

JACOBI. (A)  
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INFANT FEEDING  
AND  
INFANT FOODS.

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BY

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## INFANT FEEDING AND INFANT FOODS.



MR. VICE-PRESIDENT, LADIES AND GENTLEMEN, MEMBERS AND DELEGATES OF THE MEDICAL SOCIETY OF THE STATE OF NEW YORK: I hold in my hand a report of the Committee appointed to co-operate with the New York Society for the Prevention of Cruelty to Children, "in all things pertaining to the physical and moral safety of infants and children." The report I refer to was read in last year's meeting, and has been widely distributed by the above-named Society. One of the measures contemplated and advised in it was, that there should be a place or places in large cities, where the infants and young children of the poor might be supplied, at cost, with the simple though sufficient articles of food. These simple and sufficient articles of food were milk, barley, oat-meal, and, for those no longer infants proper, eggs. Their value as infant food for those who were without breast-milk, was taken for granted, and considered almost in the light of an axiom. To make it so has been one of the duties of my life. Truth, however, is frequently suspected because of its very simplicity, and often do we see complicated and roundabout means and measures resorted to in preference to plain and direct ones. Now, what I have to say may, in part, appear very common-place and trifling, because of its application to common-place things and interests. But questions are involved which it has taken, and will still take, much time and labor to solve. To render the results hitherto obtained available, the normal feeding of the infants possible, and to protect them from the injuries inflicted by ill-directed love, ignorance, and the evil-devised plans and frauds of what is called commerce and industry, will be the object of the brief remarks which I shall have the honor to make before you in regard to the dangers to which our infants are constantly exposed.

Mortality amongst infants is very great. In Europe, out of one hundred born alive, eighteen die before they reach the end of their first year. Out of one hundred who die at all ages and of all diseases, in New York City, twenty-eight are less than a year old. The causes of these deaths vary; it is a characteristic fact, however, that of all those taking place in infants under a year, from 40 to 53 per cent. are the results of diseases of the organs of digestion.

Thus the attention of the physician called to see a sick child is mostly claimed by the alimentary canal. His care and that of the mother or attendant is therefore due to preventive measures mostly. The best preventive measure, and sometimes it proves curative, is the breast-milk of mother or wetnurse. That is an axiom, an undisputable law of nature, as long as the circumstances of the case are favorable. In view of the great mortality in the first two months, breast-milk is the one and indispensable food for those under two months. A mother who refuses to nurse *at least that time* for other than reasons of health or life, is an accomplice in causing, perhaps even the only cause of, the death of her offspring. It is true that a baby may be taken sick with intestinal disease in spite of being nursed at the breast, for there are *many* causes of disease; it may, however, occur that babies are taken sick *because* of being at the breast. And it is those cases that both mothers and physicians ought to be well acquainted with. Sometimes it is not the breast-milk which is at fault, in the beginning, but the faulty use it is put to. Many babies suffer intensely because they are not limited to intervals of from 2 to 4 or 5 hours, as required by either age or constitution. In their cases, by too frequent feeding, both the milk of the mother and the digestion of the infant, are impaired. Here regularity is the sole indication. Sometimes, though fortunately in few cases only, there appears to exist an idiosyncrasy not explained, on the part of the baby who cannot thrive on the milk of the mother, and may do so after a change of food. In many cases, however, there are demonstrable dangers in the very breast-milk of either mother or nurse; there may be an undue percentage of fat, or of cheese, or of salts, or of sugar, or even accidental admixtures. These may occur

in the secreting organ (thus blood may be found in the milk) or be traceable to the circulating blood of the whole system; of the latter they may be the very constituents, or foreign bodies floating in it. They can be classed as either morbid dispositions or as actual admixtures. Women suffering from constitutional syphilis, chronic consumption, or anæmia, extensive rachitis, severe nervous derangement, hysterical or other, those suffering from care and hard work, and those who are compelled to take a great deal of medicine, will serve their babies best by not nursing them at all.

In regard to the influence of the medicines, the opinions *have* been divided. It was claimed that milk being a secretion of the gland, and not a transudation from the blood, would not contain foreign material to any great extent. That is true so far as an absolutely healthy woman and normal milk are concerned. But the first period of lactation yields colostrum, not normal milk, and very often the latter is changing into a colostrum condition, such as it was soon after birth, containing different-shaped fat globules, more sugar, soluble albumen, in fact, real blood serum. This may take place in every case of impaired health. And the more serum of blood is contained in any milk, the easier is the admixture of soluble substances circulating in the blood. Such substances are ethereal oils, coloring matter, iron, iodide of potassium, arsenic, zinc, mercury, salines, bismuth, lead, antimony, nitrate of potassa, magnesia, all of which have been frequently found in the milk, and frequently missed. They will be missed the more frequently the healthier the woman and its mammary secretion. But, as I formulated the subject some years ago, milk secreted from an insufficient mamma, by a woman not in full health and vigor, by an old woman, by a very young woman, by an anæmic woman, by a convalescent woman, who has consumed a large portion of her albumen, be it circulating or tissue albumen, by a neurotic woman with frequent disturbances of the circulation—milk, in fact, which is not the normal transformation of the elements of the mammary glands, but consists of more or less transuded serum, is apt to be impregnated with elements circulating in the blood. The indications on one hand for the permission to nurse, on the other, for the administration

of medicines to a nursing woman, require, therefore, a greater strictness than is usually conceded. At all events, the good results obtained in many cases of ailment on the part of the infant, *by artificial feeding, in preference to nursing*, are better than accidental.

