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CONDENSED MILK

THE importance of milk as an article of diet is so great that anything offered as a substitute for it, or that renders it more available as food, demands attention. The composition of cow's milk is so nearly like woman's milk that the addition of a little water and sugar may be said to convert the one into the other; hence the practice of giving cow's milk to young children, and making it a substantial article of their diet long after they have cut their teeth and are able to masticate bread and meat. No inconsiderable quantity of milk is also consumed by adults, and its nutritive effect is not exceeded by any article of diet, as it contains all the constituents that are necessary to the perfect nutrition of the human body.

There are, however, several drawbacks in the use of cow's milk which diminish its utility, limit its use, and sometimes render it dangerous. One of the great drawbacks in milk is its liability to decomposition. The sugar it contains becomes acid, the caseine separates in the form of curd, and a fermentation ensues which renders it unpleasant and sometimes even dangerous as an article of diet. The latter effect is seen more particularly in young children. During the summer months they suffer extensively from diarrhœa, and there is little doubt that this is largely due to the acidity of the milk which is given to them. Milk bought in the morning in London is frequently unfit to be used in the evening for the diet of infants. These changes in milk are hastened by the present system of bringing milk to London from a distance in cans, by which means it is shaken, and its tendency to change hastened.

Another drawback in the use of milk is its liability to adulteration. Unfortunately the agent by which milk is adulterated, is easily accessible and can be detected with great difficulty. We cannot instruct cooks and poor people in the use of lactometers and hydrometers by which the learned test milk: moreover, the natural liability of milk to vary is very great. Thus the quantity of cream in milk received by the Aylesbury Condensed Milk Company varies from 9 to 17 per cent. Dr. Hassell states that the cream given by the milk of a cow, the milk of which he personally inspected, was but 4½ per cent. Although then all milk containing less than 9 per cent. of cream may be suspected of adulteration, yet it may happen that a milk containing but 4½ per cent. may be really not adulterated with water at all.

This varying quantity of cream also shows that even when milk is not adulterated it is liable to great variations in the quantity of cream which may be taken as the measure of its usefulness as an article of food.

Many attempts have been made to overcome these objections to the use of milk, and from time to time preparations of it have been sold by which freedom from acidity and adulteration are secured. The most available of these preparations have been those that submitted the milk to a process of evaporation by which more or less of the water naturally contained in milk is got rid of. By these processes the nutritive constituents of the milk are retained; the preparation keeps for some time, is easily conveyed from place to place, and by the addition of water milk, so to speak, is readily manufactured. None of these preparations, however, seemed to succeed till a process for making what is called "Condensed Milk" was introduced. Whether America or Europe has the honour of the invention we need not dispute here. It is now made in this country by thousands of gallons daily, and its manufacture may be witnessed on a large scale at Aylesbury.

Although the process of evaporating milk may be regarded as an exceedingly simple one, the attempt to carry it out at Aylesbury on a large scale has developed a complicated machinery in which steam power is extensively used; 200 persons are employed, and the milk of 1,200 cows, each yielding 14 quarts, is daily evaporated. The milk used is brought from farms in the neighbourhood in ordinary tin cans. Each can before it is sent to the factory is carefully tested by the taste and smell and the lactometer. Any doubtful specimens are set aside for re-examination or rejection. The milk is then passed into a vacuum pan, and the vapour thus produced is carried off and condensed and thrown away. When the milk has acquired a proper consistence it is mixed with sugar. This addition of sugar is the distinguishing feature of the condensed milk process. After this the milk is still further condensed till it reaches the required consistence, and is run off into the little tin cans which are so well known. The whole of these operations are carried out with a regard for cleanliness, which would look almost fastidious if it were not known that a single particle of decomposing milk allowed to get into the receiving pans might destroy the whole mass. Every can is returned thoroughly cleansed to the farmer who sends it, having been first submitted to hot water, then to a jet of steam, and then rinsed out by a jet of cold water.

The condensed milk thus prepared is of a semi-liquid consistence, and can be taken out of a jar with a spoon. Several analyses of this milk have been made. The late Baron Liebig found that it contained—

Water	22·44
Solids	77·56
	100·00

The *Lancet* has more recently published the following analysis:—

Moisture	25·10
Butter	11·73
Caseine.	15·17
Milk sugar.	16·24
Cane Sugar	29·46
Ash	2·30
	100·00

From these analyses it will at once be seen that the only perceptible difference between condensed milk and ordinary milk is that the former contains more sugar and less water than the latter. Both these things are necessary for attaining the objects for which condensed milk is manufactured. The diminution of the bulk of the water from 87 per cent. in ordinary milk to 25 per cent. in the condensed secures diminution of the bulk of the milk, and thus renders transportation comparatively easy. The condensed milk is easily converted to the condition of ordi-

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nary milk by the addition of either cold or hot water. The addition of the sugar is found to be necessary, in order to enable the other constituents to resist decomposition. Milk will keep any length of time when entirely desiccated, but by the process of drying entirely the milk loses its flavour and many of its properties. The semi-liquid condition of condensed milk prevents these changes, but in this state it is liable to decompose; hence the necessity of additional sugar.

