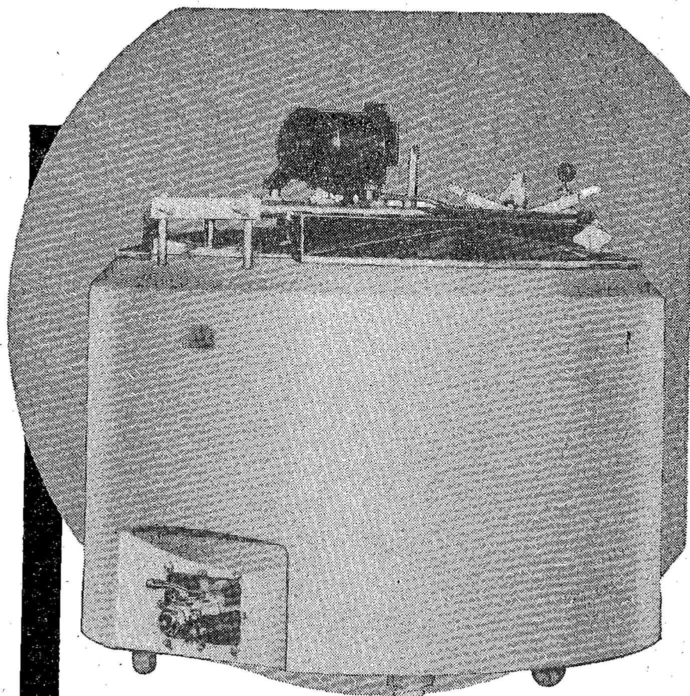
JOURNAL OF
MILK AND FOOD TECHNOLOGY

Including MILK AND FOOD SANITATION *Section*

MARCH-APRIL
1948
VOLUME 11 · NUMBER 2

Official Publication of:
INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS
(Association Organized 1911)

Designated Official Organ of:
ASSOCIATIONS OF MILK AND FOOD INSPECTORS AND SANITARIANS
and DAIRY TECHNOLOGY SOCIETIES
As Listed Herein



JOURNAL of MILK and FOOD TECHNOLOGY

(*including* MILK and FOOD SANITATION)

Official Publication of the

International Association of Milk and Food Sanitarians

(Association Organized 1911)

Designated Official Organ of Other Dairy Products Organizations

Office of Publication 374 Broadway, Albany, N. Y.

Entered as second class matter at the Post Office at Albany, N. Y., March 4, 1942, under the Act of March 3, 1879.

Published bimonthly beginning with the January number.

Subscription rate, $2.00 per volume. Single copy, 50 cents.

(For complete Journal Information, see page 116)

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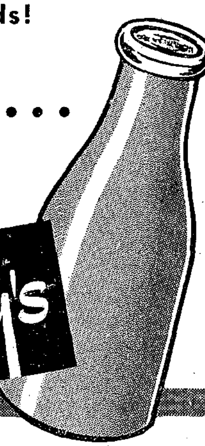

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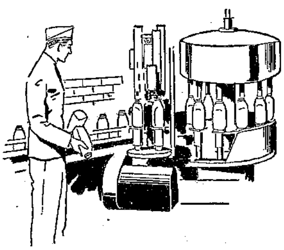

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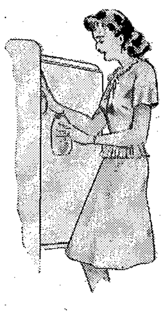

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Volume 11 March–April, 1948 Number 2

Editorials

The opinions and ideas expressed in papers and editorials are those of the respective authors. The expressions of the Association are completely recorded in the transactions.

What Does the Average Health Officer Think About Milk?*

No opinion about the average Health Officer's thoughts can be more than a guess. So, if the reader will accept a guess, here it is.

As far as dairy farms are concerned, the average Health Officer still clings to his right to set his own standards. (The writer's thoughts differ from those of the average Health Officer on this point.) He refuses to fall in line with outside group thinking. His own standard has probably been given to him by his Bureau Chief, but he regards it as his own thinking and he is sure he is right. He trusts his own inspectors and will send them one hundred miles to check on milk which is going to be pasteurized anyhow. Neither he nor practically any other Health Officer will trust the County or State inspectors working in the dairy farm areas even to the extent of giving them a trial and using spot inspections to check the results. Inspection programs of milk company representatives are accepted as being important from an educational standpoint—that is about all.

As to milk plants, the Health Officer accepts sound engineering practice. That is why the recommendations of the U. S. Public Health Service for plant standards are so generally accepted. The State Health Officer now wisely realizes that plant inspection involves special knowledge rarely possessed by the inspector of a town or small city. He, therefore, sends out his own men either to do the job alone, or in cooperation with local inspectors. The latter plan is based on the sound principle that a relatively untrained man can, in the course of time, be shown what to watch for in a particular plant.

* This article was written at the request of the editor for the thoughts of the practical health officers on milk control.

The average Health Officer still clings to the belief that dairy farm inspection is a necessary measure in the prevention of milk-borne epidemics. The assumption is that milk may, through some error, occasionally by-pass the pasteurization process. Perhaps this is correct. Some health officers, however, must have noticed the inconsistency between this position and that taken regarding water. Water is protected by chlorination, much as milk is by pasteurization. Periodic policing of water sheds have been almost entirely abandoned. A corresponding position in regard to milk would be to make approximately one educational visit to each new shipper to get him started right.

The average Health Officer, especially one trained in medicine and epidemiology, is now less concerned over milk sanitation than over tuberculosis, school hygiene, and other services more closely associated with medical practice. He gives his support but not his time to the Chief of his milk division. He tells him to watch pasteurization but avoid disputes. His predecessor probably got a kick out of his quarrels with dairymen about such matters as the style of lettering on bottle caps, but he has lost interest in such matters. To him milk sanitation is getting along all right while tuberculosis needs revamping to bring it in line with new procedures.

The average Health Officer knows that groups of school children still visit milk plants and see that each is more marvelous than the others. This is all right with the Health Officer who realizes that we are in a free country. But to him the glamor of super milk has passed.

V. L. ELLICOTT

The foregoing editorial is the result of a request by this editor that "the average health officer" (in this case, an unusually good one) express his thoughts out loud. And he did. Ouch! He is good natured about it, and speaks out of the abundance of his observation and experience extending over the past twenty-five years.

Well, we have it coming to us, as the current saying goes. We are so close to the problems of milk supervision that we are prone to lose perspective.

To a health officer who is responsible to the community for the most effective use of funds in the interest of the public health, he cannot help but look askance at expenditure for dairy farm inspection across two whole states (remote control) when he has immediately before him the need to modernize his communicable disease program. This feeling is strengthened in view of the conflicting dairy farm requirements of different communities. He suspects, to say the least, that most of this part of the milk control program is a leftover, a sort of "vestigial remains," from the early days when this factor was really necessary.

Dr. Ellicott's point about the importance of sound engineering practise in pasteurization plants is based on the recognition that plants are increasingly larger, are using more complicated equipment, are turning out greater volumes of milk, cream, and other dairy products, and constitute potentially greater health hazards than in the old days—this latter because there are fewer distributors per thousand of population, hence infection from a plant exerts a more widely distributed health hazard. He relies on dependable pasteurization of milk as he does on dependable chlorination of water—both are engineering jobs involving complicated plant operation and control.

He has lived through the days when brands of milk were put on the market under high-sounding names—he calls it "super milk"—such as "select," "special," "approved," "baby," "A," "AAA," "hi-test," all at higher prices, of course, than that of the regular supply. Fictitious values!—which a large percentage of the public falls for, and which another large part (uninformed concerning real values) cannot afford.

And those "marvelous" plants—which are made to look like hospitals in order to convince the public that milk therefrom will not send them to hospitals. Great sales psychology this! J. H. S.

The Dubuque Dairy Technology Society

For several years past, numerous dairy technology societies have associated themselves with us by designating the JOURNAL OF MILK AND FOOD TECHNOLOGY as their official organ (in return, receiving the JOURNAL at a club subscription rate). However the Dubuque Dairy Technology Society has gone a step farther and has applied for (and now received) affiliation status with the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC. This action raises each member of the Dubuque organization to the level of membership in the International Association (including subscription to the JOURNAL). This good group has taken the first step (among the dairy technology societies) to join forces with dairy technologists and sanitarians over the country to advance the whole profession and to strengthen the JOURNAL.

Sanitarians for a long time have striven to secure recognition as a profession. We maintain that such recognition does not come by our own solicitation nor by merely labeling ourselves as being professionally competent. Recognition by our brother professionals comes when the quality of our work compares favorably with that in other fields that have already won such acceptance. This quality is attained by the contributions of time, interest, expert service, professional competence, educational training, and money by the individuals concerned. It demands a pooling of resources—brains, spirit and finances. It calls for educational standards, a technical literature, a broad vision of public interest, and a sense of group identity and high-minded responsibility. All this cannot be attained overnight. It requires years of collaborative effort to build it all up into an imposing structure.

In union there is strength. The Dubuque group see this. They act on it. We are stronger because they help us toward the above goal. Dubuque—we commend your vision. We welcome your fellowship. J. H. S.

Sanitary Standards for Dairy Equipment

PURSUANT to editorial announcement in the January–February, 1946, issue of this JOURNAL, we have published the following sets of dairy equipment standards:

1. Milk-piping Fittings, January–February, 9, 12–21 and May–June, insert (1946).
2. Storage Tanks for Milk and Milk Products, May–June 9, 152–155 (1946).
3. Weigh Cans and Receiving Tanks for Raw Milk, September–October, 10, 277–279 (1947).
4. Milk Pumps, September–October, 10, 280–281 (1947).

Copies of the last three sets have been mailed to the health officer and chief milk sanitarian in each city in the United States and Canada with population of twenty thousand or over. Extra copies are available without charge to milk and food control officials in federal, state, and municipal government. Some cities are having copies sent to each of their inspectors. Copies of any of the last three sets of standards are available to any one else at the nominal cost of twenty-five cents each. Some firms are having copies sent to each of their salesmen. These may be secured from the Secretary-Treasurer (address on page ....).

The work of preparing standards for other equipment is progressing as rapidly as the technical difficulties allow. J. H. S.

Thirty-fifth Annual Meeting

PHILADELPHIA, PA., Oct. 21–23, 1948

Hotel Bellevue-Stratford

Present Status of the Phosphatase Test*

GEORGE P. SANDERS AND OSCAR S. SAGER

Division of Dairy Research Laboratories, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture, Washington 25, D. C.

A DESCRIPTION of an improved phosphatase test for pasteurization, applied to Cheddar cheese and fluid milk, was published in 1946 (12). During the research work it became evident that milk phosphatase is much more stable than had been generally supposed, retaining a large proportion of its activity almost indefinitely in raw or under-pasteurized products. It seemed, therefore, that the quantitative measurement of the enzymic activity of most dairy products should be an index of the enzymic activity of the milk used, and therefore an index of pasteurization of the milk. Accordingly, the scope of the work was enlarged to attempt to develop a unified method applicable to various dairy products.

The application of the phosphatase test as an index of pasteurization is based on the following facts, determined by earlier research work of others: All normal milk that has not been pasteurized contains a phosphatase enzyme. This milk enzyme is inactivated by heating for a prescribed time at a temperature a few degrees higher than that required to kill the organism that causes tuberculosis, which, as pointed out by North and Park (10), is the most heat-resistant of the pathogenic organisms that may occur in dairy products. Therefore, a negative phosphatase test provides an index of the adequacy of pasteurization, indicating indirectly that the product was heated sufficiently to kill any pathogenic organisms that might have been present.

According to researches of Theobald Smith (14), the tuberculosis organism is killed in milk by heating at 140° F. for 15 to 20 minutes, and in cream by heating at that temperature for a slightly longer time. North and Park repeated Smith's experiments and verified the results. They determined the thermal death points of this organism also at various other temperatures, and found, for example, that it is killed in milk by heating at 160° for approximately 20 seconds. The results of these experiments, and similar experiments by others with various organisms, were the basis of the present specifications for pasteurization.