Those infants who are thus deprived of breast-milk, or never had it, or have an insufficient supply of it, require artificial feeding. The material resorted to ought to be as much like mother's milk as possible; and naturally, when human milk cannot be had, animal milks are selected. Amongst them only two are available to any extent, that of the goat and of the cow. If there be any objection to either, it is principally valid in regard to the former. For the chemical incongruities and other difficulties, to which I shall briefly allude in regard to cow's milk, are even more pronounced in the case of goat's milk.

My remarks of this evening I expect to be of a practical nature throughout, and brief. Thus I shall not try to go into chemical or physiological questions beyond the time allotted or the opportunity afforded. Therefore, I shall allude to but two points which it is interesting to appreciate, in order to understand why it is that cow's milk, as a sufficient substitute for mother's milk, must necessarily be a failure.

Human milk and cow's milk differ mainly in that the percentages, and probably also the properties, of fat and of caseine contained in them, differ widely. The percentage of fat in cow's milk is larger than in human milk, and, on close observation, we shall learn that woman's milk contains as much fat as the young digestive organ can tolerate. From what we know of the diastatic power of the infant pancreatic gland, we must conclude that its property of digesting fat is but slimly developed soon after birth; and daily observation proves that such is the case. When you examine chemically the normal alvine digestions of the infant, well mixed, uniform, and yellow, you will discover not only fat acids, but free fat to the extent of about 12 per cent. Some more fat leaves the intestines in a saponified condition. Many of the passages which have been believed to contain caseine in excess, because of their white color, were found to contain large quantities of fat. And all this happens when the normal infant is

fed exclusively on normal breast-milk. Now if much fat is not required nor absorbed under normal circumstances, if fat acids form so easily when the digestion is apparently normal, with the constant tendency of deranging digestion; if we know, as we do, that even normal breast-milk contains more fat than the infant has any use for, we must admit that in artificial feeding, with cow's milk or other material, we are in greater danger from giving too much fat than too little. Good milk has been called that which contains most fat, say from four to five per cent. The more cow's milk deserves the title of being good—that is, fat—the greater is the danger arising from giving it to infants without considerable modification. This result authors appear to gradually appreciate. When Forster fed a baby of four months with cow's milk and rice decoction in the proportion of 1 to 4, all the albuminous substances and sugar of this mixture had disappeared when the fæces came to be examined. Thus they were entirely digested, but of the ashes 34, and of the fat 30 to 40 per cent. were found unchanged. This experiment proves, in the opinion of Prof. Bollinger, whom I rejoice in quoting, that a milk less rich in fat is more adapted to serve as infant food than one with a large percentage of fat; and further, that cows whose milk is destined to be used as infant food, ought to be fed so as to reduce rather than increase the amount of fat contained in it. A good authority, Prof. Feser, makes the distinct statement that the milk he examined on the Alps of Switzerland, and which he prefers greatly as children's food, contained less fat than that from the cows in the neighborhood of a large city. If that be so, and it is so, I recommend as a matter of practice that the morning milk, with its lesser percentage of fat (butter), should be given, in preference to evening milk, if any at all.

Now, if the excess of fat be one of the causes why cow's milk should not be employed as infant food, why not remove it or diminish its percentage? Easily said, not easily done; for when milk is allowed to stand, and the cream to rise, the milk at the same time changes its reaction. Instead of being alkaline or neutral, it becomes acid, and acid milk is a danger which an infant must be protected from. Some years ago, Lefeldt and Delaval invented each an apparatus which, by rapid

centrifugal motion, separates the cream from the milk very thoroughly. Such an apparatus may, perhaps, be found useful in reducing the normal fat of cow's milk to an acceptable standard in the future. For the present, however, I know of no proceeding which accomplishes the end in view; and, while submitting to the unavoidable, I must protest against the avoidable occurrence which is reported to have taken place in a court of justice but lately. In one of the skim-milk police cases—and unfortunately there are less “cases” than adulterations—the expert for the defence, a well-known chemist, tried to clear his client by proving him a public benefactor, inasmuch as Dr. Jacobi objected to an excess of butter in the milk used for children.

*Caseine* is represented in cow's milk in a larger percentage than in human milk. To reduce its relative quantity, compared with the rest of the solid constituents, is possible by the increase of these only. There is no method by which its absolute quantity in a given amount of milk could be diminished, except such as would render the remaining part of the milk unfit for use. This diminution, moreover, would have to be a very thorough one, for a mixture containing more than 1 per cent. of caseine has been found to be indigestible by Hammarsten, and by Biedert. But these are not the only objections to cow's-milk caseine. Not only is its percentage in the milk too great; its chemical and physical properties *differ greatly* from that contained in human milk. Mineral, acetic, and tartaric acids, epsom salts, phosphate of lime, form a dense and hard coagulation with the caseine of cow's milk, while human milk coagulates in loose and small flakes only, under the same circumstances. Cow's milk, when introduced into the infant stomach, forms hard curds; if the organ be strong, or the infant liable to vomit easily, as most of them are, thick massive pieces of cheese are thrown up, and relief will follow. If no vomiting occur, these hard masses are propelled into the intestinal tract, where sometimes they give rise to obstruction. Sometimes, however, they irritate the canal to such an extent, that *diarrhœa* is the result. In both cases lumpy cheese is the main constituent of the evacuations. In every case of infant diarrhœa, the examination of the passages ought to be made; in many cases the appearances will

be found as described, and no case of the kind will terminate favorably unless the food be changed. To say that these cases will occur, would not do justice to the facts. They are very frequent, I have seen hundreds; but lately a child of sixteen months of age, and of six pounds in weight, was presented to me with the same symptoms, and with the additional remark, not only that everything had been done by the medical adviser to stop the exhausting diarrhœa, but also that a cow had been purchased for the sole purpose of furnishing pure milk for the suffering baby. That suffering baby was instantly improved when the pure milk was stopped, and more suitable food was substituted.

