the addition of one-fifth of its weight of water and a little sugar, is as nearly as possible the same as woman's milk, and has, moreover, the advantage of being a well-known substance, easy to be administered".

The following letter is from the Director of one of the large hospitals in Paris as to the feeding with cow's milk of the young babies (in good health) there. When the amount of milk mentioned may be given is decided by the physician in charge. I have found the proportions 3 to 1 will usually agree at about the age of twelve months. The kind of "food," or the "diluent" used with the milk, and also if cream be added, will make a difference.

"HOSPICE DES ENFANTS ASSISTÉS,
"RUE DENFERT-ROCHEREAU, No. 74,
"PARIS, LE 7 *Fevrier*, 1890.

"MADAME,—J'ai l'honneur de vous faire connaître en réponse à votre lettre du 9 Janvier dernier, qu'on donne aux enfants de l'Hospice qui boivent au

[1] *Diseases of Infancy and Childhood*, p. 337.
[2] *Encycl. des Sciences Médicales.*

biberon trois quarts de lait de vache pour un quart d'eau chaude.

"2nd. On met environ *50 grammes* de sucre par litre de lait.

"3rd. On donne à boire aux enfants toutes les deux heures.

"Veuillez agréer, Madame, l'expression de mes sentiments distingués.

"LE DIRECTEUR."

Dr. Starr gives the following where milk is required for a new-born infant:—

"A little sound cow's milk, diluted with double its quantity of water,[1] and sweetened with sugar of milk,[2] may be given every fourth hour, the baby being put to the breast in the meanwhile. So soon as the flow begins, however, artificial feeding is to be discontinued."[3]

Writing of cow's milk and water with reference to the *newly-born*, Dr. Cheadle remarks:[4] "The child gets on very well, as far as nutrition is concerned,

[1] At a fortnight, with a robust infant, and when the agent used for the distribution of the curd is suitable, this does well for entire feeding. If given for only an occasional meal as Dr. Starr directs it does at birth.

[2] "Sweeten with half a teaspoonful of milk sugar" (*Dietetics of Infancy and Childhood*, p. 269).

[3] *Dietetics of Infancy and Childhood*, "Annual of Universal Medical Science," vol. iv., p. 243.

[4] *Artificial Feeding and Food Disorders of Infants*, p. 44.

for a short time with 16 to 24 ounces of this dilution—2 parts water to 1 of milk—if it digest it thoroughly;" and adds:[1] "The strength of the dilution may be cautiously increased till equal parts can be digested". The nature of the *diluent* used with the milk and water will be a large factor in the matter of digestion. With an ordinarily strong child as a rule at about two months, if the diluent used is right, "half milk and half water" will be borne. When giving an increase of cow's milk, it is best to begin with an additional teaspoonful or tablespoonful to the usual proportions of milk and water given to the child. A sudden large increase of cow's milk, as well as too early a one, is sure to cause sickness in the infant. If the child has hiccough, is restless and wakeful, or is sick after an increase of milk is made, leave off at once, and go back to the old proportions which have agreed for a little time longer. The quantity of cow's milk a child will bear is so much an individual matter that *no exact proportions for any given age* can be named. This—what proportion of cow's milk and water, and the age when to increase the milk—must be decided for each infant by whoever has the care of the child, and must necessarily be quite a matter of observation. The diluent to be used is best decided by the medical man, who will know the child's digestive

[1] *Artificial Feeding and Food Disorders of Infants*, p. 45.

powers. Dr. Cheadle says:[1] "Pure cow's milk[2] should never be given before the sixth month. The diluted cow's milk, with sugar added, at any rate, as soon as the sufficient strength of 2 parts milk and 1 water is reached, would seem to satisfy all the essential conditions." Dr. Cheadle adds:[3] "With a very young infant—under one month—it is not safe to begin with more than 1 to 3". Dr. Cheadle says[4] in some cases infants, "with even a dilution of 1 part of milk to 3 of water, are sick, bring up undigested curd, are griped and flatulent, constantly crying with pain and discomfort, are restless and enjoy little sleep, suffer from diarrhœa as well as from colic. If nothing be done, the vomiting and purging go on and increase, and may lead to a fatal issue. The child becomes pallid, lean and flabby, with wrinkled, loose-hanging skin, wastes away to a mere skeleton, and, if no change be made, dies eventually of inanition. A successful device in

[1] *Artificial Feeding and Food Disorders of Infants*, pp. 45, 46.

[2] "Cow's milk may often be given undiluted about the age of one year" (Angel Money, *Disease in Children*, second edition, p. 31).

When cow's milk is given to an infant *at an early age* undiluted, it seldom agrees unless given *immediately after being taken from the cow*. No doubt milk undergoes change when kept, and more especially when carried in a cart, which makes the curd indigestible to the very young, and to those with weak digestive powers. A cow, too, which gives *light* milk should be chosen.

[3] *Ibid.*, p. 43.

[4] *Ibid.*, p. 62.

many cases is to put the child upon what is called artificial human milk." Some infants have such weak digestion that even this preparation of milk (the curd in it being unchanged, see p. 160) will disagree. In this case it might be found that condensed milk and cream (see p. 98) would suit, or a trial might be made of peptonised milk till the child becomes stronger. "The child's stomach may be educated to the digestion of cow's milk by careful training and management. If the process is sufficiently gradual and cautious it is always successful in the end."[1]

Dr. Starr says:[2] "The object to be accomplished in the preparation of cow's milk is to make it resemble human milk as much as possible in chemical composition and physical properties. To do this it is necessary to reduce the proportion of casein, to increase the proportion of fat and sugar, and to overcome the tendency of the casein to coagulate into large firm masses upon entering the stomach. Dilution with water is all that need be done to reduce the amount of casein to the proper level; but, as this diminishes the already insufficient fat and sugar, it is essential to add these materials to the mixture of milk and water. Fat is best

[1] Cheadle, *Artificial Feeding and Food Disorders of Infants*, p. 70.

[2] *Dietetics of Infancy and Childhood*, "Annual of Medical Science," vol. iv., p. 262.

added in the form of cream, and of the sugars either pure white loaf sugar or sugar of milk may be used, though the latter is greatly preferable, as it is little apt to ferment, and contains some of the salts of milk, which are of nutritive value. The risk of firm clotting may be anticipated by the addition of an alkali, or a small quantity of some thickening substance, as barley water, gelatine, or one of the digestible prepared foods. Lime water is the alkali usually selected. It acts by partially neutralising the acid of the gastric juice, so that the casein is coagulated gradually and in small masses, or passes, in great part unchanged, into the intestine, to be there digested by the alkaline secretions."

Dr. Angel Money writes of adding only water to cow's milk in infant feeding:[1] "In my experience few sickly infants have the power of digesting the cow's curd with ease and comfort; simple watering does not prevent the compact clotting". Dr. Money advises *with all infants* the employment of something for the distribution of the curd when cow's milk is given, as this milk is apt to clot "as the result of the action of the gastric juice," unless some diluent be used, or "if not guarded by mucilaginous fluids, in putty-like or wet cheese-like masses".[2]

Cow's Milk.—"The water with which it is diluted for infant use should be boiled also. Its hardness,

[1] *Disease in Children*, second edition, p. 23. [2] *Ibid.*, p. 21.

where excessive, as in London water, for example, is thus reduced, and any active contagion it may contain is thus destroyed, while other organic impurities are rendered innocuous."[1]

Mr. Moss asked "if boiling water entirely destroys all pathogenic microbes".

M. Margon said "that if water was kept at 130° C. for ten minutes it was perfectly sterile, but that it was not sterile if kept at that temperature for five minutes".[2]

"Water containing sewage to any appreciable extent gives off a fœtid smell just before the boiling temperature, and may easily be detected in this way. The boiling temperature renders it safe from germs capable of communicating infectious disease, but it does not make it clean or wholesome."[3]

If water for drinking when boiled is put in an *earthenware* pan till cold, and is then filtered through *charcoal*, it will not have the flat insipid flavour accompanying boiled water.

Boiled Water.—"If it be filtered through charcoal it is 'aërated,' and assumes the refreshing taste of spring water."[4]

[1] Cheadle, *Artificial Feeding and Food Disorders of Infants*, p. 57.

[2] *Reports and Discussions of the Congress of Hygiene and Demography*, 1891, p. 147.

[3] C. A. Straton, medical officer, Wilton (*Medical Reports*).

[4] *Popular Educator*, vol. ii., p. 236.

"The charcoal (of filters) must be washed in Condy's Fluid to keep up the filtering action."[1]

Dr. Routh, in *Infant Feeding*, pages 327, 328, mentions cream as being of much service diluted with water in some instances in infant feeding. Dr. Routh says: "In many cases it is observed that there is a great quantity of acid produced in the stomach of the child, and the same effects result when it takes saccharine matters. It is in such instances that the mixture of one part of cream to three of water[2] proves often very beneficial. I have known," he goes on to say, "of a child reduced almost to a state of complete atrophy gradually recovering 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 calorifiant aliment. The addition of water diminishes the density, and makes the mixture more digestible. If to every

[1] Dr. Parkes's *Practical Hygiene*.

[2] Biedert gives for the newly-born feeble of digestion at birth—

Cream, 125 grammes.
Water (which has been *boiled*), 375.
Milk, sugar, 15.

—*Bull. de l'Acad. de Méd.*, 1890.

half-pint of this mixture 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 ensured, and both these last become more assimilable."

All medical men are against using "cream diluted with water" alone, for feeding *infants in good health.*

Dr. Edward Smith, F.R.S., in his *Practical Dietary*, pages 121 and 122, says: "Again, some infants are fed on cream and water, in the belief that they are thus offering a food richer than milk; but in so doing they fall into a grievous error, and the child rapidly pines away. The explanation is that the cream is composed entirely of fat, except the small quantity of milk which accompanies cream when skimmed off the milk; and fat by itself is totally inadequate to sustain life." Dr. Smith adds: "But much more to be reprehended is the plan of feeding an infant with sop, consisting of bread or biscuit with water and sugar, and with only a very small quantity, if any, of milk added;[1] for, as the foods other than milk and sugar are not digested, and as the quantity of milk is insufficient alone to support the infant, it follows that starvation, or some approach thereto, must occur. It has been already shown that milk contains casein or cheese in large quantity, with sugar, and numerous impor-

[1] I have seen biscuit powder *given with cream and water* to infants; but the result has not been satisfactory.

tant salts, besides the fat; and all these are necessary to nutrition and growth."

Want of a properly nourished appearance in a child indicates some mischief which should be inquired into by a medical man; and very often giving cream and fattening foods, etc., without proper advice only increases the evil, by not getting at the real cause, which, being cured, would soon produce a satisfactory result.

Dr. J. F. Meigs writes:[1] "A common symptom in children of a diet deficient in nutriment is diarrhœa. It assumes, when severe, the dysenteric type, streaks of blood appearing in the light green mucous evacuations."

In the case of continued diarrhœa, or blood appearing in the motions, medical aid should be summoned *without delay*, as it most clearly indicates a condition attended with grave danger.

When cream is given alone to an infant it is essential to see that it is *pure*—not the usual "London cream," as prepared cream would neutralise all the good likely to result from giving cream. Some recommend the use of Devonshire cream; but its use, if given, must be watched, as after a time, if not at first, it has a tendency to relax the bowels. With ordinary cream it appears to be the reverse. Dr. Chambers says of Devonshire cream:[2] "Devonshire

[1] *On Diet of Infants*, from the American medical weekly, "Mortality Statistics of the United States".

[2] *Manual of Diet in Health and Disease*, p. 338.

cream has been used as a substitute,[1] but I cannot say it has proved in my hands an efficient one. If taken in sufficiently large quantities to be of service, it is apt to exercise a purgative action."

Dr. Chavasse gives the following receipt for cream and milk, which he calls "the Cream and Milk Food":—[2]

Take of cream, from the milk of *one cow*, one large teaspoonful.
Fresh milk—the milk of *one cow*—eight tablespoonfuls.
Hot water, seven tablespoonfuls.
Pure raw (Demerara) sugar, one teaspoonful.
Table salt, a small pinch.
Mix.

Dr. Chavasse[3] gives three months as about the age at which this may be used. I have not given it at so early a period. During the eighteenth and twentieth months a child will perhaps flag and fail with its food. I have sometimes found at such a time the above recipe useful; adding, however, thereto 1 teaspoonful of Mellin's Food[4] (as a corrective to the curd), and giving this "Cream and Milk Food" only twice a day.[5] Other meals of an easily digested kind.

[1] For cod-liver oil.

[2] With many children this preparation of cream and milk will not agree, possibly owing to the lack of something with it for the distribution of the curd. See p. 138.

[3] *Counsel to a Mother*, p. 30.

[4] For Mellin's Food at an earlier age, see p. 204.

[5] See p. 201 for Dr. Starr's directions for giving "cream and milk" in combination with other food.

Dr. Chavasse writes:[1] "The cream and the raw sugar will make the food more aperient and more fattening".

"Children are fond of sugar, and make up with it where they fail in fat; and there is no evidence whatever that sugar is harmful when taken at proper times."[2]

"The moderate use of sugar in the food of children is of essential value, and should only be eliminated from the diet in cases of disease."[3]

Dr. Ellis writes:[4] "It is erroneous to consider sugar non-nutritive. Of its utility to children we have the strongest proof in the amount in which it is present in the mother's milk. Sugar is an element of food assisting to keep up the animal temperature, and its moderate use cannot be reasonably objected to. But if any symptom of disordered digestion present itself it may be desirable to remove it altogether, since no question can be entertained as to its ready capability of entering into a state of fermentation."

Dr. Strange observes:[5] "The action of sugar and its homologue starch is much the same as that of the oils. They are all heat-producers or savers, and therefore desirable in cold weather, and under much

[1] *Counsel to a Mother*, p. 30.

[2] Goodhart's *Diseases of Children*, second edition, p. 81.

[3] *Lancet.* [4] *Disease in Childhood*, pp. 157, 158.

[5] *Seven Sources of Health*, p. 121.

exposure, and for children and old people, both of whom require a large quantity of heat-making material."

The *Dict. Encycl. des Sciences Méd.*, Art. "Lait," 1868, gives the following preparation as the nearest possible approximation to human milk:—

	Parts.
Whole cow's milk - - - -	600
Cream - - - - - -	13
Sugar of milk - - - - -	15
Phosphate of lime - - - -	1½
Water - - - - - -	339½
	1000

Dr. Goodhart writes:[1] "One other food still requires mention, that which goes by the name of 'strippings'.[2] All infants digest cream with facility; the curd, on the other hand, is an obstacle with all. 'Strippings,' obtained by re-milking the cow after its usual supply is withdrawn, is rich in cream and

[1] *Diseases of Children*, p. 27.

[2] Assimilable proportions of this are:—

Strippings - - - -	f℥j. (1 fluid ounce).
Water - - - - -	f℥ij. (12 fluid ounces).

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

Strippings - - - -	f℥jss. (1½ fluid ounces).
Barley water - - - -	f℥jss. (1½ fluid ounces).

—*Dietetics of Infancy and Childhood*, by Louis Starr, M.D. Philadelphia, "Annual of Universal Medical Science," vol. iv p. 267.

poor in curd, and consequently has much to commend it as an infant's food."

With regard to strippings, I received the following from the Aylesbury Dairy Company :—

"LONDON, W., *May* 27, 1889.

"MADAM,—We beg to acknowledge the receipt of your letter of the 24th inst., and, in reply, to inform you it has long been a well-known fact that the first portions of milk drawn from the cow contain much less fat (cream) than the last portions, which are known as the 'strippings'. In every other respect, however, the composition is identical, and by the addition of cream to milk a mixture will be obtained which has all the properties of 'strippings,' and is of the same composition.

"We beg to remain, Madam,

"Your obedient servants,

"THE AYLESBURY DAIRY COMPANY, LIMITED."

When cream is used in infant diet great care should be taken to see that the can the cream is put in is perfectly clean. If cream is going to be given for a time, it is well to buy, or get the milkman to keep, special cans for the cream. Cream for infant use *should not be kept in an ordinary can,* but should as soon as possible be turned into a jar, or cup, which should be washed out each day with Condy's

Fluid and water, and be well rinsed before putting in the fresh cream.