A positive phosphatase test involves two reactions, the chemical equations for which were given previously (11). The first is hydrolysis of disodium phenyl phosphate (known as the substrate, and added in the test) by the phosphatase, producing free phenol. The second is chemical combination of phenol with 2,6-dibromo (or -dichloro) quinone chloromine (known as BQC, and added in the test), forming blue indophenol. The quantity of phenol is determined by measuring the intensity of the blue color, either with a colorimeter or by comparison with visual standards.

Detailed directions for the laboratory method for testing various dairy products are published in the December 1947 issue of the *Journal of Dairy Science* (13) and will not be repeated here. The following discussion is presented in three parts: First, difficulties encountered in conducting earlier tests; secondly, the manner in which the test was modified and im-

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* Presented at the Thirty-fourth Annual Meeting of the International Association of Milk and Food Sanitarians, Milwaukee, Wisconsin, October 17, 1947.

proved to yield reliable, quantitative results on various products; and thirdly, some of the results obtained.

DIFFICULTIES IN THE TEST

Late in 1944, certain members of the cheese industry and of the Research Committee of the National Cheese Institute requested information from these laboratories as to whether it would be possible to develop a test that would show reliably whether the milk used in making Cheddar cheese had been adequately pasteurized. Two methods that were available, and most recommended for the test on milk, were the Kay-Graham method and the Scharer method. There was also available an advance copy of a report (3) of research on the application of a modified Scharer test to Cheddar cheese, the results of which indicated that the test on raw-milk cheese tended to be negative in many instances after a curing period of three to six months, and also that the optimal pH for phosphatase activity in the test could be maintained by mixing the samples of cheese with a buffer solution before testing.

There were available in our laboratories approximately 375 Daisy-style Cheddar cheeses, made in pasteurization experiments in which exact records of the heat treatment of the milk had been obtained. In the preliminary tests numerous difficulties were encountered. In using the methods then available, "false negative" results (negative results on samples of cheese made from raw milk) were encountered very frequently, and values much lower than those obtained on milk were encountered generally, especially with cured cheese.

Determinations made with a Beckman pH meter showed that the pH values during incubation were, in many instances, so low as to be outside the range of activity of the phosphatase enzyme in the test. The buffers in use for testing milk were not adequate to bring the reaction in the tests within the optimal pH range. Moreover, different dairy products have different buffering capacities, and the buffering capacity of cheese increases with age. It was therefore necessary to modify both the concentration and the alkalinity of the buffer for each type of product, and also for cheeses of different ages.

Earlier tests involved preliminarily diluting the sample with water, or with a mixture of butyl alcohol and water, and then using a portion of the liquid material in testing, in order to decrease the buffer capacity of the sample to a level corresponding with that of the relatively weak buffers then available. It was found that this practice of testing only the liquid portion excluded most of the enzymic activity from the test, and produced erroneous and low results. Tests on samples of cheese and on the filtrates prepared therefrom showed that the enzymic activity is associated more with the solids (fat and also casein) than with the aqueous phase. Moreover, preliminarily grinding the samples with a mortar and pestle or with a blender was laborious and apparently unnecessary.

Experiments showed that phosphatase activity is inhibited by certain negative ions, including phosphates and citrates. The sodium buffers used in earlier tests did not remove these ions from solution, and it was desirable, especially in testing process cheese, to use as buffer a reagent that would precipitate these ions.

Difficulty was encountered in the use of lead acetate, recommended in an earlier procedure, as a protein precipitant. The filtrates were frequently cloudy, due to (a) insufficient removal of the proteins from some samples, and (b) the frequent presence of colloidal lead hydroxide in the filtrate, requiring further adjustment with alkali to clear up the filtrate. It was found to be very essential that the protein material be removed as completely as possible, and that the filtrates be clear, in order to obtain uniform, maximal color development, sensitivity, and precision in the readings.

The use of lead as a precipitant yielded an excessive amount of interfering yellow color when BQC was added, and an insufficient amount of blue color, requiring the use of more BQC than should be necessary otherwise and thus further increasing the amount of yellow off color.

It was found also that lead tends to cause some catalytic decomposition of the substrate, with a resulting tendency toward misleading, slightly positive controls.

In the methods available, adequate provision had not been made for adjusting the pH accurately, in testing cheese, for uniform and maximal production of blue color without excessive development of yellow color.

The tests available were not quantitative over a sufficiently wide range to measure phosphatase activity accurately in all samples.

An incubation period of 10 or 30 minutes was found to be inadequate for precise results and desirable sensitivity. On the other hand, an incubation period as long as 24 hours was considered too long for practical purposes.

The Kay-Graham procedure was found not applicable for use with cured cheese, sour buttermilk, butter, and other stored or ripened products, principally for two reasons: First, the Folin-Ciocalteu reagent used for color development was developed originally as a specific reagent for the detection of tryptophane and tyrosine, two amino acids which are liberated when hydrolysis of casein occurs. Therefore, the blue color was excessively intense in all controls prepared in testing ripened products. Moreover, the intensities of blue color in tests employing the Folin-Ciocalteu reagent on fresh, raw samples were relatively less than those in tests employing BQC. Secondly, the preparation of the Folin-Ciocalteu reagent in the laboratory is time-consuming and complicated.

As a result of these difficulties it was necessary to investigate as thoroughly as possible the chemistry of the test. In lieu of a presentation of the voluminous research data, a brief description of the details and improvements is given below.

IMPROVEMENTS IN THE TEST

A flow-sheet diagram of the test is presented in figure 1.* The new improvements are outlined as follows:

1. Barium borate-hydroxide is used as a buffer, instead of sodium tetraborate, to aid in precipitating the proteins and especially to precipitate phosphates and citrates, which interfere with the activity of the phosphatase enzyme. In controlled experiments on samples of milk, the use of barium resulted in an average increase of approximately 12 percent in the quantity of phenol liberated by the enzyme.

2. The barium borate-hydroxide buffer has a high buffering capacity in the pH region in which the enzyme is most active. The concentration and the alkalinity of the barium buffer are specified for each type of product and are so adjusted as to yield the optimal pH of approximately 10, or within a range of 9.85 to 10.2 (in no case should the pH be below 9.5) during incubation, thus improving the quantitative accuracy. For example, one specified concentration of this buffer suffices for testing uncured Cheddar and most other uncured cheeses, and it is only necessary to dilute it with water for testing products of lower buffering capacity, such as milk, cream, chocolate drink, cheese whey, cottage cheese, and cream cheese. More concentrated solutions of this buffer, specified in the method, are used for testing cheeses with higher percentages of nonfat solids, such as Parmesan, and for aged cheeses.

Folley and Kay (4) showed that, with a concentration of substrate similar to that used in these experiments,

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* The times and temperatures stated for a negative test in figure 1 are the minimum heating conditions for pasteurization, as defined in the U. S. Public Health Service milk ordinance.

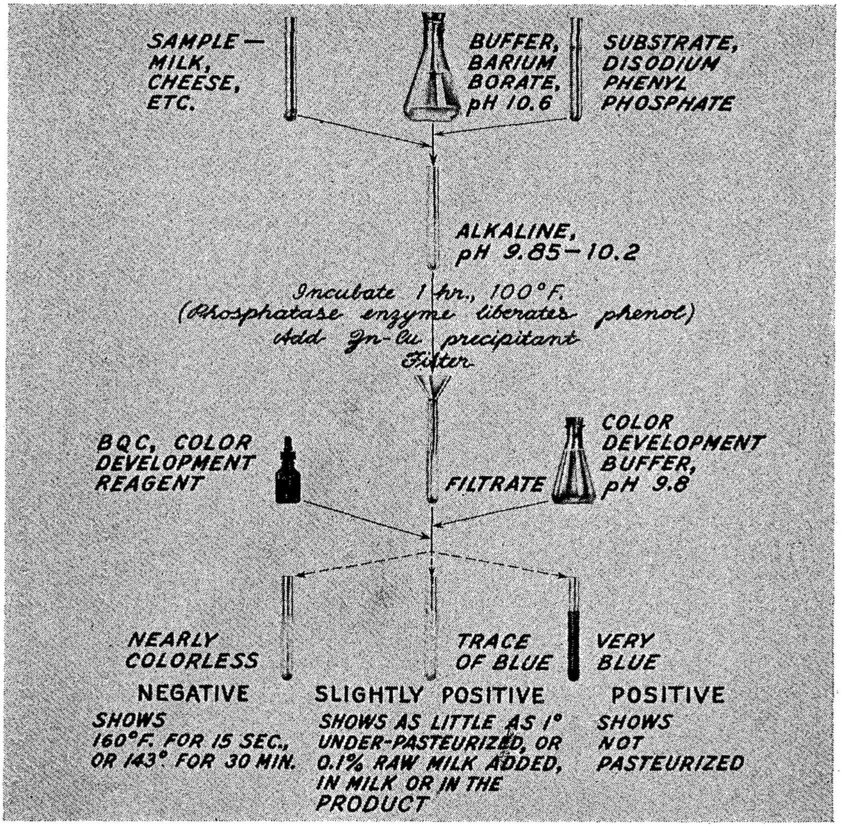

FIGURE 1. Flow-sheet diagram of the improved phosphatase test

the optimal pH for the activity of the enzyme is approximately 10.0. In testing milk and cottage cheese, Horwitz (6) found the average optimal pH to be 9.91. In our experiments with milk it was found to be in the region of pH 10.0 to 10.05. Horwitz pointed out that the pH of incubation in testing milk by an earlier method was found to be considerably lower than the optimum, *i.e.*, as low as 9.3–9.4.

The correct pH during incubation is apparently the most important condition for a successful, reliable test.

3. A protein precipitant containing zinc (for testing ripened products) or zinc and copper (for fresh products) has been introduced, replacing the lead precipitant used earlier. The use of the new precipitant yields uniformly clear filtrates. More important, the zinc-copper precipitant increases the brilliance and the intensity and rate of development of the blue color and decreases the interfering yellow color produced by a given quantity of BQC. This was proven by spectrophotometric analyses (12) of the colors.

4. A sodium metaborate-sodium chloride buffer, known as the color development buffer, is added to the filtrate. It serves to dilute somewhat the interfering compounds present, and it also adjusts the pH to 9.3–9.4, which was found to be optimal for the development of the blue color with a minimum

of yellow color. The use of sodium chloride in the buffer also aids in reducing the yellow color.

5. A dilution method has been introduced to make possible the full color development from all the phenol present, at the same time reducing the amount of off color, thus increasing the precision and making the test quantitative even for raw samples.

Preliminary preparation of samples with a mortar and pestle or with a blender has not been found necessary. With the alkalinity and concentration of the buffers adjusted to give reliable results for samples of any given type, it is generally unnecessary to determine and adjust the pH when testing. All reagents are prepared by weighing, and the need for primary standards or solutions of designated normalities has been eliminated.

SUMMARY OF RESULTS

No attempt will be made here to present the voluminous data obtained in studying the optimal conditions in each step in the test and in analyzing several thousands of samples of products made under known condtiions of heating. For example, more than 1,500 samples of various cheeses, and more than 3,000 samples of milk and cream, have been tested. Some of the data were presented earlier (12), and only a few of the results that seem most important will be discussed.

Table 1 lists examples of the products tested, and shows the range of phosphatase values found in tests on a considerable number of raw samples of each product. The method was found to give reliable results as an index of pasteurization on each of the products listed.

In connection with these data it should be pointed out that the unit of measurement is the intensity of blue color produced by 1 microgram (0.000001 gram, designated by the symbol γ, or "gamma") of phenol. It is possible to detect visually, in the test, the intensity of the blue color produced by 1 microgram of phenol, equivalent to 1 unit of phosphatase activity, and, by means of a photoelectric colorimeter, to detect 0.5 unit. Tests on many samples of raw milk show average activities greater than 1,000 units per 0.5 milliliter. The test is sufficiently sensitive to show an increase in the reading due to the presence of as little as 1 pound of raw milk added to 2,000 pounds of properly pasteurized milk, and the addition of raw cream to pasteurized cream in the proportion of 1 pound in 5,000. It is sufficiently sensitive to detect a decrease of 1° F. below

TABLE 1

PHOSPHATASE ACTIVITY FOUND IN RAW MILK PRODUCTS

Product; other details	Range of phosphatase values
Milk, 4%	900–1,300 units per 0.5 ml.
Skim milk	600– 800 " " " "
Cream, 20%	1,800–2,600 " " " "
Cream, 40%	3,500–5,000 " " " "
Ice cream mix	1,400–2,200 " " " "
Sherbert mix	700– 900 " " " "
Butter	600– 800 " " 0.5 g.
Butter serum	4,000–5,000 " " 0.5 ml.
Buttermilk, sweet	4,500–5,500 " " " "
Buttermilk, sour (pH 4.3)	1,400–1,600 " " " "
Cheese, uncured Cheddar	600– 900 " " 0.25 g.
1-year-old Cheddar	300– 600 " " " "
uncured Swiss	100– 400 " " " "
Cottage curd	200– 450 " " 0.5 g.
Cheddar cheese whey	400– 500 " " 0.5 ml.
Goat milk—regular test for milk	60– 105 " " " "
special test for goat milk	350– 600 " " 1.5 ml.

a standard pasteurizing temperature, or, at a given temperature, an equivalent shortening of the holding time necessary for adequate pasteurization.