The question arises as to whether this added sugar in any way interferes with the quality of the milk in its relation to the diet of infants or invalids. In comparing human milk with cows' milk, we find that the latter contains more caseine and less sugar than the former. Hence, when given to children it is customary to add a little water and a little sugar to make it like mother's milk. This object is really effected by the addition of cane sugar to the condensed milk, and it may therefore be unhesitatingly employed in the nursery as a substitute for ordinary cows' milk.

After a personal inspection of the Aylesbury manufactory, and a full consideration of the whole subject, we are quite prepared to say that where good fresh cows' milk is unattainable, as it is almost practically so in our large towns, there is no substitute for it equal to condensed milk. Nor is this a matter of theory; hundreds of gallons are being used every day in London, and most of it under the direction of experienced medical men. One medical man assures us that he has a healthy, fine-grown child of ten months that has never taken anything but condensed milk.

As the diet of invalids, it may in some cases require watching when the action of sugar is injurious to the system: but in these cases milk should be altogether interdicted.

It is to be hoped that no disadvantage in the use of this agent has been overlooked, as the advantages of its use are so many and so obvious. It presents a pure form of milk in a condition in which it may be kept for any length of time, and is not injured by removal. It is always at hand night and day, and by the addition of cold or hot water can be converted into nutritious and wholesome food. . . . . E. LANKESTER

THE PHYSIOLOGY OF MAN

The Physiology of Man. By Austin Flint, Jun., M.D. Pp. 470. (New York: D. Appleton and Co., 1872.)

WE have already had to speak in terms of high commendation of Dr. Flint's comprehensive treatise on human physiology, as being written in a clear, methodical, and judicial style, the statements made being carefully weighed, and in most instances supported, by the best, if not the most numerous, authorities; whilst the author has in many parts enriched it with the results of his own important researches. The present, which constitutes the fourth volume of the work, is no exception to our remarks. It is occupied with the consideration of the nervous system, excluding the special senses, and gives a very complete account of that difficult and extensive section of physiology, the study of which has engaged the attention of so many of the best workers in all civilised countries during the past twenty years. Dr. Flint commences by a short *résumé* of the principal facts that have recently been made out in regard to the structure of the nerve-centres and cords, and the mode of termination of the nerves in muscle, gland, and skin; entering into the subject perhaps as far as is necessary in a strictly physiological work, the author taking Schultze's article in the recently published "Handbook of Histology" of Stricker, Kölliker, and Robin as his guides. The first chapter concludes with an account of the recent observations of Voit on the regeneration of the cerebral hemispheres after their ablation, which show that a large portion of these bodies may be reproduced, and that the organ may recover its functions to no very inconsiderable extent.

The second chapter deals with the general functions of the motor and sensory nerves, and gives a very fair account of the history of the discovery of the difference in the function of the anterior and the posterior roots, due prominence being given to the claims of Walker, Mayo, and especially of Majendie. In speaking of the recurrent sensibility of the anterior roots, Dr. Flint is not satisfied with Brown-Séquard's explanation that it results from the compression of sensory nerves distributed to the muscles during the spasm caused by the irritation of the anterior roots; but inclines to Majendie's and Bernard's opinion that there are actually recurrent sensory nerves in the anterior roots, on the ground that the pain is sometimes apparently severe when the cramps are slight. The relations of the nervous system to electricity, and the rapidity of nerve conduction, with the means of estimating it, are well and correctly given.

The cranial nerves are next considered. In this section we think the author fails in his account of the deep origin of each nerve. He does not appear to have heard of or seen the papers of Lockhart Clarke contained in the Philosophical Transactions (1858-67). Yet these contain by very far the most minute and the most accurate descriptions hitherto published on these points, and the importance of their relations to pathology would have fully justified more elaborate details. Thus, to take one point only, whilst speaking of the deep origin of the sensory root of the fifth pair of nerves, he makes no allusion to the very interesting facts described by Clarke of the internal connection of this root with the vagus and glossopharyngeal nerves in the grey tubercle, or caput cornu posterioris; of the connection of its motor root with the glossopharyngeal nucleus and the fibres of that nerve, and with the fasciculus teres; or, finally, of the connection of the sensory root with the nucleus of the third through the intermediation of the grey tubercle, into which the sensory root penetrates. On the other hand, his account of the functions of the various nerves and their branches is given extremely well; the account of the chorda tympani, for example, being excellent; and the conclusion at which Dr. Flint has arrived, namely, that it is a nerve of gustation, as well as a motor or stimulant nerve for the submaxillary gland, being fully borne out by Lussana's observations recently published in Brown-Séquard's journal, and which, at the time Dr. Flint wrote, had not appeared. A very long section commensurate with its importance is devoted to the pneumogastric nerves, the action of which on the heart, larynx,