"Milk," writes Dr. Chambers,[1] "is rendered unwholesome in the customer's own house by the vessels in which it is received not having been properly scoured out with soda. On stale milk, even in minute quantities, there very quickly germinates a blue mould, such as is seen often on cream cheese, and called *Oïdium lactis*. The mixture of this, adhering to the corners of the can, on the addition of fresh milk, causes it to turn sour and to give rise to colic and diarrhœa, and possibly also to thrush, in children, for the crust which forms in the mouth is a not dissimilar form of mould."

Referring to "the presence of large curds in the intestines" as causing "in the first few months of infancy the simple form of diarrhœa," Dr. Angel Money writes:[2] "To prevent the formation of these lumps isinglass will effect the purpose". Dr. Money gives as the quantity to be used,—"a teaspoonful or more of the jelly according to the quantity of the meal".[3] For quantity of isinglass, see p. 150.

Dr. Ellis is of opinion that gelatine is a useful addition to cow's milk for delicate infants. "Gelatine," writes Dr. Ellis,[4] "forms a very large portion of the tissues of all young animals. Its ordinary

[1] *Manual of Diet in Health and Disease*, p. 57.
[2] *Disease in Children*, second edition, p. 55.
[3] *Ibid.*, p. 23. [4] *Disease in Childhood*, p. 142.

source from the foot of the calf is an illustration of its abundance in the young. In order that the due supply of this material may be kept up in the system of an infant, some of the albuminous matter which it receives in the milk must be decomposed to repair the waste of the gelatinous tissues. If, therefore, gelatine is given to a child it goes directly to the supply of the gelatiniferous tissues, and there is, therefore, the less need for any appropriation of the albumen of the milk; and, as this implies a double loss, first of vital force in the decomposition, and next of nutrient material which might have gone to feed other structures, it is plain that the addition of gelatine to a child's food when its digestive powers are feeble, or the child weakly and delicate, is a positive gain." Dr. Ellis further remarks: "I am disposed to consider the use of gelatine as not only wholly unobjectionable in the case of delicate or weakly children of this age,[1] but as absolutely serviceable in a remarkable manner. Gelatine, which includes jellies made of isinglass, calf's foot, or the dried gelatine of the shops, does not require digestion at all; it passes unaltered into the blood, when taken into the stomach as food in a liquid state, and requires no expenditure of digestive power in its preparation, and no exercise of vital activity for its absorption. It is, therefore, plainly a most bland and unirritating kind of food." Dr. Ellis adds:[2] "The best way of

[1] Infants. [2] *Disease in Childhood*, p. 143.

giving gelatine to an infant is by adding it in small proportions to the warm and sweetened milk and water of the ordinary meal. It is most conveniently kept in the form of a jelly, made either from isinglass, prepared gelatine, or calf's foot, one or two teaspoonfuls of which may be easily melted and added to the meal."

After recording the researches of several scientific men to see if gelatine could be used entirely as a nutriment, and the failure of their efforts, Dr. Edward Smith, F.R.S., says:[1] "My own experiments have proved that gelatine, like albumen, is transformed within the system and leaves the body as urea, and hence it must have played its part in nutrition; but whether its nutritive value is quite equal to that of albumen is another question. I believe gelatine to be a valuable food." "Gelatine," Dr. Edward Smith continues,[2] "is found in its most pure form in isinglass and in dried gelatine; the former derived from the sturgeon, and the latter from various parts of animals." Bischoff and Voit are of opinion that gelatine presents to some extent a substitute for other plastic matter; and Dr. Letheby, in his important lectures on food,[3] says: "Possibly it may serve in the direct nutrition of gelatinous tissue". "Dr. Carpenter says of gelatine that it can take the place of part of the nitrogenous substances

[1] *Practical Dietary*, p. 88. [2] *Ibid.*, pp. 87, 88.
[3] See Letheby on *Food*, p. 173.

which are being oxidised in the blood. That hygienist rightly dwells on the importance which this gives it as a food for invalids, obviating the waste of tissue in respect of which their inability to digest ordinary meals leaves them no other mode of prevention. . . . But I may at once remark, in respect of using jellies as foods, that the enormous difference between the quantity apparently taken in and the real amount of aliment must not be overlooked in computing nutritive results."[1]

Isinglass is said to be better for weakly infants by some authorities on infant dietetics than what is called gelatine. "Gelatine never agrees with the delicate stomach of an invalid, like isinglass; and therefore it is often important to discover the difference."[2] In the case of a delicate or invalid baby this should be noted; with an ordinarily strong baby gelatine agrees perfectly.

Dr. Starr's receipt (which I have always used) is: "Put a piece of plate gelatine into half a tumblerful of cold water, and let it stand for three hours; then turn the whole into a teacup, place this in a saucepan half full of water, and boil until the gelatine is dissolved. When cold, this forms a jelly; from one to two teaspoonfuls[3] may be added to each

[1] Thomas Twining, *Food and Nutrition*, p. 29.

[2] Letheby on *Food*, pp. 173, 236.

[3] One teaspoonful to the four-ounce bottle. Two teaspoonfuls to the eight-ounce bottle usually answer.

bottle of milk-food."[1] "Employed to prevent the formation of large compact curds."[2] Of the various kinds of gelatine sold in England, I have found the thin flaky variety the most suitable. Of this *it is necessary to use a square piece.* I have found a spirit lamp best for dissolving the gelatine. Gelatine jelly should not be kept in any place which is at all contaminated. "Gelatine is a favourite nutriment of morbific bacilli."[3] Nurses are sometimes not as careful as they should be in keeping infants' milk, cream, left food, in nurseries. A case of poisoning by custard, investigated by Dr. Victor C. Vaughan, U.S.A., illustrates the danger of keeping articles intended for food in an impure place. "The custard made from the milk was divided into two portions, one flavoured with lemon, the other with vanilla. The lemon was harmless, while a teaspoonful of the other caused vomiting and purging. It was proved that the vanilla was not the poisonous agent. The explanation of the difference was found in the fact that the vanilla custard stood for two hours in a very filthy room, with the air in a most polluted condition, while the lemon had not done so."[4]

[1] *Dietetics of Infancy and Childhood*, "Annual of Universal Medical Science," vol. iv., p. 263.

[2] *Hygiene of the Nursery*, second edition, p. 232.

[3] *Transactions* of the International Congress of Hygiene and Demography, 1891. (Paper read by Dr. Ballard, F.R.S.)

[4] *Ibid.*

To prepare isinglass jelly, Dr. Chambers directs:[1] "Boil an ounce of isinglass in a quart of water down to a pint. Strain hot through a flannel bag." It is necessary to remove as well the scum which rises to the top of isinglass in boiling. Francatelli says:[2] "First wash the isinglass in cold water, to free it from the dust that is apt to gather about it; then put it into a stewpan, and to every 2 ounces add half a pint of spring-water and about 1 ounce of sugar; stir this on the stove fire till it boils, then throw in the juice of half a lemon,[3] and set the stewpan by the side of the stove to continue gently boiling for about ten minutes, in order to dissolve the shreds of isinglass, and that it may thereby throw up all the scum, which should be removed as it rises to the surface; the isinglass may then be strained through a napkin into a basin and used for the required purpose." "Isinglass," Francatelli adds,[4] "may also be clarified by adding a very small quantity[5] of whipped white of egg after it has been dissolved in water as directed above, and then allowed to cool previously to mixing in the white of egg; it must then be allowed to boil gently by the side of the stove-fire, and when perfectly cleared of all the scum should be strained through a napkin."

[1] *Manual of Diet*, p. 273. [2] Francatelli, *Modern Cook*, p. 459.

[3] Lemon would, of course, be out of the question for infants' use, but white of egg is harmless, and may be used instead.

[4] *Modern Cook*, p. 460. [5] The white of one egg.

"The best isinglass is brought from Russia; some of an inferior kind is brought from North and South America and the East Indies; the several varieties may be had from the wholesale dealers in isinglass in London. In choosing isinglass for domestic use, select that which is whitest, has no unpleasant odour, and which dissolves most readily in water. The inferior kinds are used for fining beer and similar purposes. Isinglass is much adulterated; to test its purity, take a few threads of the substance, drop some into boiling water, some into cold water, and some into vinegar. In the boiling water the isinglass will dissolve, in cold water it will become white and 'cloudy,' and in vinegar it will swell and become jelly-like. If the isinglass is adulterated with gelatine, that is to say, the common sort of gelatine (for isinglass is classed amongst gelatines, of all which varieties it is the very purest and best), in boiling water the gelatine will not so completely dissolve as the isinglass, in cold water it becomes clear and jelly-like, and in vinegar it will harden."[1]

Artificial Human Milk has lately been much used for the early feeding of infants and delicate babies. I have made an extended trial, and can speak favourably of it. The artificial milk has three advantages, in my idea, to recommend it:—

[1] Mrs. Beeton's *Household Management*, p. 731.

1. Cheapness—which places it within the reach of people of limited means. It costs only the price of the ordinary milk, with the exception of the rennet, which I found came to about 1s. a week. If lime water is used as well (see p. 157) about 10d. extra. If sugar of milk is used it will cost about 6d. more.

2. Its digestibility in most cases (see p. 161). (It needs no medical direction for giving—any one may try it.)

3. The being able to prepare it easily. A spirit lamp and ordinary saucepan are all that is necessary, and a cullender. I have used prepared rennet in preference to the butcher's rennet, which is difficult to get at some seasons of the year and in some places. Another objection is its tendency to become very quickly unfit for use in hot weather. *I have found Harvey's Cornish rennet the best.* It may be had direct from the maker, J. S. Harvey, chemist, 11 Market Jew Terrace, Penzance, Cornwall; or from J. Allden, chemist, 156 Cornwall Road, South Kensington, London. It takes a teaspoonful of Harvey's rennet to rennet the quantity of milk named in Dr. Frankland's receipt. Another rennet is sold by S. G. Clements, Lewin Mead, Bristol, called "Bristol Prime Rennet". Another preparation of rennet is Walden's extract of rennet, sold by R. W. Walden, chemist, 65 Elizabeth Street, Eaton Square, London, S.W. *The milk is fit for use when made, and*

needs no addition of water.[1] In reheating the milk for the child's use it is best to warm the quantity, when required, in a cup placed in hot water in a saucepan over a spirit lamp.

Dr. Bannister writes of rennet:[2] "The effect of the addition of rennet to milk is to make the casein, which really is not in solution in the milk, apparently insoluble. The coagulation thus taking place when the milk is sound and good enables the operator to have the curd under complete control, and it has been already pointed out that the quantity of rennet added limits the intensity of such separation.

"The separator used from time immemorial has been the fourth stomach of the young calf, which, under the name of rennet is a well-known article of commerce. The calf whose stomach is most active for the purpose is one which has had no other food than milk. The stomach must be carefully cured

[1] This is not a hard-and-fast rule. Some infants might require the addition of a little water (see Eustace Smith's directions, p. 158). The *British Medical Journal* recommends instead of putting water, for a child with feeble digestive powers, at first to remove the curd from one-half the milk instead of from one-third. In the latter the writer remarks (the curd removed from one-third of the milk) "the proportion of proteid is 3·6 per cent., or nearly equal to that of human milk". "Normal breast milk has a specific gravity of 1·031" (Starr, *Hygiene of the Nursery*, second edition, p. 169).

[2] *Our Milk, Butter, and Cheese Supply*, by Richard Bannister, F.I.C., F.C.S.

and preserved, and, without fully recording the methods of curing in use, it is essential that it be kept sound and free from all other taints except its own."

Professor Frankland's Receipt for Artificial Human Milk.

Allow one-third of a pint (20 fluid ounces go to 1 pint) of new milk to stand for twelve hours, remove the cream, and add it to two-thirds of a pint of new milk as fresh from the cow as possible.

Into the one-third of a pint of blue milk (left after the removal of the cream) put a piece of rennet about one inch square. Set the vessel (a small basin or breakfast-cup may be used) into hot water (the *milk* must not be allowed to get *hot*, or the activity of the rennet will be impaired) until the milk is fully curdled (which takes from ten minutes to half an hour or so, according to the activity of the rennet, which should be removed as soon as the curdling commences, and put into an egg-cup *without* any washing—for use on subsequent occasions, as it may be employed daily for a month or so. A piece of cotton must be drawn through the rennet, by means of which it may be readily introduced into, or removed from, the milk).

Now break up the curd repeatedly with a dessert-spoon, and carefully separate the whole of the

whey, ladling and pouring it into a small tin saucepan.

When the curd seems to have had all the whey extracted, the whey must be rapidly heated to *boiling*, over a spirit lamp.

During this process of heating a further quantity of casein separates, and must be removed by straining the whey through muslin.

Now dissolve 110 grains of powdered milk sugar in the hot whey, and mix it with two-thirds of a pint of new milk, to which the cream had been added, and the food is complete.

The artificial human milk should be used within twelve hours of its preparation.

If the milk thus prepared should be too rich for any individual infant, a fourth part (or less) of lime water may be added to each meal.

I have found it difficult to keep the artificial human milk in very hot weather for any length of time, unless the milk has been boiled up after being prepared. The following letter is from Professor Frankland on the subject. With the infants I tried the *artificial milk* it appeared to be equally well digested when boiled after being prepared, as when made *exactly* according to the receipt.

"*November* 25, 1890.

"DEAR MADAM,—The artificial human milk ought to keep for twelve hours. I have had no

experience with boiling the whole of it, and possibly the milk might not then be so digestible. At the same time the risks attending unboiled milk are so considerable that I should advise you to try.

"There can be no objection to renneting one-half of the milk; indeed, with a newly-born infant I should deem it desirable, and then gradually decrease until you arrive at pure milk. Up to the age of four or five months, the quantity of unrenneted milk ought not to exceed two-thirds.

"The prepared milk should be kept as cool as possible until used. Do not keep it in the nursery.

"I am, dear Madam,

"Yours very truly,

"E. FRANKLAND."

Dr. Eustace Smith recommends the following: "A useful addition to the breast milk, where an addition is required during the first few weeks of life, is a mixture of cream with diluted whey; one tablespoonful of fresh cream is added to two of whey, and the mixture is diluted with two tablespoonfuls of hot water. This mixture may be given from the feeding-bottle every three or four hours. The whey should be made fresh in the house, as required, by adding prepared rennet to new cow's milk, in the proportion of a teaspoonful to a pint of milk, after

which the curd is removed by straining through muslin."[1] Artificial human milk has only been of recent use in the hand rearing of children. There is, however, mention in the British Pharmacopœia, as long ago as 1857,[2] of artificial ass's milk, but the receipt is hardly likely to commend itself to English people. To French people, who are accustomed to the use of snails as an article of food, the receipt might not be so repugnant.

Artificial Ass's Milk.

℞	Snails from a vineyard - - - -	No. 6.
	Hartshorn shavings - - - -	ʒiii.
	Pearl barley - - - - - -	ʒiii.
	Distilled water - - - - -	2 lbs.

Boil to make 1 lb. of strained decoction, and add syrup of maidenhair, ʒi.

Mix.

The following analysis I had made[3] of the humanised or artificial human milk, as made by myself at home with Harvey's rennet (see p. 154).

"The sample," write Allen & Hanburys, "had the usual physical characteristics of milk. Examined microscopically, the sample was found to be free from clotted masses and misshapen globules. Examined chemically, it gave the following results:—

[1] *British Medical Journal.* [2] Redwood.

[3] By Messrs. Allen & Hanburys, 7 Vere Street, Cavendish Square, London, W.

"*Analysis of Humanised Milk made according to Dr. Frankland's Recipe.*

Reaction - - - -	Feebly acidulous.[1]	
Specific gravity - - -	1034	
Cream layer, on standing -	8·53 per cent.	
Total solids - - -	15·25	„
„ fat - - - -	2·45	„
„ proteids - - -	4·75	„
„ sugar - - -	5·05	„
„ ash, soluble ·15	·22	„
„ „ insoluble ·07		
„ extractives - -	2·78	„

"The ash contained lime, soda, and potash as bases in union with phosphoric, hydrochloric, sulphuric, and carbonic acids."

Dr. Cheadle says[2] of artificial human milk that it "will contain all the lactine, all the cream, but only half the quantity of casein. It will thus be nearer in composition to human milk than cow's milk, but somewhat short, of course, of proteid element. But it is not absolutely identical with human milk; the proportion of proteid is not the same, and, what is of more importance, the curd is unchanged in nature. It is still, as ascertained by experiment, coarsely coagulable cow's milk curd. The fat and lactine are in larger proportion than in human milk.

