HYGIENIC REQUIREMENTS IN THE MILK TRADE.*

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THE first laboratory for the exact modification of milk was established in Boston in 1891, under the name of the Walker-Gordon Laboratory.

The purpose of the milk laboratory may briefly be stated to be—first, to insure a clean, constant, and reliable milk-supply; and, secondly, to provide a place where different combinations of milk may be put up according to the prescriptions of physicians, with accuracy and under such conditions of cleanliness and asepsis as to insure the best possible food for infant feeding.

Having decided on the breed of cow and the question of herd, a few words in regard to the farms where these especial herds for infant feeding are kept, the feeding of the cows, their care, their quarters, how they are milked, by whom, and under what precautions, and what is done with the milk to preserve it, may be of interest and of practical value to you.

1. As regular feeding as possible should be employed throughout the year, and guarding the cows from eating too fresh green food in the spring, and unsuitable herbs and grasses in the pasture. I should, however, state that our method of caring for the cows in America is different from what is usually the case in England. The English climate is such that the cows do not have to be housed nearly so much during the year as is the case with the climate of America, so that the English cows feed more commonly in the pastures, and in this way have less regularity in the quality of their food than occurs with the American cows. This, though in a general way desirable, is not conducive to the best milk for infant feeding, as the milk is not so stable as where the food is unvarying. The American cows, or rather the American cows that are kept for feeding, and which are intended to produce as stable a milk as possible, are practically housed cows, and so far as their feeding is concerned they receive the same rations all the year round, getting their exercise in well-kept, sunny paddocks, with shade trees in the summer. In regard to the ratio of the nitro-

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genous to the non-nitrogenous elements of the food, it may be said that just as the ratio of 1.0 to 4.50 has been found the best for the making of butter, and 1 to 8 for beef, so for infant feeding the ratio of 1 to 5.50 or 6 is most desirable. In past times, before I could rely as I do now on this carefully-managed method of feeding in rations, I found that the flush pasturage in the spring of the year, and the fresh grass following the autumn rains, greedily eaten by the cows, were fruitful sources of infantile digestive disturbance.

2. There should be a practical grooming of the cows in clean sheds away from the stable, as a rule dry cleaning being better than wet unless the cow can be thoroughly dried after washing; the cow is very sensitive, and too fine a toilet alters the quality of her milk and makes her produce less fat.

3. As nearly an ideal cow-house as possible should be provided. This means a building with cemented walls and ceilings and floors, having no connection with sewer-pipes or drain-pipes, and a cement gutter filled with the absorbent waste and extending behind the stalls, so that the gutter can be thoroughly washed out with the hose a number of times a day. There should be drinking water in each cow's stall, and the food, such as hay or grain, is not to be kept in the same building with the cows. The cows in our model stables are kept from lying down until after they have been milked by a peculiar contrivance at their head, thus avoiding dirt. There is also being tried a wire contrivance which keeps the cows' tails raised, and prevents their carrying dirt to their bodies and legs, and thus to the milk. In regard to this last procedure, it will probably never be successful—at least, until the cow can be entirely kept from flies, for the cow is extremely sensitive to flies, and will get nervously excited unless she can use her tail. Of the many species of flies there is one which especially attacks the cow, and this species is one which breeds in horse manure; we are therefore, especially at the Washington Laboratory Farm, quarantining the cows from horses by keeping the latter a long distance from the cowsheds. A barn is needed for cows which are to be used for infant feeding which will allow each cow at least 1,200 cubic feet of fresh air.

4. There is the most careful supervision of the cow's health, and with the slightest indisposition or rise of temperature the cow is removed to a clean, isolated barn a long distance from the cow-house, and kept there until she is considered to be in a perfectly normal condition by the veterinary surgeon.

5. Careful tuberculin tests are made of the cows.

6. Far more important even than the tuberculin test is the careful microscopical examination of the milk, which is made on these farms for the purpose of detecting the reappearance of the colostrum corpuscles or any pernicious micro-organisms, such as streptococci, or the presence of pus corpuscles, more than five pus corpuscles to each field given by a $\frac{1}{12}$ oil immersion lens contra-indicating the milk for the time being for infant feeding.