The objections to cow's milk, as the exclusive diet of infants, in place of mother's milk, which cannot be had, are dependent on its very chemical composition and physical properties. These cannot be changed by the most studious and successful attempts at procuring the most uniform and pure article possible. That, however, does not prove that a bad or indifferent milk is as good and useful as the very best milk from the very best cows. The inference is rather this, That the employment of inferior milk is criminal when good milk can be had through precaution, care, and industry. To have accomplished that purpose is the pride of several European cities. In some it was through medical societies that the idea was started and put into effect, to procure as good milk as cows of good stock, well fed under favorable sanitary conditions, could furnish. Stuttgart had the first establishment of the kind; that in Frankfort-on-the-Main commenced its operations in 1877, with thirty cows, and increased that number to eighty-one in 1881. The amount of milk produced, and delivered to consumers, in 1881, was 313,563 litres (quarts), more than ten quarts per cow daily. The establishment is private property, but to earn the support of the public, and to secure the desired co-operation of the physicians of the town, the proprietor bound himself not to engage in any other business, and solicited the control and advice of a committee, consisting of three delegates of the medical society, one veterinary surgeon, and one chemist. Great pains are taken in the purchase of animals of a good stock, all of them thus far being imported from Switzerland. Before they are

admitted, they are examined by the veterinary surgeon, who superintends the institution, and keeps a regular record of those who may fall sick. Two months before calving the milk is not sold at all. The age of the cows of from three to eight years is considered the only available one. The stables are well ventilated, and washed, drained, and connected with the system of city sewers. The floors of the stalls, the ceilings, and the lower part of the walls are cemented. The skin of the animals is looked after with great care. The stables are so near the city limits, that the milk cannot suffer by transportation. It is tightly corked in half-quart and quart glass bottles (this process being cautiously watched), and speedily delivered. Printed directions for its further treatment accompany the article. Besides, stress is laid on avoiding a prejudice on the part of the public, to which I have raised objection long ago with but very partial success, viz., not to select the milk of a special cow for the special use of the same individual, but to mix and equally distribute the milk of the whole dairy.

A great innovation for practical purposes, based on good experiments and long experience, is that no change of food takes place, and poisonous, purgative, or otherwise injurious admixtures to the food of the animals are avoided. Dry food only is given, viz., 15 kilog. (30 pounds) of hay,  $6\frac{1}{2}$  kilog. (13 pounds) of meal and bran, 6 grammes ( $1\frac{1}{2}$  drachms) of salt, and spring-water to drink.<sup>1</sup>

Human knowledge and foresight have almost exhausted themselves in these praiseworthy efforts. But the result of them all is *good cow's milk, and no equivalent for mother's milk*. But do I mean to say that cow's milk, given pure, or cow's milk mixed with water, is absolutely injurious, poisonous, to babies? Far from it. The undeniable fact that there are infants who thrive on that exclusive diet, or whose general condition of health remains such that no medical or medicinal interference in their behalf appears called for, would give the lie to such an exaggerated opinion. Still, there are a great many infants *who appear to*

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<sup>1</sup> Dr. V. Cnyrim, in "Frankfort-on-the-Main, Its Hygienic Conditions and Institutions." Ed. by Dr. A. Spiess, 1881.

thrive better than *they actually do*. Many grow fat and rotund on improper food, no immediate harm makes its appearance, and still you see many such as increase in weight, even more than the average infant, and still lay the gradual foundation to future ailing. For such fatness and rotundity means, too frequently, rachitis, and requires watching and change of food. Still, the number of infants remaining in good condition on that food is not very small. What does it prove? Nothing else but that the digestive processes permit of a certain latitude, that nature does not do routine work, and that the sum total of vital processes do not respond to certain occurrences, or influences, like reagents in a chemical test, where the same process always yields the same results. There is *no food on which certain infants will not thrive*. But when, in a large percentage of cases, the same unfortunate results are exhibited, and when these can be traced to their exact and uniform cause, that particular food is to be condemned. The assertion of many that cow's milk is an exact substitute for human milk, is the counterpart of that which claimed equality for animal and human blood. The practice, based upon this assumption, resulting, as it did, in the transfusion of animal blood into the human circulation, outlived itself very speedily.

Cow's milk, as a universal substitute for mother's milk, has lost its credit with many through the differences in the article; which, however, as long as no adulterations are perpetrated, are less marked than the same secretion of the human being. If that were not so, how does it happen that all over the civilized world substitutes are sought for, offered, and purchased, though milk be as cheap and handy as anything else? Why is it that to avoid cow's milk, untold risks are run in procuring more expensive, more unknown, and more unreliable vegetable compositions, which seldom keep the promises loudly displayed on the labels? What are these promises? What does it mean when they claim to take the place of mother's milk?