[1] "This is entirely corrected by the addition of lime water, of which there was none in the sample of milk sent for analysis, as Professor Frankland does not mention it in his recipe, unless the milk is found too rich." (See receipt, p. 156, for quantity necessary.)

[2] *Artificial Feeding and Food Disorders of Infants*, p. 62.

This is probably an advantage, and some children who are able to digest only a limited amount of cow's casein do remarkably well on it. Those who are quite intolerant of this casein cannot take even this dilute mixture."

Wine whey should be given under medical direction.

Dr. Angel Money writes:[1] "It is a valuable food and stimulant in infants".

Dr. Routh observes:[2] "Wine whey should not be given extensively, and as a substitute for the ordinary milk food supplied. One meal in the twenty-four hours of this wine whey will suffice, and the quantity given at a time should not exceed one wineglass." Dr. Routh adds: "Wine whey is made by pouring a wineglassful of good sherry or port into three wineglassfuls of boiling milk".

Dr. Routh gives another receipt for wine whey: "Boil three wineglasses of milk, and add a wineglass of sherry or port wine. Strain, and add a wineglass of warm water; a wineglassful of this may be given once or twice a day."[3]

Dr. Chambers says of whey:[4] "All wheys are sudorific and nutritive."

Milk with Tea.—Dr. Routh writes:[5] "There is a

[1] *Disease in Children*, second edition, p. 34.

[2] *Infant Feeding*, p. 435. [3] *Ibid.*, p. 512.

[4] *Manual of Diet in Health and Disease*, p. 258.

[5] *Infant Feeding*, p. 392.

vegetable compound in use among the inhabitants of these islands which has some advantages even when given to children, and that is *tea;* and what is remarkable is its close resemblance to juice of flesh. The equivalent of tea as a nutritive substance is very high, considerably higher than the best cereal grain. The exhausted leaves after tea is made contain also from 12 to 14 per cent. of casein. In juice of flesh we have creatine and creatinin present—two animal compounds which, according to Liebig, closely resemble the active principle of tea—*theine*. The richness of tea in albumen, fibrine, and probably casein, is also remarkable. The large quantity of potash and phosphoric acid likewise is worthy of note."

"Now and then," Dr. Routh adds,[1] speaking of infants artificially reared, "not only is diarrhœa present, and intense debility, but the stomach is very irritable; no kind of food can be kept down, particularly milk—not even wine whey; and those substances perhaps, which have hitherto best agreed with the child, cannot now be borne. The aliments to be given in these cases are two: *good black tea,* mixed with milk, which last should be given only in sparing quantities, and raw meat." Dr. Routh further remarks: "Tea comes to resemble very closely beef tea, and as such may be looked upon as a very good substitute. While it dilutes the milk, which in the cases

[1] *Infant Feeding*, p. 455.

we are now considering appears to be too rich for children, it facilitates the digestion of the smaller quantity of milk now given, and itself sustains the strength of the little child, retarding the waste of the body. The small quantity of sulphate of copper which it contains seems to act as an astringent, and, as it often does in the adult after an attack of sea-sickness, it allays the nausea also.

The following case, stated succinctly, is an example of this kind. "A little girl, aged about one year, of delicate constitution, hearty nevertheless, and who from the age of four months had been brought up by hand—on milk and water at first; subsequently milk only, corrected by lime water and sugar of milk—was suddenly seized with vomiting: the moment it took its milk, of which it always partook with its usual avidity, it became sick. Diarrhœa also supervened, the motions passed were unchanged food, the child became weak and emaciated and appeared to be losing flesh every day. My colleague Dr. Savage, being called into consultation, recommended that pure milk should be discontinued, and from two to three parts of weakish infusion of black tea to one of milk should be given to it. No other treatment was ordered, but this sufficed to restore the functions to their normal condition. In this case the child was not bilious, and the milk was exceedingly good. The simple fact was, it could no longer digest pure milk."

Dr. Edward Smith, F.R.S., writes:[1] "The essential action of tea is to promote all vital actions, and to increase the action of the skin".

Sir Erasmus Wilson, F.R.S., observes:[2] "Tea, then, must be regarded simply as a chemical agent, having a specific purpose, that of neutralising the acid of the stomach". "Infusions of tea . . . should be made with boiling water, but they should never afterwards be boiled, for the aromatic principle is very volatile and would be thus lost; besides which a decoction of tea . . . is disagreeably bitter on account of the solution of the coarse forms of extractive matter."[3]

In the preparation of tea it makes a great difference, using a china or earthenware teapot. Who does not know the seaside lodging-house Britannia metal teapot? And the tea, made with half-boiling water, and tasting as if a bit of soda had by mistake found its way into the teapot? The use of a copper kettle in boiling water for making tea is of doubtful advantage. *All copper vessels, unless carefully looked after, and kept well cleaned and properly tinned inside, are dangerous.*

Tea, when made, should be of a dark, amber-brown colour, *not black*. The reason tea is generally

[1] *On the Use of Tea in the Healthy System.*

[2] *Dyspepsia and its Treatment.*

[3] Letheby on *Food*, p. 89.

so rough in flavour is, there is either too much tea used, or it is kept by the fire too long, thus becoming a complete decoction instead of a soft, agreeable-tasting drink. The old adage says: "Of tea take one teaspoonful for self, and one for the teapot".

"The Royal poet of China, the late Emperor Kien-Long, composed an ode eulogising tea. He first describes the mode of drawing tea, which, when divested of his peculiar and methodical phraseology, is just the same as our own. 'On a slow fire,' he says, 'set a tripod whose colour and texture show its long use. Fill it with clear snow-water. Boil it as long as would be sufficient to turn fish white and crayfish red. Throw it upon the delicate leaves of choice tea. Let it remain as long as the vapour rises in a cloud and leaves only a thin mist floating on the surface. At your ease drink this precious liquor, which will chase away the five causes of sorrow. We can taste and feel, but not describe, the state of repose produced by a liquor thus prepared.' Tea, indeed, is a beverage the use of which is quite consistent with the temperance of the Chinese character."[1]

"*Black China tea* is considered by all medical authorities to be the best for health."[2]

[1] Michael Donovan, M.R.I.A., Professor of Chemistry, *Cabinet Cyclopædia*, p. 64.

[2] *Lancet.*

It is not advisable to use tea in infant feeding except in a similar case to that mentioned by Dr. Routh, and it should be discontinued as soon as may be.

Dr. Anstie writes:[1] "A kind of chronic narcotism, the very existence of which is usually ignored, but which is in truth well marked and easy to identify, is that occasioned by habitual excess in tea and coffee. There are many points of difference in the action of these two substances, taken in poisonous excess; but one common feature is very constant, *viz.*, the production of muscular tremor. . . . The paralysing influence of narcotic doses of tea is further displayed by the production of a particularly obstinate kind of dyspepsia, while coffee disorders the action of the heart to a distressing degree." Dr. Anstie adds:[2] "I believe that a very much larger amount of illness is caused by intemperate indulgence in these narcotics than is commonly supposed". The immoderate use of the most harmless things will cause ill effects. Some take tea in inordinate quantities; for instance, we read that Dr. Samuel Johnson would drink as many as twenty cups of tea in an evening. Mrs. Piozzi relates that she "sometimes sat and made tea for him until four o'clock in the morning"; and Dr. Johnson describes himself as "a hardened and shameless tea-drinker, who has for many years diluted his meals

[1] *Stimulants and Narcotics*, pp. 249, 250. [2] *Ibid.*, p. 250.

with only the infusion of this fascinating plant: whose kettle has scarcely time to cool: who with tea amuses the evening, with tea solaces the midnight, and with tea welcomes the morning". This last phrase was thus parodied by Tyers: "Te veniente die—te decedente".[1]

Sterilised Milk.—Speaking of the use of this milk Dr. Victor C. Vaughan, U.S.A., in his paper[2] on "The Infection of Meat and Milk," says: "The infection of milk is one of the most serious questions which can interest the student in public health, as it constitutes one of the most important factors in the causation of infantile mortality. . . . Recognition of this factor in infantile diarrhœa has led to the use of sterilised milk; and though a lessened death-rate has followed, the total result is disappointing." Dr. Vaughan adds the failure is due to the following reasons:—

"1st. The process is difficult, and as often attempted is not accomplished. 2nd. Even when efficient there is no evidence that the chemical poison is destroyed. 3rd. The food is often reinfected in the alimentary canal of the child."

Dr. Vaughan further adds:[3] "It would be best if milk which had never been infected could be ob-

[1] Croker's *Johnson*, 8vo edition, p. 105.

[2] Read at the International Congress of Hygiene and Demography, 1891. See *Transactions* of the Congress.

[3] *Transactions* of the Congress.

tained. I am also satisfied that in the feeding of a child suffering from summer diarrhœa it is better to wholly withhold milk for some days, than to give sterilised milk, because the latter immediately becomes reinfected in the stomach and intestines."

Dr. Deshayes, of Rouen, writes to me of the use of sterilised milk in the case of the newly-born thus:—

"Par suite d'impossibilités maternelles, il faut parfois donner à l'enfant du lait de vache. Celui-ci devre être *sterilisé*, *pasteurisé*. Si on soumet le lait (lait de vache ou de chèvre) à une température prolongée supérieure à + 70° ce liquide perd son goût agréable, ce qui est dû à une altération de la caseine; ces inconvénients sont evités à l'aide de la *pasteurisation*, qui consiste à eléver rapidement le lait à une température un peu inférieure à + 70° à continuer pendant 25 à 35 minutes, puis à le refroidir rapidement et à la maintenir à + 10° ou 12°. De cette façon nous eviterons à coup sûr la *diarrhée verte*."

Professor Budin says, after experience in Paris since 1892, with whole milk *sterilised*, that milk dyspepsia and rickets are unknown amongst the infants he treats. The difficulty, however, with this method is of course with those who cannot be trusted to always efficiently sterilise the milk. Professor Budin is very careful as to the age and condition of health of each child so treated and under his care, and he variously prescribes dilution with lime water, barley water, or other diluents.

Milch Mares at the river side (near Oranbourg, Russia).

Section II.

OTHER ANIMAL MILKS.

Koumiss (*Fermented Mare's Milk*) "is an alcoholic drink made by the fermentation of milk; it is prepared by the nomad population of Asia (especially by the Tartars) from the milk of the mare and that of the camel".[1] A substitute for koumiss made of mare's milk is prepared from cow's milk, and is sold in this country under the same name, and can be procured at most of the well-known dairies. As koumiss is a preparation essentially of the nature of a medical remedy, a doctor should be consulted before using it.

Dr. Carrick writes to me from Russia that with infants "koumiss or fermented mare's milk is occasionally, and with success, resorted to in dysentery and dyspepsia".

ANALYSIS OF KOUMISS.[2]

	Mean of ten Analyses. König.	Koumiss from Mare's Milk. W. Fleischmann.	Koumiss from Cow's Milk. W. Fleischmann.	Koumiss 48 hours old. J. A. Wanklyn.
Water	87·88	91·53	88·93	87·32
Milk sugar ...	3·76	1·25	3·11 }	6·60
Lactic acid ...	1·06	1·01	79 }	
Casein	2·83	1·91	2·03	2·84
Milk fat	·94	1·27	·85	·68
Alcohol	1·59	1·85	2·65	1·00
Carbonic acid ...	·88	·88	1·03	·90
Ash	1·07	·29	·44	·66

In the koumiss from cow's milk, Fleischmann separated ·166 per cent. of glycerine.

[1] Wynter Blyth, *Foods*, p. 295.

[2] *Ibid.*

Mare's Milk is said to be nearest to human milk in the digestibility of its curd. "S'il était facile de s'en procurer, le lait de jument serait, de tous, le meilleur succédané du lait de femme; il en a, à tres peu de chose prés, la composition, et un médecin russe, M. Berling, qui l'a essayé, lui a reconnu toutes les qualités nécessaires pour l'allaitement des nouveau-nés." [1]

Dr. Carrick, in his letter to me as to the use of mare's milk for infants in Russia, remarks: "Children or infants are never placed direct to the mare in Russia that I know of—not even among the nomad Khirghiz". Dr. Carrick says that mare's milk should be given "warm and direct from the mare, and boiled for the night"; and adds: "The experiment of rearing infants on mare's milk exclusively was made about twenty years ago by Dr. Berling, of the St. Petersburg Foundling Hospital, at Tsarskoe Selo, and gave very good results. The experiment was too expensive to be continued, however." An eminent traveller who has lived long in Asia informs me that "mare's milk is sometimes used with infants when from any cause they cannot have the mother's milk. It is given *immediately* after being taken from the mare by the women."

Milk.	Water.	Sugar.	Butter.	Cheese.	Salts.
Human -	89	43	24	33	1·7
Mare's -	90	67	90	19·2	4·0 [2]

[1] "Clinique des nouveau-nés, l'Athrepsie," *Bulletin de Thérapeutique.*

[2] *Medical Press and Circular*, Feb. 3, 1875.

Woman milking Mare (Asia).

Ass's Milk is by French medical men considered a good milk to bring up weakly infants on, being light and easy of digestion; and when an infant is very feeble, or when the stomach is delicate and does not retain food easily, it is often found of great service for a time. Continued, however, as a sole nourishment in some cases in England (perhaps from the mode of giving the milk, the kind of ass, or the feeding of it) the result has not been satisfactory. Some authorities consider ass's milk too poor in casein and butter, and as having in it too much sugar and salt to be perfectly suitable as a milk for vigorous infants.

Dr. Frankland thus writes:[1] "The rearing of infants who cannot be supplied with their natural food is notoriously difficult and uncertain, owing chiefly to the great difference in the chemical composition of human milk and cow's milk. The latter is much richer in casein and poorer in milk sugar than the former; whilst ass's milk, which is sometimes used for feeding infants, is too poor in casein and butter, although the proportion of sugar is nearly the same as in human milk. The relations of the three kinds of milk to each other are clearly seen from the following analytical numbers, which express the percentage amounts of the different constituents:—

[1] *Experimental Researches in Chemistry*, p. 843.

	Woman.	Ass.	Cow.
Casein - - - -	2·7	1·7	4·2
Butter - - - -	3·5	1·3	3·8
Milk sugar - - -	5·0	4·5	3·8
Salts - - - -	·2	·5	·7."

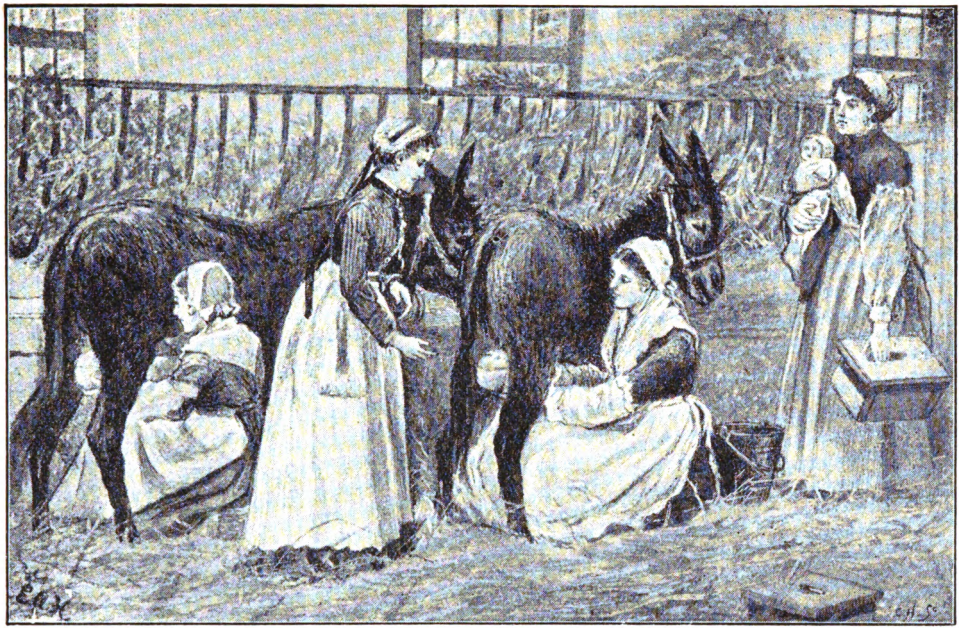
I give analysis of the composition of ass's milk as obtained by the best authorities on the subject (see p. 184).