Data obtained in tests on milk and on products made from the same milk show that the activity of the enzyme is greater in cream than in milk, increasing with increasing percentages of fat, and less in skim than in whole milk; that there is more than twice as much activity in 1 gram of fresh cheese as in 1 gram of the milk used, and less in cheese whey than in milk; and that the activity is low in butter and high in fresh buttermilk from sweet cream, and in butter serum. Samples of cultured buttermilk stored for one week at 45° F., with a pH of 4.3, still retained about one-third of the original activity of the fresh buttermilk.

The activity of the phosphatase was found to be much lower in goat milk than in cow milk. A special modification of the test for use with goat milk, with an increase in the quantity of sample and in the period of incubation, is given in the description of the method.

In order to determine effects of different heating conditions on the extent of inactivation of the enzyme, pasteurization experiments were carried out under accurately controlled conditions. A laboratory pasteurizer was assembled, comprising a tubular metal coil 30 feet long and ⅛ inch internal diameter, with a metal chamber at the end, immersed in a water bath with temperatures controlled thermostatically with a variation not greater than ±0.2° F. Fluid samples were forced into the coil under pressure, and removed by suction into tubes immersed in ice water. The holding time at the bath temperature was controlled with an error not greater than ± 3 seconds. In addition to tests on fluid dairy products, 3-gram samples of cheese were ground and placed in heat-sealing metal foil envelopes, which were squeezed to a thickness of 1 millimeter, sealed, and immersed in the bath. The time required for the temperature of the samples of cheese to reach that of the bath was not more than 18 seconds. A four-junction thermocouple was used to determine the temperature of samples.

Some of the results are shown in figure 2. The experimental data for phosphatase destruction show that, at any given temperature and different heating periods, the rate of destruction of the enzyme is very rapid at first and diminishes to a relatively slow rate with time. It was found also that a straight line results when the logarithms of the times of heating, to produce negative tests, are plotted against the corresponding temperatures. Van Bever (15) and others have shown that a similar straight-line relationship exists with respect to the destruction of bacteria by heat.

Holding periods found necessary to produce negative phosphatase tests, *i.e.,* not more than 2 units per 0.5 milliliter of whole milk, were: 37 minutes at 143°, 30 minutes at 143.6°, 24 seconds at 160,° and 15 seconds at 161.7° F., respectively.

The temperature required to produce a negative test generally was found to be about 0.7° lower for skim milk than for whole milk, about 0.7° higher for 20 and 40 percent cream than for whole milk, about 4.5° higher for ice cream mix (containing 15 percent fat) than for whole milk, and about 5.7° higher for milk sherbet than for whole milk. The time required, at 143°, was about three times as long for ice cream mix as for whole milk.

Negative tests were obtained at considerably lower temperatures and shorter holding times in Cheddar cheese than in milk—*e.g.,* at 130° in approximately 13 minutes and at 140° in slightly less than ¾ minute in cheese at pH 5.3. Mixing alkalis or emulsifying salts with the cheese had some effect in stabilizing the enzyme against heat. For example, the temperature required to produce a negative test in approximately ½ minute was 150° in samples of cheese containing 1.5 percent an-

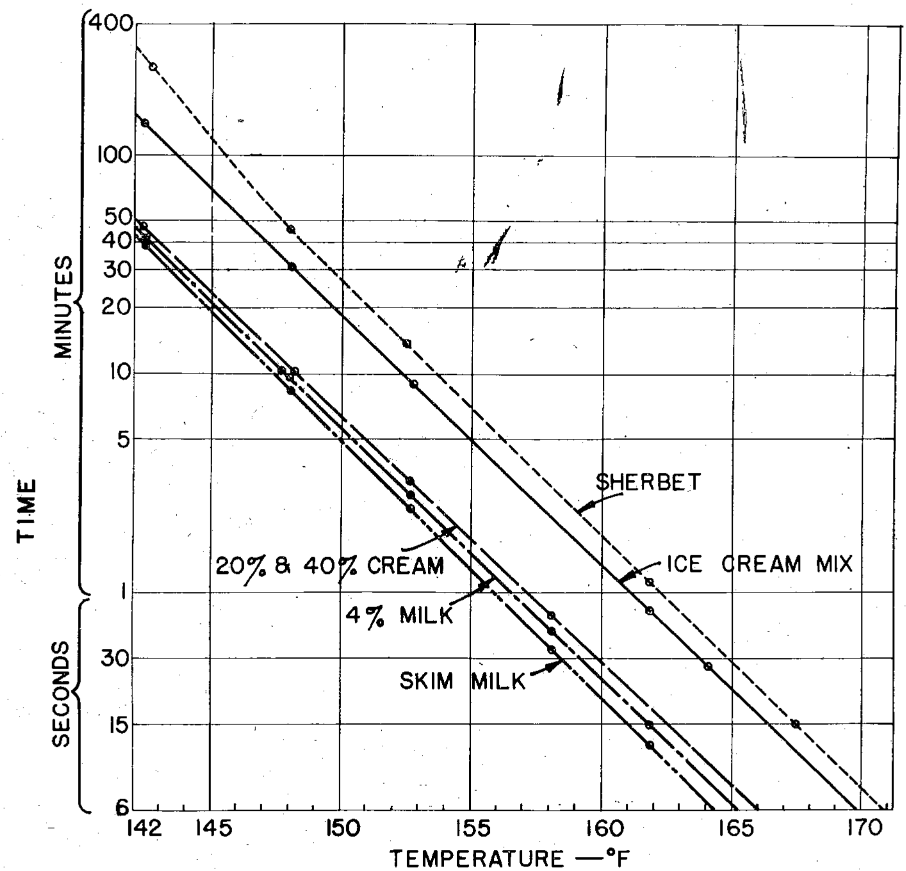

FIGURE 2. Time of heating at different temperatures found necessary to reduce phosphatase activity to 2 units per 0.5 ml. in milk and in other fluid dairy products

hydrous disodium phosphate and having a pH of 5.56.

Although these data do not pertain to destruction of bacteria by heat, they should be useful in studies on pasteurization, in pointing out equivalent effects produced by heating for given times at any temperature in the pasteurization range.

Concerning the problem of so-called "false positive" tests, phosphatase activity caused by microorganisms has not been found in this work in any fresh or reasonably fresh products. It has been encountered in some samples of old butter and old cream, on the surfaces of some soft and semi-soft ripened cheeses (Limburger, Liederkranz, Camembert, and, to a less extent, brick), and in several specific cultures of microorganisms. Such activity, in the samples tested to date, is indicated by blue color in the controls or blanks which have been heated slightly beyond the pasteurizing temperature to destroy the milk enzyme, as described in the method.

The discovery that phosphatase produced by certain microorganisms is inactivated at a higher temperature than milk phosphatase was reported in 1939 by Neave (9), and in 1942 and 1943, in tests with certain other microorganisms, by Buck (2), Kaplan (8), and Barber and Frazier (1). As Kaplan and also Barber and Frazier pointed out, this difference in inactivation temperatures apparently may provide a means of differentiating between "false positive" tests caused by at least some microorganisms and true positive tests caused by the milk enzyme.

Accordingly, if the test itself is positive and if any blue color is noted in the control that has been heated slightly beyond pasteurization (we recommend heating the control momentarily to 185° F.) before testing, the presence of microbial phosphatase can be suspected. To test further for microbial phosphatase, the following procedure is recommended: Using another portion of the sample, increase the pH to nearly 10 by adding 1 milliliter of the appropriate barium buffer (without substrate), heat it for 5 minutes in the tube in boiling water, cool the contents, and conduct the determination in the usual manner. If this control is negative, it indicates that the blue color in the original control was due to microbial phosphatase, *i.e.*, a "false positive" sample.

Collaborative work was done in 1946, under the Association of Official Agricultural Chemists, by Gilcreas on the phosphatase test applied to hard cheese, and by Horwitz on the test applied to soft, unripened cheeses. In Gilcreas' work (5), both a modified Kay-Graham method and the method discussed here were investigated, with tests on a large number of samples of Cheddar cheese, some of which had been cured for as long as 4 years. The results showed, as had been found also in our work, that the modified Kay-Graham procedure could not be adapted satisfactorily as an index of pasteurization in testing cheese. Gilcreas found that the Sanders-Sager method provides a reliable estimate of the inactivation of the enzyme by heat, and thus of the degree of heat treatment of the milk from which hard cheese was made. He recommended at that time that the Association adopt it as a tentative method. Horwitz (7) likewise found that this method could be applied successfully in testing soft cheeses.

At the annual meeting of the above-named Association in October 1947, as a result of the collaborative work and additional results reported, this laboratory procedure was adopted as an official method, first action, for use with fluid milk and cream, Cheddar cheese, and the soft, unripened cheeses. It was adopted as a tentative method for the other dairy products mentioned.

It can be stated with assurance that if the milk, cream, or fluid mixture used is negative, the cheese, butter, ice cream, or sherbet manufactured from it will also be negative, unless there is contamination with a raw product after pasteurization and unless a "false positive" condition develops. Therefore, negative tests on the milk or other fluid products themselves should generally suffice in a manufacturing plant.

Discussion and Conclusions

A description is presented of modifications and improvements in the laboratory phosphatase test for pasteurization, and application of the test to virtually all dairy products. The test has been found to be reliable when applied to milk, cream, butter, buttermilk, ice cream mix, sherbet, chocolate drinks, Cheddar and most other types of cheese, cheese whey, and (with less sensitivity) goat milk. A description of the method is publsihed in the December 1947 issue of the *Journal of Dairy Science*.

In the case of fluid milk and cream, it is well known that pasteurization improves the keeping quality. With respect to these and other products that are consumed fresh, the knowledge that the products have been pasteurized offers further assurance to consumers that the products are safe.

The improved test for pasteurization and demonstration of its reliability makes it possible to determine on practically all dairy products whether or not the milk used has been pasteurized.

It is believed that the test will be useful to the dairy industry in checking the effectiveness of pasteurization procedures for controlling the quality and for safeguarding public health.

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Thirty-fifth Annual Meeting

PHILADELPHIA, PA., Oct. 21–23, 1948

Hotel Bellevue-Stratford

The Milk Can Problem

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Milk distributors and dairy control officials who are familiar with the improvement in the quality of milk delivered to our cities since the general supervision of milk was inaugurated, should be gratified with the progress made, but there are improvements still to be attained. The 10-gallon can has been the principal container used for transporting milk. It is usually of tinned steel construction, easily corroded, not easily cleaned and inspected, and is often exposed to dust contamination from different sources. This receptacle might well be given further protection.