Mother's milk is considered the best prepared article of food known, though, as you have been told before, it may be—it could have been improved upon. Perhaps *it is* the best, though; at least there was a time when we all were of that opinion; for perhaps the sur-

plus of fat, which passes off undigested, may serve some purpose hitherto unknown. An ideal article of food must serve two purposes and consist of two classes of constituents. It must, in the infant, supply the growing tissue with material sufficient to take the place of that which is constantly wasted, and to allow a surplus for increase; and, secondly, supply fuel for the purpose of keeping up the production of an equable temperature and the functions of the organs, mainly those of respiration. The first requirement is fulfilled by the proteinous, or albuminous, substances, the other by carbo-hydrates. This statement would require modifications, if it were the object to be absolutely correct, for the two classes will supply each other, act vicariously for each other, even change into each other, under certain circumstances, in the complex machinery of the human system. The albuminous tissue-builder in the milk is mainly caseine, sometimes, also, albumen; the second class is principally represented by fat and sugar. In vegetables the first class is represented in the gluten, the second mainly in the starch. If you add, that in the milk, the ideal food, the proportion of the first class to the second is about 1 to 4, the vegetable substitutes are to be judged, in regard to their mere chemical composition, to that formula of about 1 to 4.

But it is not the chemical formula alone which determines the rank of a substance as a nutriment. To the equivalents of the chemical formula of cow caseine infant mathematics would not object, did not the infant stomach revolt against it. Thus it is not exclusively the chemistry of an article, but its digestibility, which comes into question. Now, not everything is equally digestible for everybody, sick or well, old or young, adult or child, child or infant, infant or newly born. And particularly is that so with regard to starch, which forms such an overwhelming part in the composition of vegetables, and particularly of those which are mainly used for the purpose of the manufacture of infants' foods.

Starch is changed into sugar and rendered digestible by the secretion of two sets of glands, the salivary glands and the pancreas. The latter does not possess that function before the end of the first month of life. The former begins to perform the same function, to a

certain degree, immediately after birth. The experiment has been made by Schiffer, Korowin, and many others. Starch, enclosed in a small bag, is introduced into the mouth of the infant. After a certain time the starch is found to be transformed into sugar. To collect fifteen grains of saliva in a baby of two or three weeks took from fifteen to thirty minutes; in a baby of two months, but one or two minutes. Thus two facts result from these experimental observations: 1. That starch is digestible at any age; 2. That the transformable and digestible amount of starch is but very small in the first weeks of an infant, and increases gradually. About the eleventh month the digestive property of the saliva is equal to that of an adult, when the quantities are equal.

The inferences to be drawn are: 1. That farinaceous foods may contain starch, but *starch must not be the main part* of the food; 2. That when they contain a great deal of starch it is best to change it, by a thorough baking process, into dextrine, which is changeable into sugar, and is easily absorbed and utilized; 3. That those farinacea ought to be selected for infant food in which the proportion of gluten to starch favors the former.

There is another consideration of vast importance, which, when the infant foods now in the markets were first manufactured, could not be known. Starch is not the same article everywhere. In different substances it requires different times to be transformed into sugar. Potato starch requires 2 to 4 hours, that of peas  $1\frac{3}{4}$  to 2 hours, wheat  $\frac{1}{2}$  to 1 hour, barley 10 to 15 minutes, oats 5 to 7 minutes, rye 3 to 6 minutes, maize 2 to 3 minutes.

Guided by these facts, I invite you to scan with me a number of farinaceous substitutes—their claims, promises, and powers. You will notice, there is not one of the men or companies who supply them but is loud in the praise of his gift to infancy; not one but ranks in his actual or alleged estimation as the arch-benefactor of mankind.

Justus von Liebig's (the great chemist) substitute consisted of the flour of wheat and barley malt, bicarbonate of potassium, water, and milk in certain proportions. For about twenty years this preparation has

been the subject of eulogies and reproaches, until in its original form it has been nearly given up; for its home preparation is not so easy as its inventor claimed.

It requires too much care and attention from a person of intellectual undersize. Besides, everything containing sugar is liable to decompose in summer by fermentation and moulding; all preparations *really dry* have a bad taste. Moreover, the phosphate of lime, which, it is true, is found in sufficient quantity in both wheat and malt, does not get into the solution, and finally, *for its preparation*, you always require *milk*, milk in winter and summer, milk in city and country, with all its actual or alleged dangers. Still more, it has, though prepared ever so carefully, proven unsuccessful in too many cases. Diarrhoea has often resulted from its use. Numerous attempts have been made to put it up for the market in such a shape that little time and no intellect might be required for its final use. *Loefflund's* article has the merit of being no fraud as far as I know; that of *Liebe* I paid attention to when it was first largely advertised for sale. A dozen bottles contained in a box were examined; their consistency and composition differed considerably. Another preparation, alleged to be compounded according to the prescription of the great chemist, is sold with the name of his son, *Herman von Liebig* attached to the recommendation of the label. He has a great deal *too much* to say in its praise. "1. This remarkable preparation accomplishes everything that can be expected of a substitute. 2. Although the flour is a perfect nutriment in itself, I still recommend on my labels its mixture with cow's milk. 3. Where good cow's milk cannot be had, condensed milk may take its place. 4. Infants fed on cow's or condensed milk, ought to have it mixed with my flour." You see the unsophisticated public must come to the conclusion that the object and destination of this food is no other but to be purchased.