Dr. Edward Smith, in his *Practical Dietary* (p. 123), writes: "Generally speaking, however, wherever milk is obtainable it is that of the cow, and if that of asses could also be obtained with facility it would be wise to use each in equal parts. Ass's milk," Dr. Smith continues, "is insufficient food when taken alone."

I have heard of cream being added to ass's milk with advantage. It has been stated by Peligot[1] that "by adding cream to ass's milk in the same proportion as to cow's milk (see p. 83) a very good substitute for human milk would be formed with ease".

Dr. Goodhart remarks of the feeding of delicate infants:[2] "Till lately goat's milk or ass's milk has been resorted to, as most closely approximating to human milk. They may," Dr. Goodhart adds, "be given either undiluted or diluted, as in the case of cow's milk, with water or lime water, or even diluted with barley water."

[1] *Comptes Rendus.* [2] *Diseases of Children*, second edition, p. 26.



L'Allaitement des Nourrissons par les Ânesses à l'Hospice des Enfants Malades.

The use of ass's milk in France dates from a very early time. "Ne croyez pas d'ailleurs qu'on soit resté jusqu'à ce jour sans connaître les vertus du lait d'ânesse. Depuis bien des années, Paris et les grandes villes ont chaque matin la visite de troupeaux d'ânesses qui viennent fournir aux convalescents, aux débiles, le liquide réparateur." [1]

"S'il faut en croire la légende, l'usage du lait d'ânesse fut introduit en France sous le règne de François Ier. Le galant monarque était tombé dans un état d'anémie, d'epuisement extrème, par suite de fatigues guerrières et autres. Les médecins du temps n'obtenant aucun changement dans cette maladie, on fit venir de Constantinoplè un juif qui ordonna simplement au roi de boire du lait d'ânesse, ce qu'il fit, et s'en trouva très bien, dit la chronique." [2]

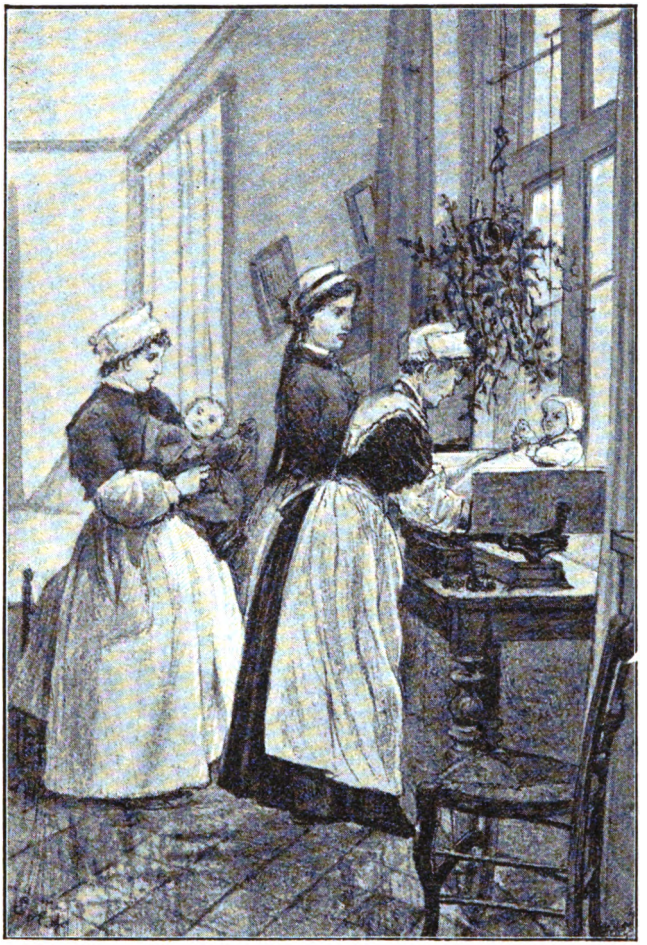
In Paris now for some years at the "Hospice des Enfants Malades," Rue de Sèvres, and at the "Hospice des Enfants Assistés," Rue d'Enfert Rochereau, and several others, they have been using ass's milk (taken direct from the ass) for suffering infants. As the superintendent of the "Hospice des Enfants Assistés" told me, "Une catégorie de garçonnets et de fillettes pâles, malingres, souffreteux dont l'aspect étiolé fait peine à voir". When

[1] *Annales d'Hygiène Publique.*

[2] *Dictionnaire Universel de Matière Médicale et de Thérapeutique.*

I last visited the "Hospice" I was told the success had been considerable. I myself saw two little children, one eight months, the other ten months, *who had had nothing* but milk direct from the ass from birth. The nurses in charge of these two told me that when born these children were in the most pitiable condition; but when I saw them they looked rosy and well, and I was told they were perfectly strong, and recovered. The asses nourish the infants for eight or ten months. They have found, however, that it is best to keep the young asses with the mothers. The superintendent told me: "L'administration de l'Assistance publique a sagement pensé qu'elle ne pouvait séparer sans inconvénient l'ânon de sa mère. En abandonnant l'ânesse à elle-même, il est à craindre, en effet, qu'au bout de fort peu de temps la bête nourricière se refuse à allaiter exclusivement les petits malades." He added that they found the milk "se rapproche considérablement par ses principes nutritifs du lait de nourrice. Il a, en outre, les effets les plus bienfaisants sur ces petits déshérités,[1]

[1] "A l'Académie de Médicine M. Parrot, médecin des Enfants Assistés, a publié récemment les résultats qu'il a obtenus dans la nourricerie de cet hôpital. Ces résultats, confirmés par les observations d'un de ses collègues, M. Tarnier, chargé d'un service important de jeunes nourrissons méritent toute l'attention des administrations hospitalières. Les chiffres sont plus éloquents que tout ce que l'on pourrait dire. Pendant une période de six mois, quatre-vingt-six enfants (atteints de maladies congénitals et contagieuses) ont été allaités à la nourricerie Les six premiers ont été, par suite de circonstances parti-



Le Pesage des Nourrissons—à l'Hospice des Enfants Malades.

qui, grâce à son emploi permanent reconquièrent petit à petit la vigueur et la santé." They are very careful at the hospitals in watching the effect of the milk, and weigh the infants regularly to see how much they gain in weight.

They give the milk direct from the ass. The sight is a curious one to those who have never seen a child taking nourishment from an animal; but it is very easily managed, and there is no trouble either with the animal or child. The children have the milk the same number of times they would if nursed by a wet nurse.*

culières, nourris avec du lait de vache à l'aide du biberon, un seul a guéri.

"Quarante-deux ont été nourris au pis de la chèvre, huit ont guéri, trente-quatre sont morts; trente-huit ont été nourris au pis de l'ânesse, vingt-huit ont guéri, dix sont morts.

"En présence de ces résultats, il n'y a qu' à s'incliner. Les nouveau-nés qu'on ne peut, pour une raison ou pour une autre, confier à des nourrices, doivent être alimentés au lait d'ânesse puisé directement par l'enfant au pis de l'animal.

"C'est la composition chimique du lait d'ânesse qui lui assure ses avantages sur le lait de chèvre ou de vache. Il contient en effet, beaucoup moins de matières plastiques et de beurre que ces derniers. Comme le lait de femme, il se précipite en petit flocons isolés que redissout facilement un excès de suc gastrique. Il ne charge pas l'estomac de ces enfants malades et chétifs qui ont déjà toutes les peines du monde à ingurgiter le breuvage et à qui il faut éviter, autant que faire se peut un travail pénible de digestion" (*Revue Pratique d'Obstétrique et d'Hygiène du Premier Age*).

"Large black Spanish asses are in use at some of the French hospitals, and the milk from such is considered to be lighter and more nourishing."

* See Appendix B.

COMPOSITION OF ASS'S MILK.[1]

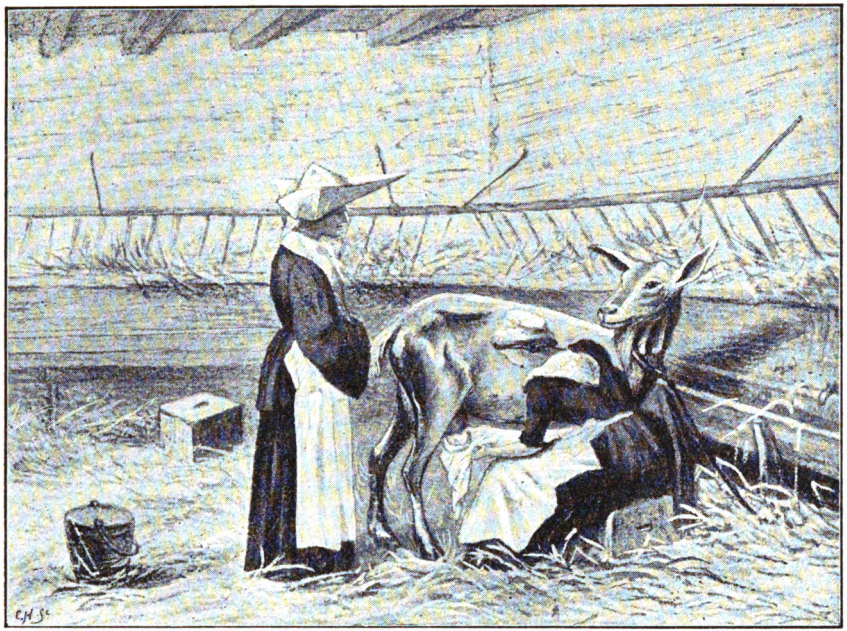
	Simon. Milk one year old.	Peligot. Mean of several Analyses.	Chevallier and Henri.	Lehmann.	Vernois and Becquerel.	Human Milk.
Water	907·00	904·7	916·3	795·0 to 789·1	890·12	889·08
Solid constit. ...	91·05	95·3	83·5	205·0 to 210·9	109·88	110·92
Butter	12·10	12·9	1·1	12·1 to 12·9	18·50	34·61
Casein	16·74	19·5	18·2	16·0 to 19·0	35·65	39·24
Sugar, with extractive matter and salts ...	62·31	62·9	—	(with extractives)		
Sugar	—	—	60·8	60·8 to 62·9	50·46	26·66
Salts	—	—	3·4	— —	5·24	1·38

Goat's Milk.—The use of goat's milk for human feeding dates from the very earliest times. We find mention of it in Proverbs:[2] "And *thou shalt have* goat's milk enough for thy food, for the food of thy household, and *for* the maintenance for thy maidens". This shows how much was thought of its nourishing nature. St. Paul mentions: "Who feedeth a flock and eateth not of the milk of the flock?"[3] which clearly indicates the keeping of goats and the general use of the milk as food.

Mayer thinks "it comes more near to human milk than that of the cow," and that "children do well on it".[4] Abroad goat's milk is largely used in

[1] *Comptes Rendus.* [2] Chap. xxvii. 27. [3] 1 Cor. ix. 7.

[4] Quoted in the *Gazette Médicale de Paris.* The analysis of Boysson proves the milk of the goat to be like human milk



Allaitement d'un Nourrisson par une Chèvre.

some parts for infant feeding, the children thriving well on it. At one time it was supposed to assist in creating a nervous temperament, and many French authorities—although some scientists hold otherwise—still think that the milk from *some breeds of goats* is apt to do so. "Si ce lait renferme des principes nutritifs des plus salutaires, il a paraît-il, un défaut, c'est de communiquer par son absorption les accidents nerveux dont la chèvre souffre elle-même. De même que l'ânesse la chèvre est rebelle à toute contamination."[1] Abroad children suck direct from the goat. Goats were much used in the French hospitals before the introduction of the ass.

Dr. Deshayes, of Rouen, writes to me: "La chèvre se prête dans certains pays admirablement à ce rôle de nourrice, et que, lorsqu'elles y sont habituées, elles viennent d'elle-même presenter leurs mamelles à la bouche de l'enfant pour la succior."

"Guidée en ce moment par un Dieu tutélaire,
Une chèvre s'approche, et son lait salutaire
À la bouche enfantine offre un pur aliment.
La mère est immobile, et sourit tristement;
Pensive, elle contemple avec un œil d'envie
La mamelle féconde où l'enfant boit la vie."

MILLVOYE, "La Tendresse Maternelle".

in composition. The smell of milk taken from goats without horns is said to be less than that from goats with horns.

[1] *Dictionnaire Universel de Matière Médicale et de Thérapeutique.*

Galton writes:[1] "It is marvellous how soon goats find out children and tempt them to suck. I have had the milk of my goats, when encamping for the night in African travels, drained dry by small black children, who had not the strength to do more than

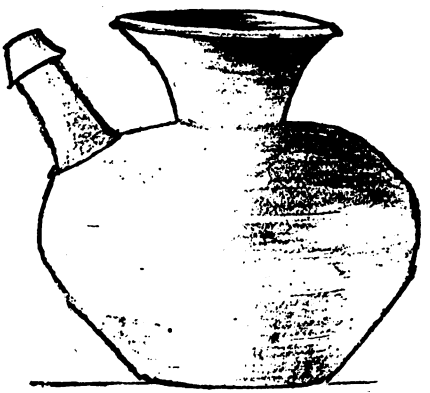
Taken from a Bronze of Romulus and Remus in the Capitol Museum at Rome.

crawl about, but nevertheless came to some secret understanding with the goats and fed themselves. The records of many nations have legends like that of Romulus and Remus, who are stated to have

[1] *Human Faculty*, p. 267.

been suckled by wild beasts.[1] These are surprisingly confirmed by General Sleeman's narrative of six cases where children were nurtured for many years by wolves in Oude." [2]

The natives of the North-west Provinces of India often feed their infants on goat's milk; the milk being taken direct from the goat by the child.



Jhāri.

"I know of two cases in which European children drank direct from the goat — one of them for more than a month. Many natives decline altogether to use an European feeding bottle; and when from any cause the mother's milk fails, use a jhāri, of which I send you a full-sized rough sketch. The jhāri is made of brass, and is filled as often as required." [3]

"Goat's milk," writes Dr. Cheadle,[4] "is highly

[1] Old authorities say a wolf.

[2] *Journey through Oude in* 1849-50, i., p. 206.

[3] Extract from a letter from a doctor in India.

[4] *Artificial Feeding and Food Disorders of Infants*, p. 61.

nutritious, richer in fact than cow's milk, and therefore excellently adapted for young children in this respect. But it is no whit more digestible[1] than cow's milk. The casein coagulates in the same large masses, and it must therefore be treated in exactly similar fashion for very young children, *viz.*, boiled, and barley water or lime water added."

Dr. Wynter Blyth says:[2] "The milk of the goat as a rule contains more cream than that of the cow,[3] and rather less albuminous matter."

"Goat's milk is free from the elements of danger in cow's milk; it is not liable to tuberculous infection."[4]

The way goats are fed would appear to affect the milk. "If a highly nourishing and rich milk is desired, it is best to feed the animal on straw and trefoil; but, if a light milk is required, beetroot is preferable. Experience has proved that the goat as well as the cow will yield a larger flow of milk if fed in stables upon proper fodder; but then great attention should be paid to the cleanliness of the stalls and the removal of all offensive matters."[5] "The best milk," it is added, "which the goat affords is

[1] It would appear that goat's milk is easily digested by infants when *taken direct from the goat by the child.*

[2] *Foods*, p. 228.

[3] For analyses of goat's and cow's milk, see pp. 195 and 46.

[4] Professor Nocard, from the *British Medical Journal.*

[5] Simon's *Animal Chemistry*, ii., 65.

two months after kidding." The smell of goat's milk "is lessened by keeping the animal clean, and washing from time to time". When people live in the country there is no difficulty, as a rule, about keeping a goat for milk; and the surroundings are more adapted for a healthy condition.[1] I subjoin an analysis to show the difference in goat's milk owing to the food given.

INFLUENCE OF KINDS OF FOOD ON GOAT'S MILK.