A survey has recently been made of the condition of cans that have been passed through the mechanical washers and driers used in commercial dairy

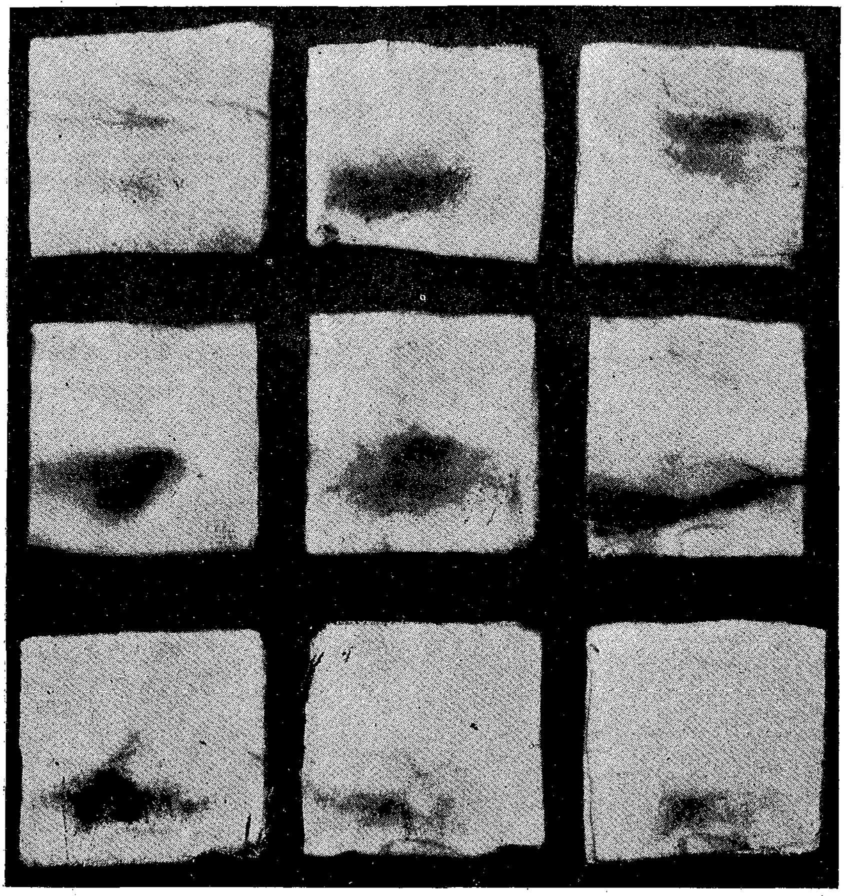

Figure 1. Dirt on cotton swabs of inner surfaces of milk cans

plants. Clean, moist, cotton pads were rubbed over small areas of the inner surfaces of normal appearing 10-gallon cans consecutively as they were taken from different types of mechanical washers. Separate swabs were prepared from the shoulders, sides, and bottoms of each can. Figure 1 shows the dark areas on the cotton swabs that consist of oxidized metal and dirt that was left on the surfaces of the metal.

The small particles of sediment on the swabs appeared to be dust that might have been deposited by dust-laden air used for drying. It seems probable that the dust of air will adhere to the moist surfaces of cans during drying and will later mix with the milk when the cans are refilled.

A manufacturer of cotton filters has demonstrated the use of gauze-backed cotton air filtering material over the air intake of milkcan driers. The writer has used the filters on can drying equipment of five different market milk plants to try to determine the amount of dust that would be removed from the air. Two sections of filtering material used in one plant are shown in figure 2; the one on the left is the sediment that accumulated on the filter after 10 hours operation, and the other, the sediment that was entrapped after the filter had been left over the air intake of the drier for 70 hours.

The filters were applied during both summer and winter months. Those used during the winter were darker in color than those applied during the summer. This was probably caused by more smoke particles being in the air during the winter months when homes and office buildings are being heated. City air appeared to carry more dirt particles than country air since the filters installed in a dairy plant in a rural area showed less sediment after the same number of hours of operation.

The air entering the can driers was examined for bacteria. It was drawn through sterile water and the water plated for bacteria. Apparently the dust particles do not carry many bacteria into the cans, but without question they are one of the sources of sediment in milk.

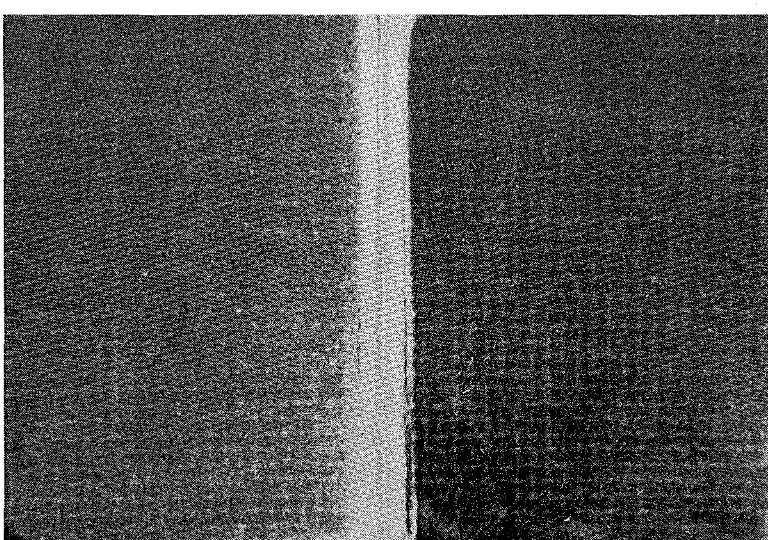

FIGURE 2. Sections of cotton filters used over air intake of can drier. The filters used at each of the dairy plants showed similar conditions; the cotton material collected particles that would have passed into the cans if the filters had not been used

Factors Affecting the Nutritive Value and Quality of Dairy Products *

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IT is interesting to have the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS schedule on its program the topic that has been assigned to me. This could be interpreted as manifestation of interest in a new concept of quality in dairy products that includes, in addition to the sanitary and public health aspects, some consideration of nutritive value. For more than 20 years I have been conducting research on the problem of relationships between dairy cattle feeding and management practices and milk quality in terms of nutritive value, as well as on the effect of various processing procedures on these same qualities. At first one approached a discussion of this nature half apologetically but now some reference to these relationships is expected in almost every meeting concerned with products of the dairy industry.

VITAMINS IN FLUID MILK

It is only natural that this discussion begin with fluid milk. Our newer knowledge of nutrition, stemming particularly from discovery of a new class of food nutrients, namely the vitamins, stimulated interest first in determining the vitamin content of milk and then in variations in vitamin content that occurred as a result of environmental changes surrounding the cows producing the milk. Whereas thousands of chemical analyses made over many years revealed that milk varies but little in chemical composition, it was soon found that certain vitamins varied greatly as to their concentration in milk. Carotene, vitamin A, and vitamin D were the vitamins found to vary most with changes in feeding and management practices, while ascorbic acid and riboflvin were found to change in concentration following production in accordance with subsequent handling and processing.

Milk ordinarily is considered to be a good source of vitamin A, the biological activity of which is the result of a combined effect of colored provitamin A (carotene) and uncolored true vitamin A. However, the vitamin A potency of milk may vary by more than 100 percent depending upon the carotene intake of the cow or upon vitamin A intake when special supplements are fed. No real measure of this variation in vitamin A potency was available until very recently. Because of availability now of rapid chemical methods, it was possible, through extensive cooperation, to determine the vitamin A potency of butter as produced and also after storage. For the country as a whole it was found that average butter contains 15,000 International Units of vitamin A per pound. During the barn feeding season, however, butter may contain as little as 8,000 units of vitamin A per pound, whereas during the pasture season this value may get as high as 25,000 units per pound. The plotted potency curve of the vitamin A potency of butter from month to month is an indirect measure of the quality of the roughages being consumed by dairy cattle, for roughage is practically the only source of carotene for dairy animals. This important study showed that butter (and hence milk) was a

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* Presented at the thirty-fourth annual meeting of the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS, Milwaukee, Wis., October 16–18, 1947.

much better source of vitamin A than previously supposed and suggested encouragement of those farm practices, like grass-silage making and mow-curing of hay, that would conserve carotene in roughages for winter feeding. The study showed further that practically no vitamin A potency was lost from butter during storage for as long as one year.

Milk, at best, is not a good source of vitamin D and varies in potency from 10 or less units per quart in winter to 40 to 50 units per quart when solar insolation of the cow is at its highest peak. Early attempts to increase the vitamin D content of milk were confined to feeding irradiated yeast to cows and to direct irradiation of milk with ultra-violet light. These methods were effective in producing milk with automatic rickets-preventing properties, but both have been replaced almost entirely by direct addition of vitamin D concentrates to the point where now a sizeable fraction of the milk supply in large cities is vitamin D milk. Undoubtedly the practice of direct addition of vitamin concentrates to milk did not come about without first creating an issue between the nutritional advantages to be derived on the one hand and the sanitary aspects on the other. This same issue will continue to be before you as attempts are made to extend milk fortification.

As produced, milk contains from 15 to 20 milligrams of ascorbic acid per quart. Were this amount of ascorbic acid present when the milk is consumed it could be said that our milk supply contributed markedly to our ascorbic acid needs. Unfortunately, however, ascorbic acid is lost from milk during the usual handling, pasteurizing, and delivery treatments to which it is subjected, to the extent that 50 percent or less of the original amount is present when the milk is consumed. Many samples of milk coming to our laboratory for vitamin D assay contain practically no ascorbic acid. It can be understood, therefore, why some interest has been manifest in the possibility of fortifying both fluid and evaporated milk with vitamin C. Again, the nutritional benefits to be derived must be weighed against the other aspects of the problem. Also suggested are improved pasteurizing procedures and various protective devices for reducing ascorbic acid loss.

Milk is one of the best food sources of riboflavin and the amount in milk as produced is quite constant (1-2 milligrams per quart). In spite of the fact that the riboflavin in milk withstands pasteurization, condensing, and drying, a problem is presented by the characteristic of riboflavin to be quite easily destroyed by sunlight or strong daylight. Since the rate of destruction is a function of temperature and light intensity, the necessity for properly cooling milk and then protecting it becomes apparent. This is especially important because milk is such an important source of riboflavin that all possible means to preserve this factor in milk should be taken. One of the major research projects in the Department of Dairy Technology at Ohio State University is concerned with trying to determine the wave length range of light that is so destructive of riboflavin. This may lead to the development of new types of containers in which to transport milk from plant to home.

Milk as produced is a fair source of thiamine (vitamin B_1) but unlike riboflavin, thiamine is heat-labile, with the result that thiamine losses occur in all processing operations involving heat, ranging from a loss of 10 percent during holder pasteurization to 33 percent during evaporation.

Several vitamins other than those previously discussed are also found in milk but these are present in such small amounts or so little definite is known about their specific functions that no further reference to them needs to be made in this discussion.

VITAMINS IN CHEESE AND BUTTER

It now becomes of interest to examine the changes that occur when milk is processed into such products as cheese and ice cream. Butter was considered previously in discussing variations in the vitamin A content of milk.

Most of the fat in the original milk is retained in the whole milk cheese-making process. Hence one might predict that most of the vitamin A potency of the original milk would be transferred to cheese. Actually in cheddar cheese about 80 percent is retained, the small loss probably being due to adherence of fat to containers and equipment during processing. During the ripening of Cheddar cheese there is little change in vitamin potency and no loss has been found during storage for one year.

In the case of water-soluble vitamins, however, (riboflavin and thiamine) considerable loss may occur in cheese making depending on the amount of whey retained in the curd, the extent to which heat is used, the method of salting, and the exposure to air and light. From one-fourth to one-third of the original riboflavin is retained in whole milk cheeses. Proportionately more thiamine than riboflavin is lost in cheese making, but some compensation for losses of both occurs during ripening and storage when synthesis of these factors can occur.

Little information is available on losses that occur from ice cream. In one study involving three flavors—coffee, maple, and vanilla—samples were stored for seven months at 10° F. During this period 15.7 percent of the carotene and 5.4 percent of the riboflavin were lost.

FOOD VALUES IN DRIED MILK

I have deliberately reserved until last a group of dairy products that from the standpoint of nutritive value rank high as potential sources of human food. I refer to dried milks. These are of especial importance at the present time because of the world food situation and the need for utilizing more completely our food resources and specifically for utilizing more completely our milk supply. To this end the milk drying industry can make a great contribution.

The matter of losses that occur in the drying process can be discussed by a general statement to the effect that losses in nutritive value in the manufacture of dried whole milk or non-fat dry milk solids are minor and that losses during spray drying are usually less than during roller drying. Even these small losses are compensated for by the concentration that occurs in the drying process. When it is realized that on a per pound basis dried milk contains significant quantities of ascorbic acid, niacin, and thiamine, in addition to being rich in riboflavin, vitamin A potency (in the case of whole dried), calcium, protein, and lactose, and that some 40 billion pounds of skimmilk, buttermilk, and whey annually are not utilized as human food, the need for exploring every possible means of utilizing more fully all the nutrients of milk becomes apparent.