Next in order is *Nestle*, as widely known as plantation bitters and cider vinegar. This food consists of milk, wheat flour (alleged to be baked, for the purpose of crushing the cellulose and cell membranes), sugar, and salts. As a chemical critic says (H. Mueller, in *Pharm. Centralhalle*, xvi., 1875, n. 34), he publishes no analysis but advertisements only; and he knew how to ad-

vertise. I remember well when the people of New York awoke one morning to find their libraries increased by a big pamphlet containing the new revelation. It was written by no less a person than an emeritus university professor of pathology, in his time a justly celebrated man, Lebert, who passed his very old age in the neighborhood of where Nestle had established his health, life, and money-breeding factory. Every such pamphlet commences with a declaration of principles. This begins by telling the reader that cow's milk is more "nourishing" than human milk; that, however, the addition of water does not make it any more similar to the latter; and that the nursling ought to have cow's milk at once alongside that of his mother—probably to improve upon nature's plan. Then why does he want or recommend substitutes, if cow's milk does so well? even better than well? For the simple reason that if people would feed their own cow's milk, they would not purchase Nestle's; and in order to induce them to do the latter, he tells you that your cows may be tubercular, may be fed improperly, their milk may be adulterated with water, or may contain disease germs. Nestle's cows are not tubercular, we have to infer, are not fed improperly, their milk cannot be adulterated, nor does it contain disease germs—indeed not. For it is the milk of *Swiss cows*, with such a halo round their horns, that even that public-spirited institution, called St. John's Guild, of New York, publishes an advertisement of Anglo-Swiss food, on the last page of its pronouncement on the bringing up and feeding of little children, which is distributed gratuitously, or for an annual contribution of three dollars.

We are assured that Nestle examines his materials very carefully, uses bread only made of the very best wheat, and the crust only; and that the starch is transformed into dextrine and sugar, under a pressure of a hundred atmospheres, by overheated steam. Thus Nestle's food is not only the very best nutriment for infants, but also for mothers who would fain raise a supply of milk in their own breasts, though it appears that that would be an uncalled-for desire in the face of all that is said about Nestle's food being a perfect substitute. All of which is respectfully submitted by Mr. Nestle's prompter, Prof. Lebert, or, perhaps,

rather by Prof. Lebert's prompter, and most of which is untrue.

Many years ago, fifteen or more, when Nestle and Lebert discharged their pamphlets, advertisements, and agents upon America, I was induced to try and employ Nestle's food; I could not say that in children of a few months or a year it did any harm; on the contrary, it was fairly tolerated by most of them. I consented even to add my name to those of others recommending the article—the only time I ever did so in my life. A few years after, another advertisement appeared which advised rather against the purchase of the former preparations and recommended the recent modification. It was then, at last, that I resolved to scrutinize what I had recommended in good faith without any examination. I found, 1, that the contents of a number of boxes did not closely resemble each other; 2, that the main substance was made up of starch; 3, that even the cell membranes were not equally crushed, and a great many not changed at all. It has also been found, and urged mainly by Eliza McDonogh (*Inaug. Diss.*, Zurich, 1877), that the fragments of the microscopic elements exhibit the appearance of mechanical destruction, and not that brought about by heat. J. Miescher also states that he finds no essential difference between Nestle and common flour. Iodine yields instantly its blue reaction; the starch elements are partly free, partly still locked up in their cells. Some particles are albuminous, they turn yellow with iodine. In his experiments the watery extract was alkaline, in those of McDonogh it was acid, and contained but little dextrine. Cnyrim found in the boxes examined by him, sugar and dextrine to the amount of 45.56 per cent., but still 20.76 per cent. of starch were left without any change whatsoever. And the result of Jacobsen's examinations is that the contents of the boxes are not alike.

Gerber, also a large advertiser, and Nestle's Swiss rival in America, claims to have improved Nestle's flour by a difference in the process of preparation; the methods of which, however, are not communicated. His flour is wheat, which is again praised as the one article containing all the material required by the growing body in the smallest possible bulk. The same

enumeration of the elements is made of an organic salt, and their mixture with organic substances is spoken of as if it were a new discovery. Potassium and phosphatic combinations, albuminates, carbon hydrates, fats, are whirled about in the most impressive and bewildering manner by every one who has a cheap article for sale at a high price. The greatest stress is always laid on the presence in the article offered for sale of all the chemical elements necessary for the building-up of the body. But that presence alone, I repeat, is not sufficient; chemical figures and equivalents still enjoy too much respect and a sort of superstitious veneration. *A thorough preparation preliminary to digestion* is required, though the proportion of elements in a mixture were ever so appropriate. In regard to wheat, however, *this proportion is not the very best* at all, for wheat contains more starch than do barley or oat-meal.

In regard to both of them, Nestle and Gerber, Drs. Altherr and Lorch, in a little book entitled "On the Weighing of Infants for the purpose of determining the Nutritive Value of Woman's Milk, Cow's Milk, Nestle's and Gerber's Flours, and Liebig's Soup," Erlangen, 1877, have no great praise to bestow. Both are declared to be improper foods for the newly born and infants in the first few months; but they admit in the later months of life, when farinaceous foods of all kinds are well tolerated, they also may be given in the same manner. Similar observations have been made in the Child's Hospital, at Berne, Switzerland; and similar remarks are due to the *Anglo-Swiss Food*, which contains milk, some gluten, and plenty of starch, like the others.

In all of the twenty-two European infant foods examined by Eliza McDonogh, the starch was never changed to such a degree as to render the recognition of its source impossible. Wheat, corn, rye, barley, could always be recognized under the microscope. A number of the granules were broken up it is true, but many more were intact. Thus, not even the very exact and uniform distribution of the starch is accomplished. All of them consist of baked flour of some kind, either by itself or mixed with sugar, milk, or salts. There are some, however—for instance, that of Hartenstein—consisting of wheat and oats, which has not even undergone the baking process.