(PARMENTIER.)[2]

	Fed on Straw and Trefoil.	Fed on Beetroot.	Normal (mean).	Human Milk (normal).
Specific gravity	1031·10	1026·85	1033·53	1032·67
Water	858·68	888·77	844·90	889·08
Solid constituents	141·32	111·23	155·10	110·92
Butter	52·54	33·68	56·87	34·61
Casein and extractive matters	47·38	33·81	55·14	39·24
Sugar	35·47	38·02	36·90	26·66
Salts	5·93	5·72	6·18	1·38

Goat's milk is supplied privately by the British Goat Society, who would, no doubt, as well give assistance in the purchase of one if required. "There are others who supply it privately, as I do myself

[1] A useful little book on the practical management of goats, called *Goat Keeping*, is published by L. Upcott Gill, 170 Strand.

[2] *Comptes Rendus.*

when required.—H. S. HOLMES PEGLER, Hon. Sec., British Goat Society."[1]

I give a sketch of a Toggenburg goat, the milk of which is said to be best,[2] and which might serve somewhat for a guide in the choice of such. She has taken five prizes.

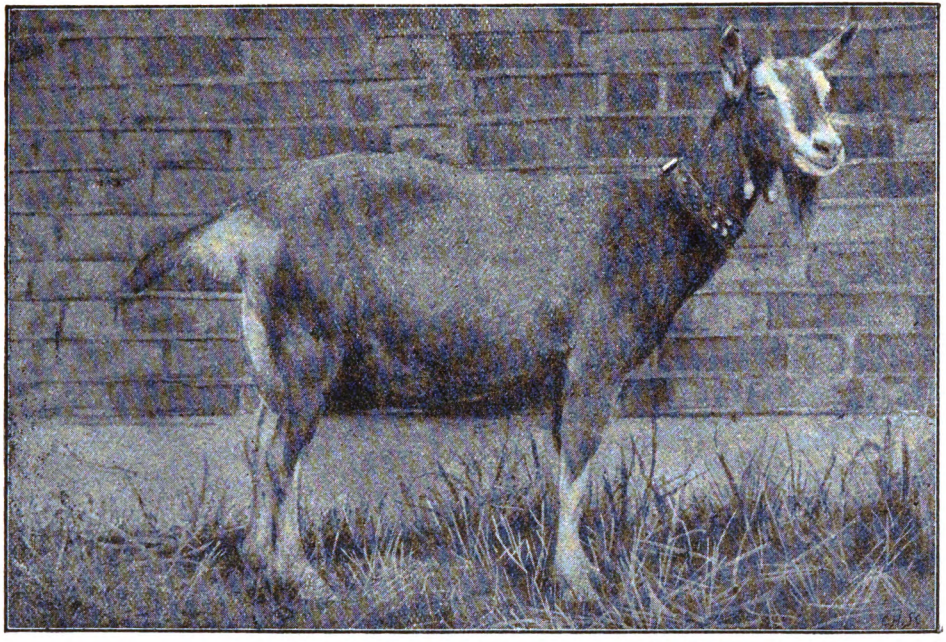
Windsor Royal Show	- - -	1889.
Dairy Show	- - - - -	1890.
„ „	- - - - -	1891.
Barnet	- - - - -	1891.

Champion prize, and medal.

Mr. Paul Thomas (Devonport House, New Malden, Surrey) writes to me "the milk of the Toggenburg goat is far the best. They are very quiet and affectioned," and adds: "The Toggenburg goats do not require any special feeding".

[1] Extract from letter.

[2] "La chèvre 'Toggenburg'.—Il y a moins de danger avec elle de communiquer 'les accidents nerveux' aux enfants" (Extract from a letter from Professor Charcot of the Salpétrière Hospital, Paris).



Toggenburg Milch Goat.

ANALYSIS OF GOAT'S MILK.[1]

	Chevallier and Henri.	Clemm.	Boyason.	John.	Payen.	Stipriaa Liuscius and Bondt.	Lehmann.	Donné.	Vernois and Becquerel.	Human Milk.
Water	868·0	865·175	892·8	849·3	855·0	744·0	886 to 884	819·4	844·90	889·08
Butter	32·2	42·507	29·9	11·7	40·8	45·6	33·2 to 42·5	48·6	56·87	34·61
Casein	40·2	60·321	52·9	105·4	45·2	91·1	40·2 to 60·3	43·8	58·14	39·24
								with ex.		
Sugar	52·8	44·065	20·7	23·4	—	43·8	40 to 53	91·2	36·91	26·66
Salts	5·8		—	—	—	—	— —	—	6·18	1·38
Residue of whey	—	—	—	—	58·6	—	— —	—	—	—
Cream	—	—	—	—	—	7·5	— —	—	—	—

[1] *Annales de Chimie et de Physique.*

Section III.

PATENT AND OTHER FOODS.

Flour

Is much used by the poor and by country people in infant feeding; but it does not always agree with the tender digestion of *very young children*, and in some few cases it fattens too rapidly. I give two or three ways of preparing it, also some medical opinions as to its use. Many consider that baked flour conduces to convulsions when given at too early an age. "When infants have been fed with flour it will be found that the stools are much larger than is proper for an infant, and, in fact, that the starchy matter is passing off unused. This is a constant source of derangement of the liver, and a frequent cause of fits."[1] It is not an uncommon practice now to give young infants flour in their milk at a very early age, sometimes, indeed, merely putting the flour with the warm milk—in which case the child practically has raw flour. The researches of Dr. Edward Smith, Dr. Letheby, and

[1] Edward Smith, M.D., LL.B., F.R.S., *Practical Dietary*, p. 121.

Professor Church show that flour is not digested unless *well and thoroughly cooked.*

"Baked flour, like the patent unmalted farinaceous foods, is prepared upon this principle of partially converting starch into sugar by heating at high temperatures. It is starchy food, not suited for *very young children.* Mixed with a sufficient amount of milk it forms satisfactory food for the later months of infancy."[1]

Baked Flour, to prepare.—Fill an earthenware jar (a salt jar will do) with flour, press the flour down tightly, do not cover the jar over; put the jar in a slow oven, and bake the flour to a light golden brown. Turn the flour out when baked by cutting round with a knife, when cold scrape to a powder and put at once in a tin or bottle tightly corked so as to exclude the air and keep the flour perfectly dry. One teaspoonful of scraped flour to a half-pint of milk, or milk and water, and boiled together for a few minutes. Keep stirring while boiling. It should, when made, be of the consistency of cream. Add more milk if too thick when boiled.

"The so-called farinaceous foods for infants are only baked flour, sometimes sweetened with sugar . . . tops-and-bottoms owe their value to the same circumstances—namely, that the farinaceous matter which is so indigestible with infants is broken up

[1] Cheadle, *Artificial Feeding and Food Disorders of Infants*, p. 88.

by baking into soluble dextrine."[1] I think in many instances the quantity of farinaceous food given to infants is too large, and in some cases it is insufficiently cooked. "Our farinaceous food is for the most part not in the most favourable condition for rapid digestion. . . . A good deal of it, too, is imperfectly cooked."[2]

Chapman's Entire Wheat Flour.

Dr. Goodhart writes:[3] "This form is more suitable than white baker's flour, because it contains the pollard or outer part of the grain of wheat; and this is rich in nitrogenous matter, fat, and salts, and also in the cerealine, which exercises a diastatic action upon the starch, turning it into sugar. The finest dressed white flour contains less nitrogen and more starch, and is, therefore, less wholesome, for reasons previously stated. The entire flour needs prolonged boiling for its preparation in order to break up its starch and convert it into dextrine or grape sugar. This may be done by tying it up tightly in a pudding-cloth and boiling. Eustace Smith orders a pound to be heated thus for ten hours, and then removed, the outer soft part to be cut away, and the inner hard part grated and used as meal. A teaspoonful at a time, well mixed with cold milk, to which a

[1] Letheby on *Food*, p. 152.

[2] Sir William Roberts, M.D., F.R.S., *Digestive Ferments*, p. 23.

[3] *Diseases of Children*, second edition, p. 29.

quarter of a pint of hot milk is added before serving."[1]

On the tins of Chapman's Entire Wheat Flour as sold by grocers and chemists there is no mention of prolonged boiling, as recommended by Dr. Goodhart, being necessary for its preparation for infants. Wishing to be quite sure on the point, I wrote to Dr. Goodhart, and received the following letter in reply on the subject of boiling the flour:—

"MY DEAR MADAM,—The directions named apply only to Chapman's Entire Wheaten Flour as sold in tins by grocers, etc.; and, although I am not prepared to say that the *printed* directions are inadequate for a number of children for whom it is in use, for *infants*, who are unable to digest starch with facility, Eustace Smith's directions, which I quote, had better be carried out.

"In other words, I consider the prolonged boiling necessary for infants as a safeguard.

"Yours faithfully,

"JAMES F. GOODHART."

Dr. Starr gives the following receipt for the preparation of flour, and says it may be given "after

[1] It tastes smoother and more palatable if the flour is boiled up with the milk, and a little sugar is added. And I have found that the milk must be given diluted in the proportion the child is used to.

the seventh month" ; some children, however, cannot digest flour before nine months. Dr. Starr writes:[1] "Instead of Mellin's Food a teaspoonful of 'flour-ball'[2] may be added. To make this material, take a pound of good wheat flour, unbolted if possible. Tie it up very tightly in a strong pudding-bag, place it in a saucepan of water, and boil constantly for ten hours.[3] When cold, remove the cloth, cut away the soft outer covering of dough that has been formed, and reduce the hard baked interior by grating. In the yellowish-white powder obtained almost all the starch has been converted into dextrine by the process of cooking, and the proportion of the nitrogenous principle to the calorifacient is as one to five—nearly the same as in human milk."

"Two meals of flour-ball daily—say, the second and fourth," adds Dr. Starr, "are all that can be digested. To prepare these, rub one teaspoonful of the powder with a tablespoonful of milk into a

[1] *Dietetics of Infancy and Childhood*, "Annual of Universal Medical Science," iv., 265.

[2] For children who are unable to digest ordinary flour, Allen & Hanburys' preparation of "Wheaten Flour" (Malted Farinaceous Food) answers well as an additional nutriment when Mellin's Food is given (see p. 207).

[3] When done place the bag on a strainer. Leave it in a cool place all night, *remove the cloth just before cutting away the outer covering of dough.* After the flour is grated it is well to pass it through a sieve, as this makes it a finer powder, and prevents the flour being lumpy when put with the milk. *Must be fresh prepared, as it will not keep long.*

smooth paste, then add a second teaspoonful of milk, constantly rubbing until a cream-like mixture is obtained. This is poured into eight ounces of hot milk, stirring well, and is then ready for use. The other meals should be composed of milk, cream, sugar of milk, and water (see p. 82), as already given." In beginning farinaceous food, such as flour, it is always better to begin with one meal (in the middle of the day) for a little time. With some children the binding nature of flour renders the occasional use of oatmeal water necessary (see p. 94, for how to prepare).

Dr. Starr writes:[1] "The nutrient value of the cereals and their products as they exist in so-called 'infants' foods' has been imperfectly determined. They are undoubtedly useful as mechanical attenuants; but it is very questionable whether any of them, unless prepared with milk, can permanently meet the demands of nutrition. At the same time it is quite probable that the soluble albuminoid substances obtained by Liebig's process have a food value of their own, making them more serviceable than the starches."

Allen and Hanburys' Infants' Food

Has a deservedly good reputation. The *London Medical Record* (January 15, 1885) thus speaks of

[1] *Dietetics of Infancy and Childhood*, "Annual of Universal Medical Science," iv., 259.

it: "Allen & Hanburys' Malted Farinaceous Food is a palatable farinaceous food, digested by diastase. It may be regarded as a new and improved form of Liebig's well-known food. It is ready for use without boiling or straining. It is made by Messrs. Allen & Hanburys, of Plough Court, Lombard Street, E.C."

This "Food" should be given with the milk in proportion to the age and digestive powers of the child (see p. 135). If the child is only some months old, as it will not take the "half-pint" of fluid (named in the directions) for one meal, it is best to begin with a teaspoonful of the "Food" and increase to one and a half as more fluid is given. It is a good food for the later months of infancy given once or twice a day, but I have not found it useful as a diluent to cow's milk in early infancy.

Mellin's Food.

Dr. Starr writes:[1] "When an 'infants' food' is used to act mechanically care should be taken to select one in which the starch has been converted into dextrine and grape sugar (see p. 71) by the process of manufacture. The articles known as 'Mellin's Food' and 'Horlick's Food'[2] can be relied upon. One teaspoonful of these dissolved in

[1] "Annual of Universal Medical Science," vol. iv., pp. 259-263.

[2] I have no practical experience of "Horlick's Food" in infant feeding.

a tablespoonful of hot water, and added to each portion of food, makes a very easily digested mixture." I have followed Mellin's directions *for the preparation* of his food.

DIRECTIONS FOR USING MELLIN'S FOOD.

I.—*For infants under the age of three months, and for delicate children.*

1.—Measure a quarter of a pint of water, pour a tablespoonful into a small *enamelled* saucepan.[1]

2.—Add half a tablespoonful of Mellin's Food, and dissolve by gentle heat and stirring.

3.—Then add a quarter of a pint of fresh cow's milk, and the remainder of the water, and heat to the required temperature.

Should the whole not be taken at one time, the remainder must be thrown away, for a second warming may turn it sour, and thus render it unfit for use. The food should not be kept warm during the night (see p. 14); if it be necessary to feed the infant, the required quantity may be prepared cold and a sufficient amount warmed just before use.

II.—*For infants above the age of three months.*

1.—Dissolve a tablespoonful of Mellin's Food in four tablespoonfuls of water as directed above.

2.—Now add sufficient fresh cow's milk to make half a pint, and heat to the required temperature.

I have found a teaspoonful[2] of Mellin's Food does

[1] Do not use a *tin* saucepan. I have found an ordinary spirit lamp (burning methylated spirit) best for preparing the food, as the heat from such is more gradual than from a coal fire. A gas stove answers the purpose very well.

Spirit Lamp.

[2] An ordinary teaspoonful is meant, or use a "measure glass".

at the age of two months, with as a rule the proportion of milk and water named by Mellin for under three months; but most children at this age can only digest the amount of fluid as quoted by Dr. Starr from Rotch's calculations (see p. 10). The intervals of feeding being according to his directions; also generally at three weeks half a teaspoonfull of Mellin's Food is found sufficient with two or three ounces of milk and water, and for the earlier weeks a small half-teaspoonful of Mellin's Food to the $1\frac{1}{2}$ or 2 ounces. (For the degrees of dilution of cow's milk at different ages see pp. 133-136.) The water and milk *before being used with Mellin's Food should be boiled*[1] (see pp. 138, 117) *and allowed to get cold* before preparing the food.

At nine or ten weeks some children bear better than the half-pint named by Mellin "for under three months" the addition of a teaspoonful of milk extra or even 2 to the four-ounce bottle given to the child, *i.e.*, 2 ounces of milk and 2 ounces of water. This makes the meal more satisfying and nourishing, and less in bulk to digest. It is better to try the additional milk for one or two bottles first. If the child cannot digest it the milk will either be thrown up or the child will have hiccough, and be crying and restless. If this occurs it is best to return at once for a little time to the

[1] I have not found boiling the milk *before use* impair the nutritive value or digestibility of the food.

proportions which are found to agree. From the latter part of the fourth month till the end of the sixth month I have given with success the following proportions:—

2½ ounces of cow's milk (*unskimmed*).

2½ ounces of water. 1 teaspoonful of water taken away and replaced by 1 teaspoonful of milk.

1 teaspoonful (large) of Mellin's Food.

½ teaspoonful of Demerara sugar (see p. 144), *boiled with the food. No salt.*

This for all the day meals. The two night bottles, however, make only half milk, half water, *i.e.*, 2½ ounces of milk and 2½ ounces of water. Mellin's and Demerara sugar the same as the day bottles. The times of feeding were as follows:—

8	o'clock.	about	9	o'clock,
11	„	„	3	A.M.
2	„	„	6	„
5	„			

Towards the end of the sixth or at the seventh month most children can take 6 ounces for each meal (see p. 10), and some few can then take these proportions:—

4 ounces of milk (cow's). 2 ounces of water.[1] An increased quantity of Mellin's Food "in the seventh

[1] The night bottles (three and six o'clock) are best made 3 ounces of milk with 2 ounces of water. In some cases it is better to give this proportion for a little time before the 2 parts milk to 1 of water is given. The milk should not be increased in strength at the same time that any additional nutriment of any kind is begun.

month" as Dr. Starr directs. Other bottles with the teaspoonful. This will give a little over a pint and a quarter of milk in the 24 hours, and with the water about the quantity of fluid named by Rotch for this age. Later on Mellin's quantities "for infants above the age of three months" usually agree; Mellin's *tablespoonful* of "Food" when measured being about equal to Dr. Starr's *two teaspoonfuls*. It is best to follow Dr. Starr's directions when giving an infant a larger quantity of Mellin's Food.