This can be depicted even more vividly in terms of disappearance of nutrients from the total milk supply. The 1944 milk supply of 119 billion pounds contained 14.57 billion pounds of nutrients (protein, minerals, lactose, and fat). Of these, about 80 percent found their way into human consumption channels; but when butterfat is left out of the picture we find that only 67 percent of the non-fat solids of milk went into human food. The balance was fed to livestock, used industrially, or lost somewhere. Since even greater nutritional significance can be attached to the non-fat solids of milk than to the fat, this disparity in utilization of fat and non-fat solids of the milk supply would seem to be neither nutritionally nor economically sound.

PROTEIN AND LACTOSE

Perhaps in the past we have emphasized too strongly the calcium and riboflavin contributions made by milk, or rather that we have failed to emphasize sufficiently the protein and lactose fractions. As our knowledge increases we become more and more aware of the importance of high quality protein in normal nutrition and in nutrition of the diseased and mal-nourished. So little is known about the nutritional significance of lactose that certainly we can hope for values not now known that will attach to milk even greater nutritional significance than previously.

RESEARCH NEEDED IN QUALITY CONTROL

By this time you may be wondering about the real significance of this discussion at a meeting of milk sanitarians. To me the significance is real for by keeping abreast of new developments of the kind that have been reviewed you will better be able to realign your sights as to what it really is that milk sanitarians are supposed to do and how these duties permit, encourage, or inhibit the wheels of progress. Certainly quality is a word that is used promiscously in the dairy industry, but who can define "quality"? Do our present concepts permit interpretation or revision as new processes, new machinery, new milking techniques, new packages, new products, new consumer demands, and new avenues of distribution make their appearance?

Research is the key to progress. Under the new Research and Marketing Act great impetus will be given to research in the economics of milk production, distribution and utilization. Keeping in mind that the primary object of milk production is to produce a basic and indispensable food, what modifications in our present concepts of milk control will need to be made? At the present time a committee of the National Research Council is struggling with the matter of defining "quality" as applied to fluid milk and cream. This was thought to be essential before proceeding with a study of factors ultimately affecting milk consumption and leads directly into consideration of movement of milk from one area to another. Inevitably consideration must be given to standards of quality and milk ordinances and regulations. Your association already is participating in this study through representation on the National Research Council committee. It is to be hoped that this discussion today may have been helpful in pointing out the vast network of procedures involved and in getting from you the courage and encouragement that will be needed as these newer ramifications of the dairy industry develop.

The real function of milk sanitarians is to assure the consuming public of a safe, wholesome, nutritious milk supply that has both esthetic and taste appeal. This can only result in increased consumption and greater utilization of all the solids of milk. The incentive for helping bring this about is the knowledge that more equitable distribution of the vital food materials found in milk can do much toward improving the standard of living of the masses and help conserve the world's greatest natural resource, which is its people.

Question 1. What would be your reaction as to the importance of a research project for devising a meat substitute product that consisted predominantly of milk protein?

Answer: Milk proteins have been demonstrated repeatedly to have high biological value, i.e. they supply essential amino acids and in themselves produce excellent growth in experimental animals when constituting the only source of protein. Milk protein in itself would not be a substitute for meat for meat contains other materials of high nutritional value, as for example, iron, copper, thiamine and niacin.

Question 2. Inasmuch as lactose in nature is found in animals for the specific feeding of the young, would not this fact indicate some unique food value of lactose in the very young?

Answer: That lactose has some unique value in the nutrition of the young is shown by work at Wisconsin in which differences in growth response between vegetable fats and butter were obtained only when lactose was the sole source of carbohydrate. At the same time it should be pointed out that during the war lactose was not given priority as an infant food ingredient when there was competition for lactose for other purposes. Our knowledge regarding the nutritional value of lactose is very meagre and yet, on a dry basis, one half of the non-fat fraction of milk is lactose. Research on this important constituent of milk should be encouraged. The presence of lactose in such large quantities in a food intended for young mammals certainly indicates some special nutritional value.

Question 3. Inasmuch as vitamin C is largely destroyed in pasteurization, but can be retained by adequate pasteurization technology (as shown by Sharp), the milk industry and nutritionists excuse their indifference to this loss by reason of the availability of citrus and other natural sources of vitamin C. Do you think such *laissez faire* should be justified?

Answer: It is fundamentally wrong to adopt the attitude that because some food nutrient can be supplied from other sources losses of this nutrient from milk should be tolerated or ignored. Milk is a universal food; other particularly good sources of vitamin C are not. We have every reason to encourage feeding and management practices and handling and processing procedures that will result in milk with enhanced food value. Aside from the nutritional advantages to be derived from observance of this principle, consumer demand and acceptance can be better developed not only because of the educational value of better nutrition but because of greater taste appeal since ascorbic acid is related to flavor.

A Study of the Temperatures of Milk in the Possession of Intermediate Handlers and Pertaining Regulations*

Report of Committee on Applied Laboratory Procedures

The Committee chose, as a subject for review, the matter of prevailing temperatures of milk in stores and restaurants, resold to consumers. Three reasons prompted the study of this subject:

1. The absence of "dated" milk in many communities and the reduced frequency of delivery started during the war frequently results in some of the milk being held for long periods.
2. The evidence that coliform organisms do grow at relatively low temperatures.
3. The practice followed by some sanitarians in obtaining samples for the testing of quality from store or restaurant refrigerators instead of directly from route wagons, trucks, or plant coolers.

A questionnaire † was sent to selected communities in a number of states. Adequate geographical distribution was recognized. The information requested covered the type of cooler (mechanical or ice), temperature of the milk as taken from the truck for delivery to restaurant and store, temperature and age of the milk in store or restaurant refrigerator at time of inspection, outside air and room temperatures, and city regulations pertaining to temperature standards for milk in stores and restaurants.

Reports were received from 37 cities in 17 states. The reports required the special inspection by sanitarians, since the information requested was not usually regularly available. The reports represent samplings of an estimated total of 15,800 stores, 23,900 restaurants and dairy bars, and 920 roadside stands. Distribution was specifically made among large and small units.

A. *Type of Refrigerator*

	In Stores	*In Restaurants*
Mechanical Refrigerators..	215	333
Ice Refrigerators..........	6	34

Mechanical refrigerators predominate in the store and restaurant establishments. In roadside stands, 10 of 48 refrigerators were found to be of the ice type.

B. *Temperature of Milk on Trucks*

The temperature of the milk on trucks as delivered to stores often was found to be greater than the prevailing prescribed city standards. The observations in this respect point up the fact that more attention might be given this area of milk handling. The data on the temperature measurements of milk on trucks about to be delivered to stores and restaurants is cited in Table 1.

The data show that about 60 percent of the milk being delivered to stores was above 50° F., and 16 percent above 60° F. About 55 percent of the milk being delivered to restaurants was above 50° F. and 19 percent above 60° F. It might be inferred more attention should be given to determine milk temperatures on dairy delivery trucks.

C. *Temperatures of milk on trucks and the prevailing city maximum milk temperatures.*

On the basis of the reports, the distribution of maximum temperatures

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* Presented at the thirty-fourth annual meeting of the International Association of Milk Sanitarians, Milwaukee, Wis., October 16–18, 1947.

† Tabulations reported herein are based upon information reported in the questionnaires. In some instances, specific answers were not recorded.

TABLE 1

DISTRIBUTION OF THE TEMPERATURES OF MILK ON TRUCKS AS DELIVERED TO STORES & RESTAURANTS

Temperature range ° F.	To Stores: No. of samples	To Stores: Percentage of total	To Restaurants: No. of samples	To Restaurants: Percentage of total
40–44	17	9.2	23	11.1
45–49	56	30.3	71	34.3
50–54	57	30.8	42	20.3
55–59	21	11.4	30	14.5
60–64	22	11.9	28	13.5
65–69	7	3.7	7	3.3
70–74	1	.5	6	2.7
75–70	4	2.1	0	0.0

allowable for milk in the cities is as shown in Table 2.

TABLE 2

FREQUENCY OF MAXIMUM MILK TEMPERATURE STANDARDS IN CITIES

	No standard	50° F (Number of cities)	55° F (Number of cities)	60° F
Milk in stores	2	25	0	3
Milk in restaurants	4	25	1	3

In the light of the reported prevailing maximum allowable temperature standards in the various cities, a tabulation was made of the frequency with which the temperatures of milk examined on dairy delivery trucks was equal to, above, or below the milk temperature standard cited. The data for this analysis are presented in Table 3.

TABLE 3

RELATION OF TEMPERATURES OF MILK ON DAIRY DELIVERY TRUCKS AND PREVAILING CITY MAXIMUM MILK TEMPERATURE STANDARD..

	City Maximum Standard 50° F. Stores	50° F. Restaurants	60° F. Stores	60° F. Restaurants
Total Number of Samples	156	189	17	25
Percentage of Samples				
1) Above city temperature standard	41.0	43.9	0	16.0
2) Equal to city temperature standard	10.8	6.3	47.0	12.0
3) Below city temperature standard	48.1	50.0	53	72.0

D. *Temperature of milk in refrigerators in stores and restaurants*

The temperatures prevailing within restaurant and store refrigerators may be expected to vary over a wide range. Control instruments lose their sensitivity, refrigerators are loaded at different periods with quantities or relatively warm goods, doors are opened frequently and often left ajar. The adequate refrigeration of milk under these conditions cannot always be expected. The actual temperatures of milk in the refrigerators in stores and restaurants as measured by sanitarians is given in Table 4.

According to this analysis, approximately only 60 and 93 percent of the milk in stores is below 50° F., and 60° F. respectively, and only 47 and 85

TABLE 4

TEMPERATURE OF MILK IN THE REFRIGERATORS OF STORES AND RESTAURANTS

Temperature Range ° F.	*Milk in Stores*		*Milk in Restaurants*	
	No. of stores and samples	*Percent of all samples*	*No. of Restaurants and samples*	*Percent of all samples*
34-39	11	5.4	12	3.2
40-44	51	25.1	86	23.1
45-49	63	31.0	77	20.7
50-54	55	27.1	97	26.1
55-59	11	5.4	46	12.3
60-64	12	5.9	36	9.6
65-69	0	0.0	9	2.4
70-74	1	0.5	9	2.4
Total Samples & Stops	203		572	

percent of the milk in restaurants is below 50 and 60° F., respectively.

The relation of the temperature of the milk in refrigerators in stores and restaurants and the prevailing city maximum temperature standard for milk is summarized in Table 5.

has been generally retained in most cities. The significance of older milk held at higher temperatures in storage is obvious. The survey included a request of an appraisal, of the age of the milk in hours, in the refrigerators. The data are tabulated in Table 6.

TABLE 5

RELATION OF TEMPERATURES OF MILK IN REFRIGERATORS IN STORES AND RESTAURANTS AND PREVAILING CITY MAXIMUM MILK TEMPERATURE STANDARDS

	City Temperature Standard, ° F				
	50°		55°	60°	
	Stores	*Restaurants*	*Restaurants*	*Stores*	*Restaurants*
Total Number Examinations	204	205	55	15	38
Percentage of Examinations					
1) Above city standard	26.0	34.6	54.5	6.2	11.0
2) Equal to city standard	12.7	11.4	0.0	25.0	3.0
3) Below city standard	61.2	53.1	45.5	68.7	86.0

E. *Age of Milk in Store and Restaurant Refrigerators*

The introduction of material- and labor-saving practices during the war

It was determined that 55 percent of the milk in stores and 45 percent of the milk in restaurants was held at least 24 hours, or more. Further, 17 percent

TABLE 6

AGE OF MILK IN STORE & RESTAURANT REFRIGERATORS AS DETERMINED AT THE TIME OF EXAMINATIONS

Age of milk in hours	*City Maximum Temperature Standard, ° F.*				
	50°		55°	60°	
	Stores	*Restaurants*	*Restaurants*	*Stores*	*Restaurants*
	(Number of Examinations)				
0	19	34	..	3	14
6	60	84	..	12	8
12	2	12	11	0	9
24	86	100	23	8	7
48	8	8	11	..	..
72	1	..	..	..	..

of the milk in stores and 14 percent of the milk held in restaurants both were held 24 hours or more, and at a temperature greater than the prevailing maximum city milk temperature standard.