Part of these European preparations have been naturalized with us. Some have made a great reputation, and probably money for many beneficent manufacturers, agents, and salesmen. But they are not alone in the field. Saul slew a thousand, David ten thousand. Europe has twenty odd infants' foods, America more than twice that number. Infants must no longer complain of lack of interest roused in their behalf.

Nature is the same all over; the nature of all natural things alike; that of wheat, oats, and manufacturer, wherever they be found. Thus the same results in regard to the composition of "infant foods" are reached here as in Europe. But a few days ago I was pleasantly surprised by the brief statements of Dr. E. Cutter, who, for *Gaillard's Medical Journal* (Jan., 1882), has undertaken the task of studying (microscopically) all the infant foods in our market. His researches, naturally, refer mainly to the proportion of gluten to starch. And some of his statements I shall refer to here, desiring to give them the greatest possible publicity. I wish the brief article of his would be distributed in a hundred thousand copies, reprinted in every secular paper, read from every platform and pulpit of the land. For it is time that fraud should be stopped, and a nefarious trade suppressed.

Amongst the better preparations are *Mellin's Food*. It claims to be the only substitute for mother's milk, and not farinaceous. It is not the only substitute, but the starch is converted into dextrine, as in *Horlick's Food*.

*Franklin Mills Wheat Flour* contains more gluten than most of the rest. So does *Arlington Wheat Meal*, which is ground coarsely, and contains much gluten. Also *Hawley's Liebig's Food*, which contains wheat gluten cells, barley gluten cells, barley tegument, wheat starch, and cooked granular masses, which do not polarize light.

*Mead's Mulled Wheat Flour*, a coarse flour or meal, which does not polarize light well; a good preparation.

*Baby Sopa* is made of unhulled oats, malted and crushed, and contains all its elements; gluten cells of characteristic shape, and starch grains smaller than those of wheat.

As you descend the ladder, there is *Keasbey & Matti-*

*son's Infant's Food.* No gluten cells; consists of grape sugar and dextrine, and claims to contain alkaline phosphates.

*Mother's Breast-milk Substitute* is better than its ignorant advertisements; it contains gluten cells, bundles of wheat starch, barley starch, and gluten granules.

*Imperial granum*, the salvator for invalids and the aged, an incomparable aliment for the growth and protection of infants and children, a superior nutriment in continued fevers, and a reliable remedial agent in all diseases of the stomach and intestines; that which makes strong bone and muscle; that which makes good flesh and blood; that which is easy of digestion, never constipating; that which is kind and friendly to the brain; and that which acts as a preventive of those intestinal disorders incidental to childhood—*Imperial granum* food, which claims that the starch, impurities, and soluble matter are effectually excluded, and that the gluten only is retained, *shows no gluten cells under the microscope*, and is no better than it should be, no better than common flour, which, when fine and white, is deprived of three-fourths of its gluten, and no better than *Savory & Moore's Food*, which is also like common flour. (E. Cutter.)

*Ridge's Food* is advertised as "a perfect food for infants." Ephraim<sup>s</sup> Cutter tells you how perfect a food it is. It contains the beard of wheat, wheat starch mass, starch bundles apparently of maize, caked mass of starch which does not polarize light, starch grains, starch granules, and small gluten granules. And he adds: "The proprietors must add gluten cells, at least in the proportion found in wheat or maize, to bring the product up to the standard of wheat flour."

*Crosby's Brain and Nerve Food*, which claims to be composed of vitalized phosphates from ox-brain and wheat-germ, consists almost exclusively of starch. There are no characteristic gluten cells, no nerve-fibre, no axis cylinder fibre, no ganglion, nor multipolar cell. The advertisement claims that the brain is that of the ox, but the label states that the brain is that of the fish. Label advertises 730 parts of starch in 1000, claims some gluten; if this exists, it is the granular gluten of common flour. There are 270 parts of so-called vital-

ized salts asserted to be in this food; that is, salts in connection with the organic substances named. If this be so, all the albumenoids in all the foods in the market are vitalized, also. There is but little gluten, if any, in this food. (E. Cutter.)

*Blanchard's Glutena*, 90 per cent. of starch, 10 of gluten, the reverse, exactly, of the claim made for the food.

*Blair's Wheat-food*, abundance of starch, no gluten.

*Redmond's Cerealine*, starch, very little gluten.

*Durkee's Glutena*, wheat, almost exclusively starch.

*Farwell's Gluten Flour* is advertised as "gluten left behind after the starch is blown out," contains starch, almost no gluten.

*Victor's Baby Food* is said to "resemble mother's milk closely," and is like cracker and biscuit ground up.

*Taylor Brothers' Pure Bermuda Arrow-Root* consists of potato starch, with an occasional addition of arrow-root.

*Hubbell's Prepared Wheat*, almost exclusively of starch.

No gluten is contained in *New York Food Company's* cold blast flour, barley flour, buckwheat flour, India wheat flour, Lost Nation wheat flour, Common Minnesota flour, Hazleton flour, Puritan flour, Patapsco flour, Underwood flour, fine granulated wheat flour.

*Gluten Flour, New York Health Food Company*, is common flour. The most superficial examination exhibits starch in abundance.