Dr. Starr says:[1] "In the seventh month the Mellin's Food may be increased to 2 teaspoonfuls and given three times daily".[2] At the eighth month see p. 200.

Dr. Angel Money writes:[3] "*Mellin's Food* contains abundance of soluble carbohydrate, but insufficient nitrogenous matter and practically not any hydrocarbon. Diluted with cow's milk, it is still wanting

[1] *Dietetics of Infancy and Childhood*, "Annual of Universal Medical Science," pp. 259-263.

[2] With 2 teaspoonfuls of Mellin's Food the milk and water must be the quantities named by Mellin for "above the age of three months". With a smaller proportion of milk or water so large a quantity of the "Food" may cause sickness or indigestion. Given as Dr. Starr directs, the other meals being of lesser proportion, the balance of nutrition is maintained, and digestion is not upset. During the later months of teething Mellin's Food is sometimes found to disagree, then the milk, cream, and lime water formula (see p. 82) will perhaps be found to suit better; but with this as with Mellin's Food "after the seventh month" some other nutriment must be given as well for one meal at least (see p. 200).

[3] *Disease in Children*, second edition, p. 27.

in fat (see p. 93), and contains too much sugar. But it is a valuable food, as it presents the carbohydrate in a soluble form, whereas the other foods are less soluble."

Dr. Angel Money's note of the insufficiency of certain elements in Mellin's Food points to the necessity for supplementing at a suitable age with boiled flour, as suggested by Dr. Starr, or some other nutriment. If this is done, however, and if in early infancy *pure cow's milk* is given in accordance with the age and digestive powers of the child, Mellin's Food being only used *as a diluent* to the milk, infants can be most successfully reared. Dr. Starr remarks of "farinaceous food" in the early months of infancy that it "is only to be employed as an addition to milk preparations for its mechanical action".[1]

Dr. Angel Money's remark, too, as to the deficiency of "fat" in Mellin's Food when it is merely "diluted with cow's milk" should be a note of warning as to the proportion of milk given to the infants being right for *full nourishment*. If a sufficient quantity of cow's milk cannot be borne, and the milk has to be largely watered to make it digest, Mellin's Food *will not make up for the lack of milk*. Some other way of preparing the milk than with Mellin's Food should be tried. "I wish to lay especial stress," writes Dr. Cheadle,[2] "upon the importance of a due pro-

[1] *Dietetics of Infancy and Childhood*, p. 259.

[2] *Artificial Feeding and Food Disorders of Infants*, p. 19.

portion of fat in the food of infants, because it is a point most imperfectly recognised. In spite of the significant fact that milk is a rich emulsion of fat, little children are constantly placed on artificial foods which are almost destitute of this vital element."

Hill's Malted Biscuit Powder.

It seems to be a matter of general agreement now that malted food for infants should be made with *malt extract*, not malt meal.

"Malt finely powdered produces food causing diarrhœa. This originates from the sharp-pointed shafts of the malt, which, in pounding, remain with the powdered malt, *and affect the bowels of a child like fine needles.*"[1]

As regards all malted food, it will agree better with some constitutions than others. It will sometimes be found to act as a laxative on children inclined to relaxed bowels.

Hill's Nursery Biscuit Powder and Biscuit[2] are made with the "malt extract". "In reply to your note we may say that we supply Messrs. Hill & Sons with malt extract for the preparation of their nursery biscuits."[3] I have not found Hill's Biscuit Powder

[1] Baron Liebig, "On the Use of Malt Meal in Malted Food," *Liebig's Letters*, second edition.

[2] Sold by Hill & Son, 60 Bishopsgate Street, E.C.; James Street and Victoria Street, S.W.

[3] Extract from a letter from Messrs. Allen & Hanburys.

at all laxative, and have given it for a lengthened period to an extremely delicate baby, with a most successful result, the child growing fat (the flesh being firm) under its use. I have seen many fine children reared on cow's milk with the addition of Hill's Biscuit Powder and Biscuits at a suitable age.

I have not given Hill's Biscuit Powder before seven months, and have begun with one teaspoonful, and for one meal at first, gradually increasing the powder[1] as I saw the child would digest it. At nine months I have given three meals a day of the biscuit powder, the other meals being of milk. I think the biscuit powder is best for the early months of infancy. Later the biscuits answer well. I give an analysis which Mr. Hill had made for me.

ANALYSIS.

Analysis of sample of Patent Malted Nursery Biscuits, received from Messrs. W. Hill & Sons, of 60 Bishopsgate Street, E.C.

	Biscuits.
Nitrogenous matter as proteids	13·30
Detvine	15·75
Maltose	16·08
Fats	1·84
Starch and cellulose	44·53
Salts (ash)	0·81
Water	7·69
	100·00

[1] I have noticed that lime water used with malted food will after a time cause the child to throw up sour water.

"The above results prove they are well prepared, and represent infant food of great nutritive power. The high proportion of malted carbohydrates (maltose and detvine) and the unusually small amount of unconverted starch combine to render the food easily assimilable.

"In these respects they compare favourably with other similar products that have been brought before me.

"ALFRED GORDON SALAMAN."

ROBB'S BISCUITS.

Robb's Biscuits and Spiking's Biscuits are well known; and also a very good kind of rusk, called "Round Rusk," is sold by Barker & Co., 176 Piccadilly, for infant feeding. A prize medal was awarded to this maker at the International Health Exhibition for excellency in the manufacture of rusks and biscuits. When giving the round rusk with the feeding-bottle prepare the same as Robb's Biscuits, and use a dessertspoonful[1] if farinaceous food is only just begun, and the child is very young. Give twice a day. After a time (about eight months) a child will take half a rusk for a meal. Later on three meals a day of half a rusk;—and ultimately, if continued, a whole rusk

[1] Given thus by a medical man to a baby seven months old, with feeble digestive powers.

for the meal. The period at which this may be given must be judged by whoever has the care of the child. I have found it an excellent infant rusk, and rather lighter than Robb's, which it somewhat resembles. I have given Robb's Biscuits to several children, giving first half a biscuit for one meal, and after a time increasing to two meals a day, beginning when the child was about eight months; and, although they are a little old-fashioned now, newer preparations having in some measure superseded them, they are excellent, and it is always safe to give them in infant feeding.[1] To prepare Robb's Biscuits so that they will go through the feeding-bottle—put the biscuit in a basin, add the amount of water boiling, to be used with the milk, cover the basin over, and leave thus ten minutes. Then beat up with a wooden spoon, and put through a fair-sized sieve, add the milk now, and warm to the requisite heat for the child to take. With some children half a teaspoonful of Demerara sugar may be added, for others it is best omitted (see p. 144).

[1] Since there has been a demand for Robb's Biscuits most bakers now keep them done up in small quantities in a paper bag; but in some cases they are kept thus (without due protection from the atmosphere) so long that the biscuits turn sour, and, as it is not easily discoverable, the child's stomach is upset before it is found that the biscuits are at fault. It is really wisest to get the biscuits direct from the makers, Messrs. Robb, 79 St. Martin's Lane, W.C.

COMPARATIVE ANALYSES OF FOODS FOR INFANTS, PREPARED ACCORDING TO THE DIRECTIONS GIVEN WITH THEM.[1]

Elements.	Standard Food, Human Milk.	Savory & Moore's Food.			Mellin's Food.		Neave's, Hard's, Ridge's.		Nestlé's Food.[2]		
		Analysis.	Diluted 7 times with Water.	Diluted in same proportion with Cow's Milk.	Malted Analysis.	Diluted ⅛ with Cow's Milk.	Analysis.	Diluted with Water ⅛ Sugar and Milk to be added.	Analysis.	Diluted with 10 parts of Water.	
Nitrogenous matter ...	3·35	15·35	2·13	4·35	5·43	1·24	12.3	1·50	15·00	1·36	These analyses have been taken from those published in the *Medical Press and Circular*, 1872, or have been furnished by the proprietors.
Fat (cream) ...	3·34	1.08	·15	·68	00·00	·46	—	—	5·00	·45	
Lactine(sugar of milk or grape sugar)	3·77	1·02	·14	·91	86·90	11·50	—	—	40·00	3·36	
Dextrine, or Starch ...	—	10·78 64·12	1·54 9·16	the same proportion.	—	—	74·5	—	30·00	2·77	
Cellulose ...	—	1·36	·19		·22	—	3·6	9·30			
Salts	—	1·92	·27		3·40	·22	—	0·40			
Ash	—	—	—	—	—	—	1·16	—			
Water	89·54	4·37	86·37	82·90	3·76	86·58	8·44	88·80	10·00	92·6	
			Deficient in nitrogen and fat, too much starch.	Nitrogen in excess, fat deficient.		Deficient in nitrogen and fat.		Deficient in nitrogen; the fat and sugar would be in the milk added "to taste".		Deficient in every element but sugar or lactine.	

[1] Taken from International Health Exhibition handbook. Issued by authority.
[2] I have not found it answer to bring a child up entirely with this food. As a change it does very well.

Lentil Powder

Is recommended by some writers on children's dietetics. Dr. Gover remarks:[1] "The meal of the lentil, or *Ervum lens*, is of extreme richness, containing more casein than either peas or beans; yet it is to be obtained in England only under fanciful names, generally mixed with barley flour, and sold at many times its value;" and adds: "I may mention the much-advertised preparations sold under names intended to imply some connection with or derivation from Indian corn are mere washed-out substances, which are destitute of the materials necessary for the formation of bone and flesh."

Maize

Again has been recommended lately by some as a food for infant feeding, but I have heard that on trial it has not been found successful. Dr. Chambers writes:[2] "Maize in various forms is often recommended as a valuable food. It contains a good deal of oily matter, and on that account is much used for fattening geese at Strasbourg, and other domestic animals elsewhere. But its oiliness inclines it readily to grow rancid, and in this state it is apt, in horses, to cause eczema of the skin. It cannot,

[1] *Dietaries in their Physiological, Practical, and Economic Aspects.*

[2] *Manual of Diet in Health and Disease*, p. 64.

therefore, be wholesome for us, and, in fact, we find that in Lombardy and the Valteline, where damaged maize is habitually eaten, a special endemic cutaneous disease—pellagra[1]—year by year slowly widens its fatal shadow over the finest lands tilled by man. It is distinctly traced by Dr. Lombroso ('V. Lombroso sulla Pellagra') to the peculiar moulds which form in this decomposing breadstuff.

"Maize flour may be refined and made safer by washing out the nutritive portion with alkalies, and in this state professes to constitute 'oswego,' 'maizena,' 'corn flour,'[2] etc. But the eater should understand that he has before him starch only, and must not reckon on it for nitrogenous nutriment. The economist will probably think he can buy starch cheaper in the form of rice flour, which, indeed, is often sold under these fancy names, according to the evidence of Dr. Bartlett before the Adulteration Committee this summer."

[1] For further information on the subject see Quain's *Dictionary of Medicine*.

[2] "Children fed on this soon grow pallid, thin and feeble. Yet their appetites are voracious; they are always hungry, always crying for food. In spite, however, of the large quantity they consume they grow thinner and thinner and die of atrophy, not so much from any overdose of starch, although that of course they digest imperfectly, as from the want of life-giving tissue—making proteid and fat" (Cheadle, *Artificial Feeding and Food Disorders of Infants*, p. 90).

Arrowroot.

The feeding of children with arrowroot is thus referred to in the *Dictionary of Domestic Medicine and Surgery*, 22nd edition, p. 37 (by Drs. Thomson and Steele): "A child fed exclusively on arrowroot, water, and sugar (and such has been the case) must become unhealthy, and, without fail, rickety. The case is abundantly altered when with arrowroot milk is combined. In this fluid exists whatever is requisite for the animal frame: nitrogen for its muscle, phosphorus for its nerve, earthy salts for its bone. The combination of arrowroot *with milk* is one of the best which can be given to a child. *It must never be given to young infants.*"

Dr. Edward Smith, F.R.S., writes:[1] "Arrowroot and sago must not be given with water only, since, as my experiments have shown, they are not digested, in the absence of some nitrogenous principle such as that supplied by milk, but pass off by the bowel unused". In France arrowroot is often given in cases of continued diarrhœa. "It is the custom at these and similar institutions,[2] whenever an infant is sick, to withdraw him altogether from the breast, and to substitute for the milk some farinaceous substance, made fluid by boiling, arrowroot, gum, and rice water, or a thickened preparation of rice known as *crême de riz*, and other preparations

[1] *Practical Dietary*, pp. 129, 130. [2] Parisian hospitals.

of a similar kind forming the diet of a sick infant. In the reported cases of the Foundling Hospital and those for the reception of sick children, prescriptions of this nature form a very important part of the treatment, as will be seen by referring to the different treatises in French on the diseases of children."[1]

"For little children arrowroot and corn flour are the poorest and least useful of foods. Prepared barley, sago, tapioca, rice, are open to the same objection in varying degree."[2]

The Bermuda arrowroot is said to be the best. "The mode of preparing the fecula from the roots greatly influences its value, and the superiority of the Bermuda arrowroot is attributed to the extreme care and cleanliness exercised in the different processes of manufacture."[3]

"The jelly prepared by boiling *arrowroot* in water grows more fluid as it cools; while that made from *potato starch* becomes more firm."[4]

Arrowroot, to prepare.—Take one teaspoonful of arrowroot. Mix it *well*, with a spoon, with one tablespoonful of *cold* milk (cow's or prepared condensed). Put, when well mixed, in a saucepan in

[1] *American Quarterly Journal of Medical Science.*

[2] Cheadle, *Artificial Feeding and Food Disorders of Infants*, p. 91.

[3] *The Preparation of Arrowroot in Bermuda*, "Journal of the Society of Arts," July 8, 1887.

[4] *Cabinet Cyclopædia.*

which is three-quarters of a pint of milk, or a pint if the arrowroot is required thinner, quite warmed, *but not boiling*. Stir gently, but not too slowly, and *all the one way*, from left to right, with a *wooden stick*, or the handle of a wooden kitchen spoon if you have not a round stick, *all the time*, till it thickens and is of a smooth consistency like cream, when it will be ready for use. In England most people stir arrowroot with the bowl of the spoon, which makes it lumpy. Abroad it is always stirred with a round stick, and this they say helps to make it smooth.

Dr. Meigs writes:[1] "In artificially feeding a child of nine months to a year old, the mixture recommended by Dr. J. Forsyth Meigs[2] of two tablespoonfuls[3] of milk, cream, lime water, and arrowroot water (a teaspoonful of arrowroot[4] to a pint of boiling water) each, and a little sugar, will often be found to suit well".

Arrowroot Water, how to make.—One teaspoonful of arrowroot; one pint of boiling water. First mix the arrowroot with a little *cold water*. Then pour on the pint of boiling water and boil up in a saucepan for five minutes. It should when made be quite thin, smooth, and clear.

[1] *Milk Analysis and Infant Feeding*, p. 88.

[2] *Sanitary Care and Treatment of Children.*

[3] A measure glass should be used, as spoons vary in size.

[4] In this case the arrowroot is not used as a "food" but as a "diluent" to the curd of the cow's milk (see p. 138).

Rice Water

Is much used abroad and in England for assisting to stop infant diarrhœa. Of this Professor Church writes to me :—

"*July* 16, 1890.

"Dear Madam,—As infantile diarrhœa is often caused by giving young infants starchy food which they are unable to digest, I do not see how it is to be cured by drinks in which starch is a large constituent.

"Yours faithfully,

"A. H. Church."

Never should diarrhœa be allowed to continue. The popular idea that the diarrhœa is checking the feverishness of teething is a complete delusion. In most cases—nay, I may say all—the cause requires to be found out by the practised eye of a medical man, and with infants especially delay in many instances means death.

Dr. Ellis says :[1] "Diarrhœa should not be trifled with in a child of any age. . . . Delay in seeking proper advice is often the cause of alarmingly fatal attacks of this kind in early life."