F. *Adequacy of Regulations*

Few cities have regulations which specifically assess purveyors or intermediate handlers of milk with the responsibility of maintaining it at a temperature demanded of milk distributors. While many regulations state that milk and milk products shall be "delivered to the consumer at a temperature not exceeding (X) degrees", or "after pasteurization milk shall be cooled to 50° F. or lower and stored at such temperatures ". . . . " until time of sale", neither the consumer nor the sale appear to be adequately defined.

Examples of specifications that more adequately define the problem, and which were quoted from their regulations by sanitarians are, in part, as follows:

> "Milk shall be cooled to 50° F. or below . . ., and so maintained until delivered to the consumer . . . every grocery store or other establishment shall have a refrigerator capable of maintaining fluid dairy products at 50° F. or below."
>
> "Milk shall be delivered and stored at a temperature of 50° F. and under."
>
> ". . . In stores or shops . . . milk shall be stored at a temperature not higher than 50° F. and refrigerators shall be used for milk and cream only."
>
> "It shall be unlawful for any hotel, soda fountain, restaurant, grocery, camp or similar establishment to sell or serve any milk or milk products which have not been maintained, while in its possession, at a temperature of 50° F. or less."

G. *Discussion*

It would appear that several conclusions may be established as a result of this survey.

1. Mechanical refrigerators predominate over ice storage units for the storing of milk in stores and restaurants. Ice storage units were present to the extent of 3 percent in stores, and 10 percent in restaurants, being more frequent in roadside stands.

2. Over 40 percent of the milk on trucks, as it is being delivered to stores, and restaurants, is above the 50° F. maximum temperature standards prescribed in those cities where a 50° F. maximum temperature prevails. It would appear that if the 50° F. limitation, as written in most regulations, is of significance, more attention should be given its recognition by primary handlers. It is possible this condition is being overlooked by the practice of sampling for quality at other points, or by lack of specificity in regulations covering this point of transfer of milk.

3. Since a significant portion of the milk purveyed in stores and restaurants is over the prescribed temperature standard, and also since a significant portion is held there at least 24 hours, and more, the need for more thorough attention to refrigeration facilities and covering provisions seems evident.

4. The conditions and periods through which milk is stored in refrigerators unquestionably affect its quality. The evident unsatisfactory conditions prevailing in the premises of many purveyors, in the light of stipulated and recognized standards, is affecting the quality of milk adversely. An assay of the quality, particularly bacteriologically, of milk taken from such refrigerators hardly can be assumed to represent the product as produced and distributed by primary handlers. It has been clearly shown coliform organisms and other cryophy-

lic types can increase in numbers in milk at temperatures of 50° F. The results of quality appraisal of milks as obtained from intermediate handlers can at best represent only what the ultimate consumer acquires and reflects that care accorded principally by the intermediate handler. Sanitarians who acquire samples for assay from intermediate, rather than primary handlers of processed milk as a means of appraisal of operations of the latter, place themselves in a questionable position when not enforcing other equally important food handling sanitary practices. It is pertinent to cite that the above practice has the obvious effect of keeping sanitarians away from the more important primary point of operations.

5. Sanitarians can afford to assay the significance of inadequate temperature control facilities in their jurisdictions.

K. G. WECKEL, *Chairman*
University of Wisconsin
FRANKLIN CLARK
Auburn, Alabama
MILTON FISHER
St. Louis, Missouri
L. W. ROWLES
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Cow Clipping Benefits Five Ways Says Dairy Expert

"Be sure to guard against a flank attack if you want to produce high quality milk," says Dr. H. A. Bendixen, in charge of dairy manufacturing at the State College of Washington.

"Millions of enemies, in the form of quality lowering bacteria, are massed under cover of the dirt clinging to long hairs on both flanks of the cow. They are bound to infiltrate into the milk at milking time, causing low quality milk and reduced returns to the dairyman. To prevent this infiltration by bacteria it is necessary, first of all to reduce the cover, which hides and shields the enemy, by keeping the hair cliped. Thus, filth and bacteria have less opportunity to cling to this vantage point above the milk pail.

"The hair of the cow becomes especially thick during winter," says Dr. Bendixen. "At the same time, the overnight stabling or sheltering of the cows increases the dirt on the cows' flanks, udder, belly and tail. Keeping the hair on these parts clipped, (a) reduces the labor of keeping the cows clean, (b) reduces the sediment rate of the milk, (c) lowers the bacterial count, (d) improves the flavor, and (e) increases the keeping quality.

"The well-groomed man and the well-groomed cow are the hallmarks of success today. This is an age of dairy progress, so be up-to-date and clipper-wise in your methods. Use a clipper every few months, and you'll be proud of your cows and the quality of the milk you sell. Above all, top quality milk production pays off in greater profits!"

MILK and FOOD SANITATION

(Application for title registration in U. S. Patent Office pending)

Some New Ideas for Cleaning Dairy Plant Equipment*

JOHN R. PERRY

Assistant to the President, Sealtest, Inc., New York, N. Y.

UNDOUBTEDLY sanitarians today are more aware than ever of the effect of the sanitary condition of equipment upon the quality of dairy products. Hence, the prime importance of the cleaning operation in a dairy plant is now keenly recognized and therefore receiving the thought and attention it has so long warranted and needed.

A careful study of the cleaning operation by Sealtest showed that while considerable progress had been made in the development of satisfactory cleaning compounds, there was an urgent need for improvement in available cleaning equipment and for the development of altogether new cleaning equipment. It was readily discernable that satisfactory cleaning using the primitive pail, nondescript brush, and clumsy, heavy, and inefficient free running hose which delivered water of an indeterminate temperature, was obtained only as a result of painstaking, arduous, and generally distasteful effort. Some new ideas for cleaning dairy plant equipment were conceived and a number of new devices were developed which were designed to make possible really satisfactory cleaning, to remove the distaste from the cleaning operation, and to improve its efficiency and economy. These devices have been designated as New Cleaning Aids.

TEMPERED WATER WITH CONTROLLED TEMPERATURE

During the course of the study the need for rinsing water of the correct temperature became evident. Mixing steam and cold water or hot and cold water at hose stations seldom gives an issuing water with a satisfactory temperature for rinsing. Hence it was decided to deliver automatically to the hoses, water with a temperature of 115° F. since water with such a temperature was warm enough to move butterfat and not high enough in temperature to "fry on" non-fat solids. Water with such a temperature was satisfactorily delivered to the hose stations by resort to a reservoir type of hot water generator with an indirect heating element equipped with a thermostatic control and one or more specialized "tempering" valves.

Where water with a controlled temperature of 115° F. is delivered to hose stations it has been unnecessary, except in rare instances, to also deliver cold water to them. If "hot" water is needed at one or more locations in the plant it can be delivered there by cutting a supply line into the main hot water line between the hot water generator and the tempering valve.

Frequently the water pressure at hose stations is greater than necessary and desirable. Where such is the case the pressure can be maintained at the optimum point by means of a pressure regulating valve. Because the pressure often varies from hose station to hose station it is desirable to have a pressure regulating valve at each hose station.

THE SPECIALIZED HOSE STATION UNIT

The Strahman-Perry Hose Station Unit is comprised of a cabinet with a removable stainless steel cover which can be affixed to a wall. The cabinet

* Presented at Thirty-fourth Annual Meeting of the International Association of Milk and Food Sanitarians, Inc., Milwaukee, Wis., Oct. 16–18, 1947.

is vermin-proof and can be so attached to a wall that nothing can get between the back of the cabinet and the wall. The cabinet houses a piston type valve, a strainer, a pressure regulator, a pressure gauge and fittings. The dial of the pressure gauge can be seen through a window in the cover of the cabinet. The water supply pipe enters the cabinet either through its bottom or through its back as may be desired. The cabinet is equipped with one or two specially designed hose racks depending on whether or not it is desirable to have one or two hoses at the hose station.

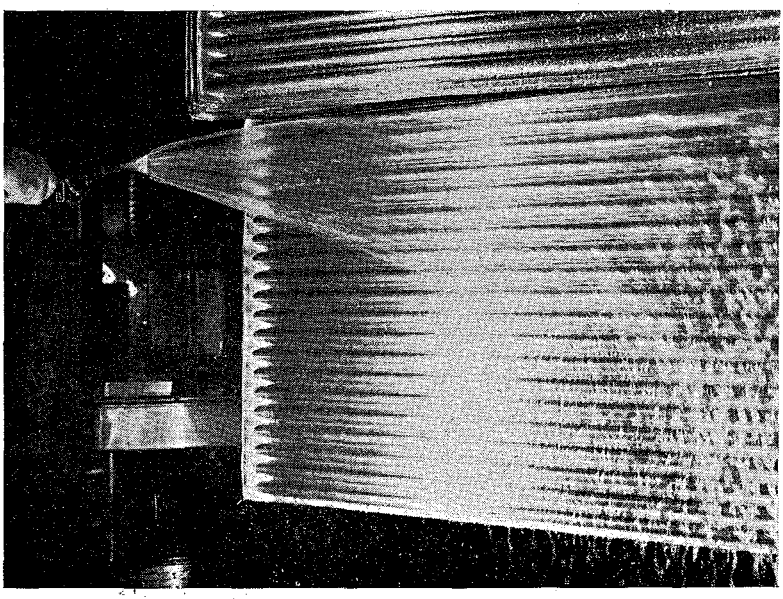
The Strahman-Perry Hose Station Unit is compact and attractive in appearance. The cover is so fastened that it can not be removed except by someone who has a proper wrench for unscrewing the small nuts which hold it in place.

If desired, the unit can be obtained with a flush front and with the body of the cabinet made to be sunk into the wall. This second type of cabinet is, of course, even better-appearing than the first type described.

THE SHUT-OFF VALVE

The Shut-Off Valve is attached to the end of the rinse hose and is intended to obviate the running of water except when it is desired to rinse or fill receptacles. This device gives the one who uses the hose complete control of the flow of water from it.

This valve has been specially designed. Where desired it can be locked in the open position. It is sturdily made and covered with a heavy coating of Neoprene which is very strongly bonded to the metal. Preferably, tempered water with a temperature of 115° F. is used. The standard nozzle, which is part of the shut-off valve assembly, delivers a blade of water. For normal rinsing, when this nozzle is used, a pressure of 15# per square inch is adequate. However, higher



The shut-off valve equipped with the standard nozzle delivering a "blade" of water pressures may be used if desirable. A special round nozzle is also supplied and with this nozzle it is possible to have a small or large stream of water, either round or feathered. Whatever pressure is necessary may be used. The round nozzle housing is so designed that a variety of nozzle tips can be used with it. This makes it possible to obtain virtually any type of stream desired. The blade of water delivered by the standard nozzle is ideal for rinsing either smooth or uneven surfaces. The blade of water has a very large coverage which permits rapid rinsing. When the standard nozzle is used the operator can stand very close to the surface he is rinsing without being splashed. The blade of water also rinses down when the nozzle is held in either the down or the side position so that the soil is carried off the surface being rinsed and does not flow back onto it as is often the case when a round stream of water is used.

The special round nozzle is useful when it is necessary to throw a rinsing stream relatively long distances in order to rinse under platforms and bottle washers or the insides of tubes in internal tube heaters or coolers.

LIGHT WEIGHT HOSE

Normally, a special light ½″ Neoprene coated hose is used with a shut-off valve. When this special hose is used a Whip-End about two feet long is attached to the Shut-Off Valve. The hose used in the Whip-End is a little heavier than the special ½″ hose so that it will flex in a relatively large arc and not crack and leak. The special light weight hose weighs approximately one-third as much as standard creamery hose. It is flexible, delivers ample water, is easily handled, and costs about half as much as creamery hose. Nevertheless, the special light weight hose has been found to have at least as long a life as creamery hose when the latter is utilized in the usual manner.

THE SANITARY FITTINGS CLEANER

The Sanitary Fittings Cleaner is designed for cleaning sanitary tees, ells, 2-C bends, and various small parts. It is comprised of a double compartment "sink" with two drain boards.