After all this, with all my heart I assent to E. S. Gailard's editorial remarks, which are as follows:

"It is almost criminal that such great questions, affecting the health, and, therefore, the happiness and wealth of a nation, should be left to the ignorance of the miller and the baker; to the foolish customs of society, to the equally foolish test of the mere appearance of bread, and to the fashionable restaurants and hotels. Manufacturers of foods for the sick, and, above all, for infants, should be held to the strictest accountability. It is the highest duty of the physician to learn the facts in regard to meal foods, and to use his information for the benefit not only of the sick, but of the whole community." And experience shows, that as the

committee report referred to expressed it last year, the community insists, with the utmost pertinacity, upon giving their babies, as soon as weaning time arrives, or before, such articles of food as they know nothing about. When an adult sits down to a meal and finds placed before him articles of food with which he is not familiar, he makes inquiries in regard to such articles before eating them. The baby, however, is credulously fed upon things with which the child, father, mother, or doctor has not the least familiarity; all of these foods which are sold in large quantities have a composition which is unknown to the public. When a manufacturer deigns to say anything about his merchandise, it is to the effect that the food offered is the best in the market, that it is the proper thing and only thing for children and invalids of all ages, that the relation of the albuminous substances to carbó-hydrates is exactly correct, and that a package costs a certain amount of money. In regard to this subject the public appear to be smitten with absolute blindness. They insist upon forgetting that the man who offers for sale, and advertises at a very heavy expense, does so, as society is constituted, for his pecuniary advantage solely. To say that when the article offered is not good it will find no market, is deceiving yourselves, experimenting on your baby, relying on the character of a single man or corporation, on the honesty or intelligence of the manufacturer's chemist, or his superintendent, or his workmen, on the nature and condition of the elements used in the composition of the article, and on ever so many influences, which can work before the manufactured article gets into the hands of the consumer. Why the sellers and advertisers of unknown compounds should be more trusted than those who raise and sell a simple article of food, such as milk, which is constantly adulterated, can hardly be perceived. Is it necessary to say that the factory furnace is lighted more in the interest of the proprietor than for the benefit of the public?

Still, in regard to the growing evil, which has assumed vast proportions, the profession is at fault, to a certain extent. There are but few but are aware of the inexpediency and sometimes danger attending the exclusive feeding of cow's milk, and look for substitutes. Examples of infants thriving on almost any food are numer-

ous; the public taste runs in the direction of the unknown; thus the responsibility of advice or assent is but a slight one; many of the foods in the market come in a pleasant form and convenient for use; thus the food-business firm certainly thrives. Professional men have become used to look upon the sale of patented foods as something quite unobjectionable. Those imbued with the strictest sense of ethics, who would not patent an invention, nor tolerate the fellowship of a professional man who so does, who frown upon patented medicines, because they are unknown and unknowable compounds, who object to reducing medical science to a mercenary standpoint, these very men forget their habits and principles when the question of patent-right and secrecy comes up in regard to patent foods. If I add, that many of the scientific journals of Europe, particularly those in Germany, dedicated to the study of children's diseases, are frequently used for the purpose of discussing the merits and effects of some new infant foods, it is only to show to what extent the evil has grown.

No profound thinking is required to appreciate the fact that a great many of the articles offered for sale are unmitigated frauds; and that a few are available compositions. But the very fact that they are compositions, that everything organic may spoil, that every compound depends on too many circumstances which are apt to interfere with its uniform condition, and that when you rely on a compound, you rely at the same time on a proprietor, his foreman, his workman, his chemist, you feel that you are easily deceived or disappointed. Besides, for an article, the constituents of which you can purchase at a low price, you are taxed to an inordinate extent.

And why all this? Because cow's milk is found to be defective, when compared with mother's milk. These defects I have pointed out. It contains too much fat, and too much caseine, the latter of abnormal condition. Instead, however, of correcting the faults of milk, the latter is simply superseded and exchanged for something else. Is potato starch or even wheat, more similar to mother's milk, than is that of the cow? Now the proportions of fat and caseine can be regulated by the addition of water; but dilution is not the only func-

tion of the water added to the milk ; the digestibility of the latter is also increased.

When albuminous material is subjected to artificial digestion with pepsin, and the process ceases, it recommences when more water is added. When the amount of water in the mixture is large, digestion will take place in a lower temperature than without it. Many digestive disorders in the living are due to lack of water, particularly in infants, who seldom or never are supplied with it in addition to what they obtain in their regular food. Infants who are apt to perspire much, either well or rachitic, who are kept in warm beds most of the time, who are exposed to summer heat, and lose much moisture through their skin, ought to be offered water a great many times in the course of the day. Particularly fat infants, who are mostly developing a rachitic or scrofulous disposition, ought to drink plenty of water. It accelerates tissue changes, and, therefore, animals which are to be fattened are habitually deprived of water. The rule then holds good in infant alimentation, that food, whatever it be, shall be given in considerable dilution.

But in the face of all the advantages water has, it is by itself not the proper dilution for the *caseine of cow's* milk. Some admixture must be found which is apt to overcome the dense coagulations of caseine referred to before. The particles of caseine must not be permitted to remain in close juxtaposition, but separated from each other to such an extent that coagulation in the stomach will take place in small loose flakes of the kind presented by curdling mother's milk. This object is accomplished by all farinaceous substances, without regard to their large or small percentage of starch ; also by gum arabic, and gelatine. Of the farinaceous substances, I have but two to recommend, barley and oat-meal. And for good reasons. The starch they contain is more easily dissolved and transformed by saliva than that found in wheat, which is the stock in trade of the infant-food manufacturers. And, moreover, there is less of it in them than in wheat.