Dr. Ellis further adds :[2] "Diarrhœa arises from such a variety of causes, and sometimes so rapidly passes into a dangerous symptom, that I feel great hesitation in advising any sort of domestic treatment

[1] *Disease in Childhood*, p. 136. [2] *Ibid.*, p. 184.

for it. The first inquiry which should be suggested to a mother by the appearance of diarrhœa should be into the food her child has partaken of, and her first duty to render it as simple and unirritating as possible.

"During the whole period of dentition, at which time diarrhœa is often a very troublesome visitor, it will often be found necessary to examine carefully into the diet, and to adapt it to the irritability of the stomach and bowels, which a little cause soon provokes."

There are three ways in general use for preparing rice water:—

1. The English is: "Soak a full teaspoonful of rice (Patna) in cold water for half an hour, pour the water away, and add half a pint of cold water. Boil this down to rather more than a quarter of a pint. When cold, strain and mix with a child's milk instead of ordinary water."[1]

"Patna rice has the least laxative action of all cereals."[2]

2. American: "Put two tablespoonfuls of rice, thoroughly washed, into a quart of water, and place near the fire, where it may soak and be kept warm for two hours; then boil slowly for one hour, or until the water is reduced one-half, and strain".[3]

[1] *Cabinet Cyclopædia.*

[2] Dr. Chambers, *Manual of Diet in Health and Disease*, p. 48.

[3] Starr, *Hygiene of the Nursery*, p. 233.

3. French: "Two tablespoonfuls of rice (having first washed in cold water); pour a breakfast cupful (half a pint) of boiling water on it. Let it stand half an hour. Strain."[1]

Of these three recipes for making rice water Dr. Pavy writes to me:—

"*July* 21, 1890.

"DEAR MADAM,—You have sent me recipes for making rice water according to the English, American and French plans. I have subjected them to trial, and consider the English plan the best. Under the French plan there is practically very little indeed extracted. The rice grain remained quite hard, and only material just upon the surface could have been removed. The product from the English recipe had the character of a more uniform decoction than that from the American.

"Yours faithfully,

"F. W. PAVY."

Sir William Roberts writes to me of giving to children who are not well, rice water (having merely boiling water poured on the grain) thus:—

"*Rice Water.*—There is very great objection to giving to invalids—especially invalid children—any form of farinaceous food that is not *perfectly cooked.* Merely pouring boiling water on the rice is insufficient. It

[1] *Journ. Pharm. et Chim.*

is far better to *boil*—and to use a smaller quantity of the rice—than to use a larger quantity of rice and merely pour boiling water on it."

Raw Meat Juice

Is given to infants in debility, in inanition and in wasting diseases, and with much success in such conditions of health. The necessity for giving raw meat juice to an infant presupposes a state, however, such as needs the advice of a medical man.

Dr. Smith, F.R.S., writes:[1] "A habit is arising of giving very strong broths and beef tea,[2] and also raw meat, to children who do not grow well. The latter is much to be condemned, since, whatever immediate value it may have in improving nutrition, it will certainly lead to the production of worms within the body, and thereby do much harm ultimately. The former may be given in moderate quantity, but only of moderate strength."

Dr. Barlow, speaking at the International Congress of Hygiene and Demography, London, August, 1891, on "Tuberculosis in children caused by milk and meat," said "the use of raw meat juice is dangerous".[3]

[1] *Practical Dietary*, pp. 133, 134.

[2] The receipts given are for broths and beef tea of moderate strength.

[3] *Public Health*, p. 137.

Professor Klein tells me, however, there is not the same danger with mutton as beef juice. It is with raw meat pulp that there is danger of the production of worms. Dr. Routh writes:[1] "Straining the meat, the worm is excluded". Dr. Cheadle also remarks: "The risk of ingestion of the cysticercus is small if only the finest quality of meat is used".[2]

Dr. Cheadle writes:[3] "Raw meat juice should be prepared by mincing finely the best rump steak, then adding cold water in the proportion of one part of water to four of meat. This should be well stirred together, and allowed to soak for half an hour, cold. The juice should then be forcibly expressed through muslin by twisting it. This process is the result of many experiments made for the purpose of ascertaining the best means of obtaining meat juice of the highest nutritive value. Raw meat juice is without doubt the best material for supplying proteid to the food of children who cannot digest a sufficient amount of the milk proteid casein. As much as 2 to 3 oz. of the juice may be given in twenty-four hours, if necessary, in place of milk casein. Even a larger quantity may be given when little other food can be taken. And here let me interpose a caution. Especial care must be taken to have raw

[1] *Infant Feeding*, pp. 348, 349.

[2] *Artificial Feeding and Food Disorders of Infants*, p. 100.

[3] *Ibid.*, pp. 97-99.

meat juice fresh. It does not keep well, and should be prepared afresh at least twice a day."

ANALYSIS.

Proteid (albumen)	5·1	8·2 total nitrogenous element.
Extractive -	3·1	
Salts - -	0·7	

Dr. Cheadle adds: "Mixed with milk it does not coagulate it—the taste is hardly perceptible in the mixture".

Dr. Angel Money gives the following explanation of how to extract the raw meat juice. He says:[1] "Take a quarter of a pound of raw meat and thoroughly shred or mince it in a saucer, then cover it with pure cold water, set aside for an hour in a cold larder, and finally strain it through muslin; it may be sweetened with sugar or glycerine when given alone".[2]

Of this Dr. Angel Money writes to me:—

"A small teaspoonful of brown sugar or 30 drops of glycerine is the usual amount required to sweeten the meat juice from ¼ lb. of lean mutton. Some infants prefer the meat juice without the sugar. These amounts of sweetening stuff never seem to upset digestion or to do harm. One infant affected with scurvy used to take meat juice and orange juice together with half a teaspoonful of sugar."

[1] *Treatment of Disease in Children*, second edition, p. 26.

[2] I have found glycerine act on the bowels with some children.

I have found rump steak the best to use, although I have used part of the undercut of a fresh sirloin of beef when I could not get rump steak. Abroad, mutton is used often in preference to beef.

Dr. Angel Money remarks in *Disease in Children*, page 339, after saying that raw beef may be "a source of tænia," that "mutton is preferable when raw meat is prescribed".

I give receipts for beef tea, chicken and veal jellies, and some puddings, suited for "baby diet," as they may be useful. I am not an advocate of the principle, "An unpalatable thing is generally a wholesome one". I think, on the contrary, food agreeable to the taste is not only nicer, but is also more nourishing. "What a healthy child likes it will usually digest; what it dislikes will disagree."[1] "My appetite is in several things of itself happily enough accommodated to the health of my stomach; whatever I take against my liking does me harm, but nothing hurts me that I eat with appetite and delight."[2] It is most cruel as well as unwise, forcing infants to eat what they dislike. Where any failure of appetite is observed the cause should be looked for, and if it continue a doctor should be consulted. When quite well, and what is given to them to eat is nice, they never refuse their food,

[1] Dr. Goodhart, *Diseases of Children*, second edition, p. 31.

[2] Montaigne, *Essay on Experience.*

and always enjoy their meals. A distaste to food shows some weakness or failure in health, and should be taken as a sure sign that a child is not *quite well.*

Dr. Cheadle writes:[1] "Beef tea is after all a very poor food for little children, and I have been much struck with the very small advantage they appear to obtain from it; sometimes," he adds, "it causes relaxation of bowels; and the children do not gain hardness of flesh and freshness of colour on it".

Mr. W. Mattieu Williams, F.C.S., in speaking of the making of beef tea, says:[2] "As the saline juices of meat are contained, for the most part, within the cell walls of the muscular fibre, or the sheaths of the bundles of fibres, we may avail ourselves of this mysterious action, and extract these saline juices by exosmosis. In spite of its unfamiliar name, it is one of the most familiar of kitchen operations, both useful and mischievous. When meat is rendered tasteless in the course of boiling or steaming, it is due to the exosmosis of its juices. On the other hand, in making meat broth, or soup, or beef tea, exosmosis is usefully applied to produce an intended result.

"The making of beef tea is a good example of this, especially when made by simple maceration,

[1] *Artificial Feeding and Food Disorders of Infants*, p. 94.

[2] *Cantor Lectures*, Society of Arts, "The Scientific Basis of Cookery".

i.e., by using cold water only. To work out the *rationale* of this, the distinction between colloids and crystalloids must be understood.

"Certain solutions perform the endosmosis and exosmosis I have just described, while others do not. On comparing them, it has been found that those which do thus pass through animal membranes are solutions of crystallisable salts, while those which do not are solutions that, when evaporated down, form jellies, mucilage, or amorphous, formless masses; hence the terms colloid and crystalloid. This being the case, it is evident that if we immerse a piece of gravy beef in cold water only one class of its juices will pass through the enveloping membranes; this class will include the saline juices of which I have spoken, and will not include the albumen, nor any gelatine that may be dissolved. If the beef is minced as in ordinary practice, a little of the albumen will be washed off the surface exposed by the cutting, and a modicum of gelatine may be dissolved from these surfaces. If, on the other hand, we stew beef in water heated just below the temperature at which albumen coagulates, more of this albumen will be washed out, and much more gelatine will be dissolved.

"Thus we shall obtain two kinds of beef tea, the first containing only those juices which are directly absorbed by the capillaries of the stomach, and thus pass directly into the blood; and the second con-

taining these same, *plus* some gelatine which has to be digested after the manner of solid food. In both cases the albumen is separated from the liquid by heating it to the boiling-point of water. It then rises to the top as a 'scum'.

"I have been asked which is the proper method of making beef tea: by cold maceration, by moderate stewing, or by boiling. The boiling may be at once dismissed, for reasons that will be understood by all who have listened to what I have said concerning the coagulation of albumen.

"The relative merits of the other two processes demand further consideration. If the beef tea is required for a very delicate invalid the 'cold-drawn' may be the best; but this conclusion presupposes a condition of the body demanding a supply of these particular saline juices, which perform certain parts of the work of nutrition, and appear to have a kind of stimulating influence. A skilful physician is required to decide whether this is or is not the case.

"If the beef tea is made for a convalescent regaining digestive power, and demanding full nutrition, there can be little or no doubt that the liquid prepared by digesting minced beef in warm water (which I prefer to call beef broth, or beef soup, restricting the name of beef tea to the cold-drawn) is the best. In this there is a little gelatine, together with abundance of the saline juices, which render the gelatine digestible and nutritious."

The following receipts were given to me by Mr. Mattieu Williams.

Beef Tea.

Pour a pint and a half of cold water on a pound and a half of finely-cut or chopped lean beef,[1] put in a covered[2] earthenware vessel. Place in the oven for two hours. By this means the whole of the soluble nutritious portions are extracted, and the insoluble fibre alone remains. Strain through an ordinary fine sieve into a bowl, and keep in a cool larder.

Chicken Jelly.

Prepare a chicken by taking off all the skin and fat, cut it into pieces, pound up with the bones, and place in a stone jar, with a pint and a half of cold water, and a pinch of salt, then tie down the opening of the jar with thick paper. Set the jar in the oven for two hours. One pound and three-quarters of veal[3] can be made in the same manner into jelly.[4]

[1] The shin of beef is best.

[2] Cover over with paper.

[3] The breast of veal.

[4] If these jellies do not turn out clear-looking and nice the cookery (not the receipts) is at fault. Either the heat of the oven is not properly regulated, or the bowl is covered over when they are put to set. *The jellies should turn out quite firm without the aid of gelatine*, and the grease on the top when cold should be white and clean-looking. Do not take the grease off *till the jellies are cold.*

Remove the fat before cutting up, and use the same quantity of water as above.

For a child of thirteen or fourteen months 7 or 8 ounces warmed of chicken or veal jelly, or for a change beef tea, with three-quarters of a teaspoonful of "tapioca de groult" added, makes a nourishing mid-day meal. Put the tapioca by degrees to the chicken, veal jelly, or beef tea while warming, and boil up for five minutes. The beef tea will require to be strained quite clear if tapioca is added.

Mutton Jelly.

Six shanks of mutton. Three pints of cold water. Half a teaspoonful of salt. Half a pound of lean shin of beef. A crust of bread toasted brown. Soak the shanks in cold water for twelve hours, then scrub them well. Put the shanks, the beef cut up, and the toasted crust of bread into a sauce-pan with the three pints of water, and let simmer *very gently* for five hours. Strain and put in a basin, and when cold take off the fat. Warm up as much as may be required.

Bread[1] Jelly

Is made thus: "A thick slice of bread (4 oz.) two or three days old, so as to be dry and sweet, and of

[1] "The giving of *slices* of bread and butter under the age of two years is injudicious. If the bread be at all new, large lumps are formed, whose exterior alone comes into efficient contact

seconds flour (since this is richer in proteid and phosphates than the finest white flour), is placed in a basin of cold water and allowed to soak for six or eight hours. It is then taken out, and all the water squeezed out of it. The object of this first soaking is to clear away the lactic acid formed in fermentation, and all other peccant matters. The pulp is then placed in fresh water* and gently boiled for an hour and a half. The object of this prolonged boiling is to thoroughly break up the starch corpuscles and to promote the change of starch into dextrine and grape sugar.[1] The thick gruel thus made is strained, rubbed through a fine hair sieve, and allowed to grow cold, when it forms a fine smooth jelly-like mass. This should be freshly prepared night and morning, for it will not keep long."[2]

Dr. Cheadle says of bread jelly that it has been used with success (with a small portion of milk

with the digestive juices. The interior of these lumps undergoes fermentative processes with the development of irritant products, which excite catarrh of the mucous membranes and cause nervous disturbances. The bread should always be second —indeed, I prefer third—day's bread, and it should be *crumbled* into the plate before allowing the child to eat it. Kept bread becomes drier and less coherent, 'crumbly,' and therefore easily broken up into particles whose collective surface area is very large and extensive, enabling the digestive juices to attack at once a large amount of material" (Angel Money, *Disease in Children*, second edition, p. 31). * One pint.

[1] See p. 71.

[2] *Artificial Feeding and Food Disorders of Infants*, p. 71.

added) for infants in cases of temporary intolerance of milk prepared in other ways.

Bread jelly, however, alone is not suitable, he adds, except as "a temporary measure".

The quantity Dr. Cheadle gives of jelly is "about one full tablespoonful to 8 oz. of warm water (previously boiled), so as to pass readily through the bottle; a little white sugar may be added".

Of milk he adds: "The quantity should be extremely small at first, especially if the child has already shown intolerance of cow's milk—two teaspoonfuls of boiled milk, or even one only to the 3 oz. or half-bottle. The milk may be gradually increased every few days, as the child is found able to digest it, the stools being carefully examined for sign of undigested curd. Thus the child may be gradually advanced to the requisite quantity of milk."[1] *Bread and milk made in the ordinary way must not be given to an infant.*

Port Wine Jelly

In theory has much to recommend it for invalids. In practice I have found that with children it is apt to upset digestion, and to my mind the want of exactitude as to the amount of wine given is against its use for *young children.*

Of the recipes for making port wine jelly, Dr. Angel Money's, which I append, is decidedly the best:

[1] *Artificial Feeding and Food Disorders of Infants*, pp. 71-73.

"*Port Wine Jelly* is made from half a pint of port wine, half an ounce of gum arabic, and of isinglass, an ounce of sifted sugar, and a fragment of cinnamon. These should stand all night tightly covered up. Next day put the jar containing the ingredients into boiling water and simmer till all is dissolved, then strain and let it stand till cold. It may be cut into fragments for use."[1]

Calf's Foot Jelly.

Calf's-foot (well washed); put on in three pints of cold water; bring it to boil; skim it well, then stew gently for six or seven hours till reduced to a pint and a half; then strain and let stand till cold; take the fat off. Put to it two whites of egg well beaten, and the egg shell crushed, then bring it gently to the boil and strain through a flannel bag.[2]

Calf's-foot jelly can be prepared without the white of eggs, but it is not so clear. Dr. Routh says:[3] "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;" and further remarks on the nutritive value of eggs in infant feeding, so that the

[1] *Disease in Children*, second edition, p. 33.

[2] To make the jelly a golden colour reboil, using the white of one egg, the shell crushed, and the peel of one lemon (no juice) with it; strain. For infants, however, the jelly should be as above.

[3] *Infant Feeding*, p. 330.

clearing of the jelly with the white of egg would in no way affect injuriously.