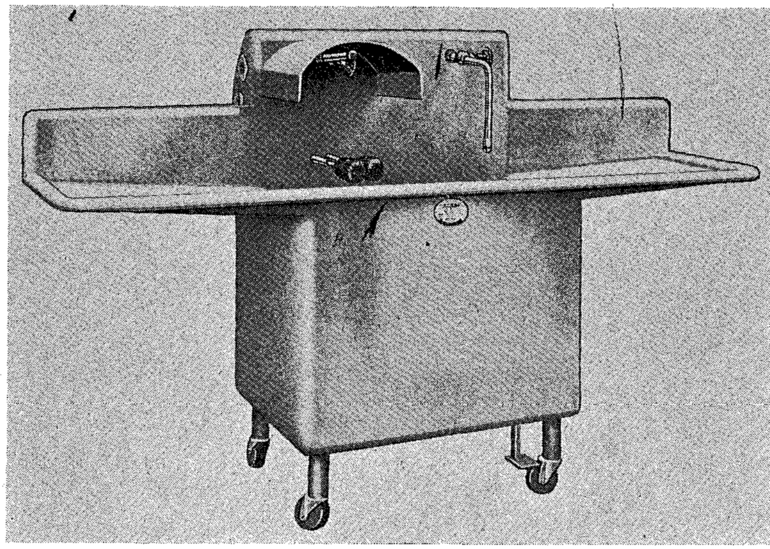
Over one compartment are two special scrubbing brushes, both moving upward and toward each other, one moving clockwise and the other counterclockwise. Above the two brushes is a perforated pipe from which cleaning solution is dropped onto the brushes along the line where their bristles mesh. A small motor is used to rotate the brushes and the centrifugal pump which delivers the cleaning solution. The cleaning solution is contained in the compartment under the brushes and is maintained at a temperature of 115° F. by means of thermostatically controlled electric heating element.

Over the rinse compartment, and attached to the end of a pipe is a special rinsing nozzle. This nozzle is supplied with tempered water having a temperature of 115° F. The flow of the water is controlled by means of a foot pedal which operates a quick action valve.

When a sanitary fitting is cleaned it is preferably brought up on a sanitary fittings buggy and deposited on the drain board at the left. It is picked up from the drain board on the left and scrubbed, both inside and outside, at the same time with the two brushes. After scrubbing the fitting is held under the nozzle and rinsed with a spray of water. After rinsing the sanitary fitting is placed upon the drain board on the right from which it is later removed to the Sanitary Fittings Buggy.

Rinse water is used only once so that the rinse compartment has an open drain which leads to the sewer.

When this unit is used it is unnecessary, except in rare instances, to soak



The Sanitary Fittings Cleaner

any of the parts which are cleaned with it.

It has been found desirable to use a specially designed refillable brush with the sanitary fittings cleaner. Satisfactory cleaning is possible with a short shank bottle brush but somewhat better cleaning is possible with the special brush.

Because the bottle brush has a wooden shaft which when the brush is used becomes soaked with water, the shaft breaks after it has been used for a short time either at the mandrel or among the bristles. Generally, the shaft breaks when the unit is in use which militates against satisfactory cleaning. On the other hand the shaft of the special brush is of metal and will not break even under heavy usage. While the initial cost of the special brush is, of course, much greater than that of the bottle brush, nevertheless the former is so long-lived that it is far more economical to use. Two of these special brushes presently in use were installed about ten months ago and have not yet been refilled. Had these special brushes not been installed and bottle brushes been used instead, it is probable that not less than 70 brushes would have been used by this time.

THE SANITARY PIPE CLEANER

The Sanitary Pipe Cleaner is comprised of two parts. The one part has the brushes for scrubbing and the other part the nozzles for rinsing. Cleaning solution is contained in a tank at the rear of the unit where it is maintained at a constant temperature of 115° F. by means of a thermostatically controlled electric heater. Rinsing is done with tempered water having a temperature of 115° F.

The scrubbing assembly consists of a brush which cleans the interior of the sanitary pipe and an assembly of three brushes that scrub the outside of the sanitary pipe. The "internal" brush is attached to the end of a shaft housed in a tube through which cleaning solution is fed to the brush. The shaft to which the "internal" brush is affixed is rotated by means of a motor which also drives the cleaning solution pump. Both the "external" brushes and the "internal" brushes scrub with the tips of their bristles. The external brush assembly is driven by a separate motor and can be adjusted to clean sanitary pipe of various sizes.

Excess cleaning solution from the brushes and sanitary pipe drops into a trough that carries it back to the cleaning solution tank.

The rinsing assembly consists of a pipe with a rinsing end through which water is sprayed onto the inside of the sanitary pipe and an "external" rinsing ring from which sprays of water are delivered which rinse the outside of the sanitary pipe. The flow of the rinse water is controlled by means of a limit switch and a solenoid valve so that the rinse water flows only when sanitary pipe is being passed between the rinsing ring and the rinsing nozzle. The used rinse water drops into a trough that carries it to the rear of the unit and through a drain pipe to the sewer.

The entire working end of the sanitary pipe cleaner is covered. There are two openings in the cover, one in front of the brushes and the other in front of the rinsing assembly.

A special brush has been designed for cleaning the inside of sanitary pipe. This brush is comprised of a metal shaft with bundles of bristles thrust through it. This brush is so designed that the cleaning solution can readily mix with the bristles while the sanitary pipe is being scrubbed. Also the design of this brush is such that the diameter of the brush is somewhat greater than the inside of the diameter of the sanitary pipe so that the brush has a relatively long life and will scrub satisfactorily until the bristles are well worn.

Where this unit is used it is unnecessary, except in rare instances, to soak the sanitary pipe.

When the Sanitary Pipe Cleaner is in use sanitary pipe is preferably brought up to the unit on a Sanitary Pipe Truck, scrubbed, rinsed, and replaced on the sanitary truck.

THE SEPARATOR DISC CLEANER

The Separator Disc Cleaner is constructed somewhat like the Sanitary Fittings Cleaner. It will, of course, clean either separator or clarifier discs.

When this unit is used, cleaning is done from right to left instead of from left to right as in the case of the Sanitary Fittings Cleaner. Brushes with relatively short bristles are used and are set close enough together so they will spin the discs. Cleaning solution is delivered against one of the two brushes and carried by this brush onto the other brush and while a separator disc is being cleaned onto its surface.

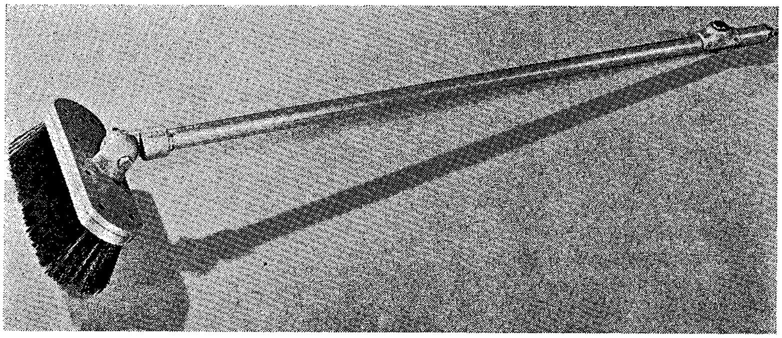
The cleaning solution is maintained at the proper temperature by means of a thermotstatically controlled electric element.

The rinsing compartment has four rinsing nozzles, one facing down and the other three facing downward and toward the center of the compartment. Tempered water is used for rinsing and its flow is controlled by means of a foot pedal which operates a quick action valve.

When separator or clarifier discs are cleaned they are placed upon the drain board on the right and removed one at a time by the operator's right hand. The edge of the disc is thrust between the two brushes which scrub it as it whirls. After a disc has been completely scrubbed it is removed by the operator's left hand, is run through the rinsing sprays and placed upon the drain board on the left. Each disc is rinsed with a fresh charge of water. The water after it has once been used runs through the open drain and to the sewer.

THE SOLUTION FED BRUSH

The Solution Fed Brush is made in three forms. The different forms are so designed that it is possible by using the three of them to scrub virtually all standard equipment found in milk or ice cream plants. Of course when it is desired to scrub in special openings such as thermometer openings, vat outlets, etc., special size brushes must be used. When these latter are used, cleaning solution can be supplied to the surfaces being scrubbed or onto the brush by means of a small Shut-Off Valve.



The Solution Fed Brush

There is a two-handed brush with a relatively large brush-head designed for scrubbing the inside of product storage tanks. This brush is equipped with an adjustable feature so that the brush-head may be set at any desired angle. It is equipped with relatively long bristles of a relatively small diameter. The stiffness of the bristles is sufficient to effect proper cleaning of cold product surfaces.

The second brush is like the first one described except that it has a smaller head and shorter bristles which are more openly spaced than in the case of the brush first mentioned. This brush is designed for cleaning surfaces where hard scrubbing is necessary.

The third Solution Fed Brush is a hand brush. It is designed particularly for scrubbing such things as the inside of heating vats and the surfaces of heater plates.

All of these brushes have cleaning solution supplied to them by means of light hose from a Cleaning Solution Tank. The cleaning solution is maintained at a temperature of 115° F. by means of a thermostatically controlled electric heater. The flow of the cleaning solution is controlled by means of a small button valve in the handle of the brush. Cleaning solution flows through a tube in the handle of the long handled brush to the brush-heads and thence out onto the surface through orifices on both sides of the brushheads. In the case of the hand brush the cleaning solution goes directly into the brushhead through a button valve located inside of the brush-head. The flow of cleaning solution in this brush is controlled by means of a lever on the side of the brushhead which opens or closes the valve inside of the brushhead.

At the present moment a power driven solution fed brush is being developed. This brush is being developed in two forms. In one form it is used for cleaning the inside of heater and cooler tubes. In the other form it is used for scrubbing flat or irregular surfaces. The brush is rotated by means of a so-called air motor which is in reality an air turbine. In the case of the brush used for cleaning tubes the cleaning solution is fed through the air line. Where this brush is used the brush and air motor assembly, which is attached to an air line, are both run through the tubes being cleaned.

The brush assembly for cleaning flat or irregular surfaces looks something like a pistol. Air comes into the assembly through the handle and behind the trigger. The cleaning solution is fed into the assembly in front of the trigger and goes through the shaft to which the brush is attached. This brush is also operated by an air motor located in the assembly which at full speed develops 0.9 of a horsepower. Both of these brushes are designed for hard scrubbing. They revolve at high speed and are light and easy to handle.

The Cleaning Solution Tank

The Cleaning Solution Tank normally is comprised of a cylindrical tank equipped with a sight glass and thermostatically controlled electric heaters on one end. The tank is filled with cleaning solution and the cleaning solution is fed to the brushes by means of air pressure. The air pressure normally runs between 5 and 10 lbs. per sq. in. This unit can be either stationary or portable as desired. It may be supplied with air from an air line or from an individual air compressor unit.

Where the power driven *tubular* brush is used a special type of cleaning solution tank must be employed which has a needle valve control. Where this tank is used the pressure utilized in the tank is much greater than in the case of the first type of tank described.

The Spray Sterilizing Unit

The Spray Sterilizing Unit advocated was not designed by the speaker but has been modified in certain details in accordance with his suggestions. It is comprised of a specialized gun for delivering the "chlorine" solution in a satisfactory form, the necessary hose, and a "chlorine" solution tank. Both chlorine solution and air are delivered to the gun where they are mixed. The gun can be set to deliver a spray of the desired character and will project it far enough so that the surfaces to be sterilized can be completely covered. The "Spray Gun" is a very important item where sterilizing is done by means of a chemical agent. The gun described is the only one presently known which is entirely satisfactory.

Economies

Although it has not yet been possible to accumulate a large quantity of data about the New Cleaning Aids, nevertheless some data of a highly indicative nature have been acccumulated.

In one plant where Shut-Off Valves were installed it was fond that after they had been installed only ⅓ as much water as was formerly used in cleaning was consumed.

In another plant where Shut-Off Valves were installed records covering eleven months operation showed a reduction in heating oil consumed of approximately 30 percent.

In a milk plant where a Solution Fed Brush was put into use it was found that whereas before the brush was put into use, approximately 20 lbs. of cleaning compound were used for cleaning product storage tanks, approximately 1½ lbs. were used after the brush had been put into use.

The Sanitary Pipe Cleaner, the Sanitary Fittings Cleaner and the Separator Disc Cleaner all not only effect better cleaning but also reduce the wear and tear on the equipment, reduce fatigue of the workmen, and make possible faster cleaning.