7. The milkers should be frequently examined by a physician to see if they are diseased in any way. Quite a severe epidemic of diarrhoea broke out in a school in Baltimore where the cause was apparently traced to sepsis conveyed by the hand of one of the milkers. Infectious mammitis to some extent seems clearly to be carried by the hands of the milkers from cow to cow. The milkers should not only be skilled in handling the cows, but should be intelligent men trained for the special purpose of milking for infant feeding. This means cleanliness of hair and skin, clean hands and arms, and clean milking suits, preferably of white duck, taken off after the milking, washed and placed in a sterilizer and kept in the sterilizer until needed again for the next milking. Sterilized milk-stools of metal should be used, and sterilized receptacles for receiving the milk. The many devices for protecting the milk by covering the udder usually interfere with the physiological action of the mammary gland, the cow being very sensitive, and her function of producing a good stable milk being easily interfered with. A new apparatus for this purpose is, however, I believe, now being experimented with in Scotland, and you doubtless have already heard, or soon will hear, of the result, which I understand is good.

8. It has usually been found that it is better to milk the cows in their stalls, where they sleep and where they feel at home, rather than in a special milking-room.

9. Immediately after the milking the milk should be brought in closely-covered receptacles to a room at least some hundreds of yards away from the barn and the milk-house. The milkers, however, should not be allowed to go into the milk-room, and a separate set of men should take care of the grooming of the cows. The milk is brought into the milk-room through sterile receptacles. As it enters it passes over sterile cooling pipes, and is received into sterile jars that are kept in ice water. The entire milk-room, ceiling, walls, and floor, are made of smooth, polished cement, and the air brought to the milk-room is drawn in through a ventilator by a fan, and as it enters the room through the ventilating pipes it is continually sprayed with clean, cold water, so that no dust can enter or pass into the room, and even if an insect, such as

a fly, should happen to get into the incoming air it would be drowned and washed away through the outlets for the water. The glass receptacles and glass tubes for bottling the milk are brought in through the side of the milk-room by means of a sterilizer and on sterilized trays being pushed through doors which open into the milk-room, and thus in bringing them in there will be no break in the quarantine asepsis.

10. The dairyman should be healthy, intelligent, and clean. His clothes, which have been subjected to steam and dried in the sterilizer by means of dry heat, should be white, so that dirt may be easily detected. No one but the dairyman should be allowed to enter the milk-room.

11. In the milk-room there is a set of sterilized glass jars ready to receive creams of definite percentages, obtained by a separator which is in the milk-room. There are other jars for the fat-free milk, and others again for the whole milk. From the milk-room these jars are transported as quickly as possible to the milk laboratories, where the modification takes place.

12. The milk laboratories, if in the city, should have an office entirely separate from the work-rooms.

THE SIGNIFICANCE OF PHOSPHATES IN WATER.—It is claimed that the determination of phosphoric acid in natural waters "by reason of the conversion of organic phosphorus compounds into phosphates through the process of decay is one which might reasonably be expected to throw considerable light on the question of the pollution of (such) waters." From the examination of a large number of samples, A. G. Woodman (*Jour. Amer. Chem. Soc.*, vol. xxiv., No. 8, 1902) concludes that "the amount of phosphate and its variation seem to follow the same general line as the other mineral constituents which either accompany the polluting material or are produced by its decay, especially the nitrates and the chlorides. It is not, however, so delicate an indicator as these. . . . The results obtained by the colorimetric method would seem to indicate that the limit of 0.5 part of phosphorus pentoxide in a million, as given by *Hehner* for unpolluted waters, is rather low. A safer amount would be one part, although the average would doubtless be lower than this." The method used was a modification of that of *J. West-Knights* (*Analyst*, vol. v., p. 197, 1880), evaporating 50 c.c. of the water and 3 c.c. of nitric acid (specific gravity 1.07) to dryness on a water-bath, and heating the residue in a water-oven for two hours. The dry residue is taken up in 50 c.c. of cold distilled water, 4 c.c. of ammonium molybdate (50 grammes per litre) and 2 c.c. of nitric acid added, and the colour compared with standards made by diluting a standard phosphate solution (1 c.c. = 0.0001 gramme phosphorus pentoxide) to 50 c.c., and adding the reagents as above. Blank determinations on the distilled water are advised.