Chicken Panada

Is highly esteemed in France for invalid or young children's diets. "Roast off a young fowl; take all the white parts, and pound them with the crumb of a French roll soaked in broth; dilute these with a little chicken broth (made from the remains of the roasted fowl) to the consistency of a soft batter or creamy substance; pass it through a tammy as in preparing any other *purée*. Previous to serving this panada, it should be moderately warmed. . . . In the composition of every sort of dietetic preparation for the use of infants and invalids it is strictly necessary to avoid the use of herbs, vegetables, and spices; even salt should be used sparingly."[1]

PUDDINGS.

Sago Pudding for a Baby.

Half a pint of new milk, three teaspoonfuls of sago, two teaspoonfuls pounded loaf sugar; boil for twenty minutes, then bake lightly in a pie-dish.

Custard Pudding for a Baby.[2]

The yolk of one new egg (no white), half a teaspoonful of sifted sugar, five tablespoonfuls of hot

[1] Francatelli's *Modern Cook*, p. 108.

[2] At about thirteen months this pudding can be digested, and is perhaps more relished than either sago or tapioca.

milk. Butter a cup. Pour the hot milk on the yolk of the egg beaten up. Add the sugar. Mix, and pour into the cup. Tie a piece of paper over the cup, and put in water on the point of boiling in a sauce-pan on the side of the fire for a quarter of an hour.

Tapioca Pudding.

Put in a pan 2 ounces of tapioca, 1½ pints of milk, 1 ounce of white or brown sugar. A little salt, *just a pinch.* Set on the fire, and boil gently for half an hour till the tapioca is tender, stirring now and then to prevent it sticking to the bottom or burning; then put in a pie-dish and bake for a quarter of an hour.

Suet and Milk.

Miss Wood gives the following receipt for preparing this:[1] "Boil one ounce of finely-chopped suet with a quarter of a pint of water for ten minutes, and press through linen or flannel. Then add one small teaspoonful of bruised cinnamon, one ounce of sugar, and three-quarters of a pint of milk. Boil again for ten minutes, and strain. From a wineglassful to a quarter of a pint may be taken at a time. This is a highly nutritive and fattening food, but, if given in excess, is apt to cause diarrhœa." *I do not think it should be given except under medical direction.*

These latter, however, are generally liked later on (between fourteen and fifteen months), and form a suitable variety in the diet. Pudding is best given for the middle-day meal.

[1] *Handbook for the Nursing of Sick Children*, p. 235.

APPENDIX A

COW'S MILK WITH CITRATE OF SODA

CITRATE of soda has for some years now been used with success in England and America, as a means of lessening the density of the curd in cow's milk.

It presents four aspects :—

(1) It needs no elaborate preparation for use.

(2) It does not lessen the nutritive value of the milk

(3) It is effective.

(4) It is inexpensive.

"Rennet Curds" are by many of the leading authorities held to be one of the causes of the dyspeptic troubles of infants. These are prevented by the use of a decalcified milk. "Before Arthus and Pagès discovered that blood could be deprived of its coagulability by receiving it into solutions of oxalates and flourides, they had already discovered that milk in which the lime salts had been precipitated by these same additions would no longer clot with rennet," writes Professor A. E. Wright,[1] and adds, "I shall endeavour to indicate a possible practical application of this fact. Milk curdles under two entirely distinct sets of conditions: (1) it

[1] *The Lancet*, July 22, 1893.

curdles on addition of an acid and (2) it curdles under the influence of rennet (when the reaction of the milk is either neutral or slightly acid). The two varieties of curd which are obtained under these circumstances may be denominated 'Acid curds' and 'Rennet curds' respectively. Acid curds must inevitably be formed in the stomach after milk has been drunk, if the gastric contents are allowed to become acid. Such curds (we are familiar with them in ordinary life in the form, for instance, of cream cheese or sour milk) are probably not sufficiently firm to set up digestive disturbances. On the other hand, rennet curds (such as we are familiar with in the form of renneted milk and of ordinary cheese) may be extremely firm. It is, therefore, in all probability these rennet curds which set up the familiar infantile dyspepsia of bottle fed children. If this is so, the facts elicited by Arthus and Pagés would appear to be of dominating importance in the treatment of these dyspeptic conditions.

In order to appreciate this correctly, the following facts must be attended to: (1) rennet coagulation is delayed and curdling becomes less and less firm as an increasing proportion of the limesalts of the milk becomes precipitated as insoluble salts (Arthus and Pagés); (2) addition of soluble lime salts [1] (up to a certain maximum) causes increased rapidity of rennet-coagulation accompanied by increased firmness of clot (Arthus and Pagés); (3) human milk con-

[1] This fact does not appear to be taken advantage of, as no doubt it ought by the purveyors of rennet extract.

tains 0·03 per cent. of lime (Bunge); (4) cow's milk contains 0·17 per cent. of lime (Bunge). It is evident from these facts that the rennet coagulation in the human stomach could be delayed by precipitating a portion of the lime salts contained in cow's milk. It is further evident that a great proportion of the lime salts in cow's milk could be dispensed with without injury to the nutrition of the human infant, inasmuch as the infant, who does not need to walk for more than a year after birth, is fed with milk which is provided with a view to the calf walking almost as soon as it is born. Lastly, the question of a suitable precipitant for the lime in the milk comes up for consideration. As I have already shown, the salts employed by Arthus and Pagés were the fluorides and the oxalates—that is, salts which have poisonous properties and which cannot be employed in dietetics. In lieu of these, citrate of soda[1] may be employed as an efficient precipitant. I find in the samples of milk with which I have experimented, that an addition of 1 in 200 of citrate of soda—one fiftieth volume of 25 per cent. citrate of soda—suffices to prevent any rennet coagulation, whilst it can hardly be detected by the palate. Cow's milk with a somewhat less addition of citrate of soda would, with regard at any rate to its lime salts, constitute a true 'humanized milk.' If it should turn out that the acid curds are also contributory to the dyspeptic troubles of infants, super-addition of the

[1] This addition has already been employed in preventing the coagulation of the blood by Griesbach and Pekelharing.

customary bicarbonate of soda or lime water[1] would apparently be indicated."

Sir Almroth Wright's instructions are to add "1 grain of citrate to 1 ounce of milk, i.e., 10 grains of citrate, in the form of a powder, to half a pint of milk." Any chemist will supply these powders. The powder to be put with the feed of milk diluted in whatever proportion or way is being done. With the use of citrate of soda one difficulty sometimes has been found to arise, and this is constipation, but it can easily be put right by appropriate treatment. See p. 92 to 97.

The fault made in giving citrate of soda is very often giving it in too great a quantity, and when it is given with water, nurses are apt to be careless and keep the solution too long. If weak solution of citrate of soda is kept in a warm place, a fungus is apt to grow on the surface. That it can be good to give anything so affected to an infant no sensible person could possibly think, and the habit which has grown up of adding what is called a few drops (which in the hands of the careless nurse is sometimes almost a small teaspoonful) of chloroform to the citrate dissolved in water to prevent this is also bad for infants.

[1] Bunge (*Physiological Chemistry*, translated by Wooldridge) has pointed out with respect to the latter that lime water contains less lime than the cow's milk, to which it is added, so that, paradoxical though it may seem, milk diluted with lime water contains less lime than the natural milk. Lime water probably aids the digestion of cow's milk by virtue of its alkalinity, which postpones rennet-coagulation.

APPENDIX B

THE MODERN USE OF ASSES' MILK IN INFANT FEEDING

So much has been discovered, by scientific research, towards the rendering of cow's milk easy of digestion for infants, that now in the hospitals in Paris they give cow's milk,[1] and have given up the keeping on the premises of milch asses, as they used to do in years past. Asses' milk is, however, still [2] highly thought of and very largely used in Paris, and when ordered for some special sick or delicate infant either in the hospitals or elsewhere, is provided by Monsieur Nicolas Riotte, '*Fournisseur des Hôpitaux.*' It is still often prescribed in Paris for infants to take the milk direct from the ass, in which case Monsieur Riotte sends the ass selected (for asses differ in the quality of the milk they give) to the domicile so many times a day. This is done, also, if the milk is ordered to be given *immediately* it is taken from the ass. Asses' milk is of a very volatile nature. *It should not be boiled.* "Le Lait d'Anesse ne se fait pas bouillir, il sa fait tiédir au bain-marie au fur et à mesure que l'on en a besoin. Le déboucher

[1] See end of Appendix B.

[2] I have just returned from Paris, where I have made numerous medical and scientific inquiries.

et le mettre dans un endroit frais." This is the advice given with asses' milk put in bottle. In some cases, where people lives a distance away from Monsieur Riotte's establishment, an arrangement is made to keep the ass with its little one at some stable handy. If the young one is left with the mother, there is no trouble whatever, as it will nurse its little charge, taking care of its own offspring as well. Monsieur Riotte has a large number of milch asses in use. He sells and sends especial milch asses, for the use of delicate infants and invalids, to all parts of the world. I was told, that only quite recently some were sent to some very remote countries where some English and some Spanish people had had to go and live. They, it would appear, had young infants, and there are no cows in these parts. The journey and voyage is, of course, at the cost of the purchaser. Monsieur Riotte will send a man with the purchase, who will take charge of the animal for the voyage, and give instructions as to its care afterwards.[1] These asses are very hardy and strong. They are wonderfully gentle, quiet, kind beasts, and seem to know by instinct what is required of them, and take very kindly to the rôle of foster-mother. An ass costs from 600 to 700 francs. As the little one is given with it, and this is useful afterwards for other purposes, I think this constitutes a good bargain. Monsieur Riotte's asses are of world-wide fame, and are an especial breed which is kept from admixture with the breed of a common ass. They are said to be the direct descendants of the asses brought

[1] See end of Appendix B.

to Paris from Constantinople in the time of François I.[1] The milk given by them is very different from that of the ordinary ass. The address is

MON. NICHOLAS RIOTTE,
35, Rue de Surène,
(près la Madeleine,)
Paris.

[1] See p. 177.

Hospital des Enfants Malades
Rue de Sèvres, No. 149.
Mai 1, 1908.

MADAME,—

J'ai l'honneur de vous informer que nous ne faisons plus usage de lait d'anesse pour nos nourrissons ni pour nos malades. Aujourd'hui ce sont les laits de vache préparés (laits homogeneises, pasteurisés, sterilisés, babeurre, etc.), qui sont seuls employés par nos chefs de service pour le traitement des enfants malades confiés à leurs soins.

Veuillez agréer, Madame, l'expression de ma réspectueuse considération.

LE DIRECTEUR.

Hospice des Enfants-Assistés,
Rue Denfert-Rochereau, 74.

MADAME,— *Avril* 24, 1908.

Je m'impresse de vous informer que l'allaitement des enfants par les anesses a été supprimé pour des raisons d'ordre scientifique il y a plusieurs années.

Veuillez agréer, Madame, l'assurance de mes sentiments distingués,

LE DIRECTEUR.

Anesse à vendre depuis 500 fr. jusqu'à 700 fr. Voyage aux frais du client. Dans cette vente le voyage n'est pas compris ; il n'y s'occupe que de la débarquer, car nous la mettrons en chemin.

Le voyage peut se faire avec un garçon de la maison conduire les bêtes en payant son voyage aller et retour et ses petits frais. En vendant une anesse l'on donne les instructions, pour la soignée.

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"A careful and thorough piece of work is Mrs. S. H. Sadler's *Infant Feeding by Artificial Means.* The treatise contains the latest as well as the widest information on the subject."—*The Guardian.*

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"The three sections into which the work is divided deal with cow's milk and its preparations, the milk of other animals, and baby foods of all kinds; the last being a really valuable addition to medical literature."—*Birmingham Medical Review.*

"We must admire the patience and industry that have been necessary for the production of this work. We congratulate the authoress in producing a work containing such a large amount of reliable and valuable information on this most important subject."—*Quarterly Medical Journal.*

"The author of this book has certainly spared no pains to accomplish the object mentioned in the preface—the collection of information from standard textbooks, and the quotation of authorities on the management of children. She looks upon her work 'as the string which binds a rare nosegay of useful flowers (*i.e.*, facts) together.' It may well be described as a 'string'—a string of facts."—*Glasgow Medical Journal.*

"Mrs. Sadler has done her work very carefully, and has compiled a really valuable book, and deals exhaustively with the treatment of cow's milk in order to prepare it for infant feeding. An interesting chapter deals with the advantages and disadvantages of various patent foods. The book concludes with a number of useful recipes for young children . . . superior to anything else of the kind in the market."—*Baby.*

"This excellent manual is not only well stored with information necessary for mothers and nurses, but contains much that is of interest to the medical reader. The authoress has spared no pains in the collection of materials, and has consulted the best English and French authorities."—*The Lancet.*

OPINIONS OF THE PRESS

ON THE

SECOND EDITION

OF

"INFANT FEEDING BY ARTIFICIAL MEANS."

"We are glad to see that this sensible work has reached a second edition. It is clearly and simply written, and appears to convey the kind of information which will be of real use to an intelligent woman. Too many works of this class err by saying too little about general principles of hygiene and feeding, and too much about drugs, which are at best dangerous tools in untrained hands. From these faults this book is entirely free."—*The British Medical Journal.*

"This is a most valuable and comprehensive hand-book for mothers and all persons who have the care of infants. It contains a mass of information upon an almost endless variety of subjects connected with the treatment of infants and the young. The authoress gives plain, practical advice, and is evidently thoroughly competent for the task she has undertaken. She has given an exhaustive treatise, which cannot be too highly commended."—*The Family Doctor.*

"There are few things in regard to the upbringing of children in which the authoress has not something to say, and it is said in such a manner that one cannot help feeling that the advice is based on experience, and is tempered by considerable knowledge of children. In all the chapters on feeding are extracts from well-known authorities, to which the authoress attaches expressions of her own opinion; it is decidedly one of the best books which mothers can have." *Chemist and Druggist.*

"The high rate of infantile mortality is one of the disgraces of

this century, when so much is being done for the preservation of life. We recommend *Infant Feeding by Artificial Means* to women in general, a substantial and readable volume, full of information and of practical hints."—*The Hospital.*

"This book strikes us as one which mothers in the middle and upper classes of life ought to, and will, read. They will read it by instalments, chapter by chapter, and will find much to instruct and to interest them in its pages; the teaching of the book is sound, while the statements for which she is responsible have had the advantage of professional revision. Its authoress treats of child-life in a very discursive but pleasant fashion withal. It is easy to see that she is a woman of culture and wide experience."—*Health.*

"A very interesting and most instructive book."—*Illustrated Paper.*

"The training of our girls has certainly improved since the day when it was considered unladylike for them to learn anything but the so-called accomplishments, and perhaps a slight smattering of housewifery. But if, as we think, the main object of true education should be to prepare the child mentally and physically to perform efficiently the work of her future life, then it must be admitted our present system is still very incomplete. The importance to our race of the manner in which these duties are carried out can hardly be overrated. Yet the majority of girls are married without the vaguest notion of how to take care of the little ones who may probably be born. This book appears to us well calculated to supply this want as far as the feeding of infants is concerned, until the time when a course of instruction on hygiene and elementary physiology shall form a part of the regular curriculum for boys and girls. When this desirable state of things shall have come about, this work will still form a useful text-book."—*The Saturday Review.*

"A handsome volume and a veritable encyclopædia on all matters relating to the feeding of infants. There is much useful advice given at first-hand, which is written in a pleasant sympathetic manner, and there is also given in support of the author's views an immense amount of quotations from the writings of our leading medical authorities on the dietetics of infancy. Perhaps the most remarkable and useful feature of the book is the extensive acquaintance the author possesses of the standard and current literature of the subject she treats of, few pages being without footnotes, giving the 'chapter and verse' of the publications of her authori-

ties; and many pages have three or four such references. The book thus becomes a useful work of reference for young medical men and nurses as well as mothers, as it enables them to go back to the original sources of information; the book is one to be read at leisure by young mothers as a part of their domestic education. The information in the book is quite up to date, and numerous subjects which are daily discussed in the newspapers, such as the spread of disease by milk, adulteration of foods, etc., are explained in a way which it is impossible to find elsewhere except in professional works. It is a perfect mine of information, and a most instructive and readable volume, and it will be a most useful addition to the school matron's and mother's library."—*Physique.*

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