The barley and oat-meal are the two substances I mostly employ, as their chemical constituents are nearly alike, with the exception of a large portion of fat in oat-meal, which is not found in barley. Barley water,

or thinned and sweetened oat-meal gruel, may be given to the child even at the breast. The indications for the use of one or the other lie in the condition of the infant. Where there is a decided tendency to constipation, I prefer oat-meal; where there is no such tendency, as usual, or perhaps even a tendency of the bowels to be loose, I employ barley. The "prepared" barley is a good preparation for older children only, for the whiter it is the larger is its percentage of starch. It is safest, as no mistake or deception can then take place, for every mother to grind the whole barley in a common coffee-grinder of her own. The younger the baby the more advisable does it become to boil the whole barley for hours, to secure the contents of the bran. A teaspoonful of either is boiled in from five to eight ounces of water, with some salt, for twelve or fifteen minutes, the decoction to be quite thin for very young infants, thicker for later months, and then strained through a linen cloth. Infants of four or six months are to have equal parts of this decoction (which ought to be made fresh for every meal), and of boiled cow's milk; some sugar besides. At an early age, the thin decoction, at a later, the milk ought to prevail in the mixture, which ought to be given at a temperature of 80-90°. The newly-born, which has to wait some days for his spring to open for him, is best fed with a mixture of from four to (in summer) six parts of thin barley water, and one part of boiled milk. A baby of two months will take the same mixture in the proportion of from two or three to one.

I beg leave to quote a single author. Biedert, a conscientious worker, the author of competent contributions to medical science, and particularly to infant hygiene, himself the inventor of a cream mixture for the use of well and sick infants, expresses himself in the following manner in the very circular accompanying his preparations: "The first demand on a method of nourishing infants must be this—that the nutriment is tolerated by all infants, including the feeble and sick, in a manner similar to mother's milk. Now I have found that a food coming up to this requirement, must not contain more than 1 per cent of caseine. Accordingly, cow's milk must be diluted with an indifferent thin decoction (oat-meal or barley.) In the beginning, the

dilution must be in the proportion of 1 to 3 or 4; this admixture must be gradually reduced. This is the very mixture which surpasses all compounds thus far recommended, and all the artificial preparations." And still in the face of this testimonial, than which I do not wish a more positive one, he invents a cream mixture.

Though my remarks must necessarily draw to an end, I must not close without at least *one additional word* in regard to some other constituent of infant food, Beside sugar, which is required both by taste and physiological necessities, the addition of common table-salt in moderate quantities both to cow's milk and to farinaceous substances is advisable.

The addition of chloride of sodium to the food is the more important the more the milk is mixed with a vegetable decoction. Carnivorous animals crave no salt; herbivorous, however, a great deal, although in their food the *absolute* amount of chlorine and sodium is as large as in that of the former. They are easily drawn by hunters into fields and woods strewn with salt; and the instinct of mankind has early taught how to add more salt to herbaceous than to animal food.

We find that the craving for salt grows in proportion to the amount of potassium salts contained in the food. In that of herbivores there is twice or even four times as much potassa compared with its chloride of sodium as in that of carnivores; potatoes, with their large amount of potassium, combined with chlorine and phosphoric and citric (pomic) acids, necessitate the addition of large quantities of chloride of sodium. In the food of carnivores, however, who eat whole animals, one equivalent of potassium is nearly balanced by one of sodium and one of chlorine.

Potassium salts and soda salts both exist in the blood, the former principally in the blood-corpuscles, the latter entirely in the serum or watery part of the blood. There is chloride of potassium in both corpuscles and serum, but phosphate of potassium in the corpuscles alone. Now if there should ever be in the blood more phosphate of potassium than can be taken up by the corpuscles, it will be immediately decomposed by the chloride of sodium in the serum—chloride of potassium and phosphate of sodium are formed, and these are both

rapidly eliminated by the kidneys, and pass away in the urine. By this means, chloride of sodium is carried away, and must be replaced: in other words, vegetable food requires the addition of a great deal of salt.

The substitution of cow's milk for woman's milk necessitates the addition of salt, for a similar reason; for while 1000 parts of human milk contain only 0.70 chloride of potassium, 1000 parts of cow's milk contain 1.30

There may be infants—I have been told of more cases than I have seen myself—who do not bear barley. Others may not bear oat-meal. If so, or if for some reason or other it is wise or whim to discontinue them, it must not be forgotten that, though feeding a breastless child *without* cow's milk, appears preposterous, feeding with cow's milk *alone* is dangerous. I do not permit it. I want an admixture at all events capable of diluting, as it were, the caseine. For that purpose, and for that alone, I formerly recommended gum arabic or gelatine. However, our knowledge of these substances has since improved. Prof. Uffelmann, in Rostock, had a little patient, otherwise healthy, who carried a gastric fistula. Through a large opening in his abdominal and stomach wall, he experimented on the child's digestion. Unmistakable and numerous observations taught him that both arabic gum and gelatine are not only emollient and soothing, but directly nutritious. Thus the list of those substances which may be added to boiled cow's milk, to make it available as the regular food for infants, is by no means small. They all come up to the requirements we look for in such substances. They must be perfectly simple and recognizable. They must be accessible, and for sale everywhere. The mode of preparing them must be perfectly simple and easy. They must be cheap.

They must be as nearly the substitute of mother's milk as an imitation can be like the original. They must be alike for throne and den, for Fifth Avenue and Mulberry Street, for the wet-nurses for the throne and for Fifth Avenue come also from the dens and from Mulberry Street. It is not wise to forget that nature is republican in principle and democratic in practice. If too often there be no equality before a court of so-called justice, *there is* equality before that of physiological law.