AUXILIARY EQUIPMENT

Certain auxiliary pieces of equipment such as hot water generators, tempering valves, specialized brushes, and pressure reducing valves are needed if a truly satisfactory performance is to be done by the New Cleaning Aids. These auxiliary pieces of equipment, except for the specialized brushes, are of standard make and can be obtained from the usual sources. The auxiliary pieces of equipment will be found beneficial from an economic and operational standpoint, even though New Cleaning Aids are not installed.

CONCLUSION

New Cleaning Aids are presently being used in a number of plants and the principles included in their design have been proven to be sound and desirable in these plants.

Sanitation in a Modern Bakery*

J. Lloyd Barron, C.E.

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The public health hazards attributable to food products from bakeries are minor. The maintenance of essential cleanliness is the major problem. The fact that prolonged and bacteria-destroying heat is applied to most bakery products is at once a potent safeguard to the baker and to the public, *and* a sedative to the traditional baker who is inclined to think of the baking process in the same way some earlier milk dealers considered pasteurization—a means of making dirty milk unobjectionable or safe.

Baking, being an art with an ancient tradition which has undergone relatively little change through the centuries, tends to conservatism in equipment and methods. Machinery for mixing and processing doughs, fillings and icings, persists in the model T stage. With the dependence on the baker's oven for a safe product, most bakeries are deficient in washing facilities, from the ordinary sink to the specialized washing machines required for cleaning pans and other containers.

In recent years, however, the tremendously increased public acceptance of bakery bread, biscuits, and cakes has necessitated new and enlarged plant structures, new machinery (such as the band oven) adapted to mass production, and a revised concept of bakery sanitation. This latter has been stimulated not so much by health authorities as by the federal food regulatory agency which does not have to justify its functions on the ground of danger to health but proceeds directly against conditions of so-called "filth" through enforcement of increasingly higher standards of quality and cleanliness in both ingredients and plants.

Insects

Grain, and its derivative, flour, being the main ingredients of baked goods and the favorite food of a multitude of insects, the miller and the baker have been plagued by their ravages for centuries, yet not too concerned about them either until modern laboratory methods have made their detection in the finished product possible. Under pressure of this type of control and the increasing sensitivity of the public to insect contamination, the baking industry is discovering that insects can be controlled by treatment of grains by fumigation, by better cleaning in mills and bakeries, and by improved storage facilities, machinery, and containers.

Sanitation in a modern bakery, so far as flour insects are concerned, is coming to have the following essentials. The wheat in elevator storage must be turned at intervals to reduce moisture and temperature and to permit the application of a fumigant such as chloropicrin, to destroy or retard the development of grain weevils. Since these insects develop and may remain, after being killed, in the grain kernels, they cannot readily be removed by cleaning before milling and are, therefore, ground up with the flour to form insect fragments microscopic in size and detectable only by the flotation test developed in the Food and Drug Administration laboratories. Their removal, as a part of the wheat cleaning at the point of milling, is of prime importance.

* Presented at the Thirty-fourth Annual Meeting of the International Association of Milk and Food Sanitarians, October 17, 1947.

National Biscuit Company was the first to make use of a new method of removal by adapting the entoleter (previously used only as a killing device) to shattering the insect-invaded and weakened grain kernels and then subjecting this wheat stream to a selective separation into dust, tips, and sound wheat by a battery of aspirators. A high percentage of the insects is contained in the dust which can be wasted. This process, in combination with other control measures, has made it possible to meet the informal and unexpressed tolerances for insect fragments in flour even when using a high-moisture, soft wheat.

In the mill, general fumigations two or three times a year are usually necessary, using methyl bromide where the mill structure can be made sufficiently tight. This must be supplemented at particular points of infestation by frequent removal of stagnant flour and by spot fumigations, using such chemicals as ethylene dichloride, ethylene dibromide and acrylonitrile.

Residual insecticides such as DDT may be used in some mill areas and the frequent and thorough removal of flour dust is essential to interrupt insect multiplication. For cleaning both mill machinery and structure, a fixed vacuum piping system is most effective.

The transportation of flour presents a major problem as to containers and as to condition of freight cars. The railroads under present circumstances assume little responsibility for the condition of their cars, many of them containing carry-over insect infestations and various soiling and odor-imparting materials from previous cargoes. DDT treatment of cars is frequently necessary. Such treatment should become routine practice by the railroads whenever weather conditions favor insect growth.

Multiple-use flour bags of cotton cloth have served long and economically in the milling industry but are now becoming out-moded by the single service, multiple-walled paper bag. Only the production capacity of the paper industry limits the conversion to this container. Several states (Oklahoma and Minnesota) have already prohibited the re-use of flour bags, and New York and Georgia are considering a similar restriction.

In the bakery, it is necessary to avoid over-stocking and long storage of flour and to maintain rotation of stocks. Storage areas must be kept clean, stocks piled out from the walls to permit inspection and cleaning, and residual insecticidal treatment practiced on adjacent wall and floor surfaces. All flour, including that used for dusting, needs rebolting at the point of consumption. Dumps, conveyors, elevators, bolters, bins, and scale hoppers become insect breeding places unless given thorough routine cleaning and fumigation. Access must be provided for cleaning, and reasonably tight closure for fumigation. If the fumigation is effective, in terms of approximately 100 precent kill, it may be done at monthly intervals using ethylene dibromide or acrylonitrile, the latter having the advantage of being much faster-acting and applied in smaller quantities.

HOUSEKEEPING

Housekeeping in bakeries is not essentially different from practices in any other food establishment. Washing facilities, while too often inadequate, should include two-compartment sinks, large enough to accommodate the largest trays and pans for both washing and rinsing. Mechanical washers are being developed which make possible frequent routine cleaning of the many pans, tins, trays, and ingredient containers used. However, manufacturers of such machines frequently fail to provide them with the accessory equipment necessary for their proper functioning. These items include indicating thermometers, float-controlled make-up valves, detergent feeding devices, insulation on drying sections, etc. Too often disappointing results from such machines are due not to the basic unit itself but to lack of essential controls and operating devices.

In bread bakeries, equipment for soaking bread pans in a special detergent is essential. This includes a tank with two compartments (one for long soaking and the other for brief rinsing), baskets and hoist for handling. Without such equipment, grease incrustations build up and eventually come off as carbon spots on the bread crust. A new chemical coating for bread pans is now being used experimentally which is designed to make greasing unnecessary.

A chronic problem in many bakeries is the chilling of doughs for mixing. Where ice is used for this purpose by adding cracked ice to the mix, foreign substance contamination is likely to result. Natural or artificial ice may carry adhering or entrained dirt and the handling and breaking of the ice within the bakery is usually a crude operation. Modern refrigerating units are desirable for cooling water to recirculate in mixer coils and to be used for ingredient water. Splinter ice, manufactured at the point of mixing, is beginning to be used, the equipment being similar to that in some large milk bottling operations.

In cleaning of food contact surfaces in bakeries for the prevention of mold and in hand packing operations where fingers are soiled or made sticky, the use of quaternary ammonium chloride compounds is desirable, to supplement the chlorine compounds. Bacterial accumulation in the water used for rinsing rags or for wetting fingers and the transfer of such bacteria to the products may be significantly reduced by use of a germicidal solution, provided the solution is non-toxic, without odor, stable, and not irritating to the skin.

Floors

One perplexing feature of bakeries is the construction and maintenance of floors. The areas where wet operations are carried on require almost continuous cleaning with mops and squeegees. This results in eventual rotting of wood flooring, or the disintegration of cement surfaces and of mortar between bricks or tile. If cement is used, it requires wet curing and special surface treatment to make it tough and impervious. Where brick is used, the best appears to be the acid brick manufactured of Ohio clay with a special process for exhausting air to make the brick dense. The most important feature, however, is the use of narrow mortar joints, 1/8" to 1/16". The wide joints quickly disintegrate and are then difficult to renew. Poured sulphur compound joints can be used or a special Portland cement containing iron filings to produce an expanded dense mortar. Care must be exercised to prevent any void spaces under the brick or in the joints. Floor drains and an adequate pitch to them must be provided. For wet areas, quarry tile may also be used wtih the same thin joints. Asphalt, if used, should be confined to runways since it requires exercise to keep it from becoming hard and brittle.

For smooth, attractive and comfortable floor surfaces in the major dry areas, hard maple wood is unsurpassed. The development of efficient floor maintenance machines, such as the Tennant, simplify this job and provide easily cleanable surfaces.

Vermin

Rodent control has top priority in a bakery sanitation program. The first element of rodent control is making the structure tight to prevent their entrance by any channel other than through necessarily opened doors. Any other means of control is largely wasted energy until rat-stoppage or rat-proofing has been accomplished. However, it must be combined with the elimination of inside harborages to the greatest extent possible. If this work is well done, and followed by a quick, complete extermination of the existing population, the rat problem is largely eliminated, provided stoppage is maintained.

For the control of mice, skillful and persistent trapping seems to be the best method. This means daily attention to the placement and baiting of traps, based upon careful inspection to determine the presence and location of mouse activity. An effective program, including elimination of harborages, should prevent any multiplication of mice within the bakery.

Assuming that grain and flour insects are being controlled in a bakery, there remains the problem of infestation by miscellaneous pests such as flies, cockroaches, silverfish, ants, etc. DDT constitutes the principal post-war weapon and is effective for residual treatment if properly used. However, where heavy infestations exist, they should be reduced by means of a contact spray having a quick knock-down and kill such as pyrethrum, piperonyl butoxide, or cyclohexanone. For routine residual spraying to control slight infestations, one of the contact sprays in concentrated form may be added to the 5 percent DDT solution. While it cannot be stated just what interval between residual sprayings is proper, it appears that one month is a practicable period, except for places where washing, vapors, or dust coatings may destroy or insulate the residual in much less time.

Fly control can, of course, be accomplished using straight 5 percent DDT at about two months intervals during the fly season. It is probable that other residual type insecticides will prove to have some advantages over DDT but it is not yet clear that they possess over-all superiority. Certainly, experience now indicates that DDT can be used generally throughout a bakery with the exercise of ordinary care in avoiding direct application to food or food-contact surfaces.

RESPONSIBILITY OF MANAGEMENT

All of the above factors in a sanitation program and many others do not produce results unless management makes provision for their implementation, and too often bakery managements offer little more than good intentions and dissipated responsibility. Sanitation functions require study, organization, balanced application, and persistent follow-up. These elements of a program cannot be scattered and added to the duties of a number of employees, no matter how effective such individuals may be in discharging their primary jobs. The sanitation job in a plant must be centered in one individual having both responsibility and authority stemming from his immediate superior—the manager or owner. Such a sanitation supervisor, of course, requires training and continuing contact with sources of information and guidance. In larger companies, this may come from an executive sanitation department and, in smaller bakeries, it may have to be supplied in part by the local health department.

Sanitation cannot be maintained and kept in balance in a bakery without thorough and frequent investigations by the sanitation supervisor and occasional check inspections by superiors or outside food control officials. Incidentally, no inspection can be thorough or effective unless it has the benefit of a good, sharp-beamed flashlight in the hands of the inspector.

Since it has been demonstrated that a sanitation program can be carried on successfully only under responsible and undivided authority, health departments and other food regulatory agencies might well devote more of their energies to the encouragement of sanitation departments or sanitation supervisor positions in bakeries and other food processing plants. By such means, the outside official can accomplish far more in terms of a consistently high level of food plant sanitation than through any practicable number of outside inspections. To this end, the food plant sanitation program and its administering personnel require the sympathetic understanding, support and help of the official food inspection agencies.

Kitchen Equipment Engineering

SAUL BLICKMAN

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KITCHEN equipment engineering is the title of this paper to be presented within an allotted time of twenty-five minutes. The field for discussion is so vast that proper coverage would be incomplete in a volume of three to four hundred pages.

In our industry Kitchen Equipment is commonly referred to as Food Service Equipment and concerns itself primarily with commercial and institutional installations and not with domestic or home set-ups.

Kitchen Equipment Engineering covers not only the preparation of specifications and construction details involved in the fabrication and selection of equipment, but involves primarily the planning and relationship of the space areas required for the type and number of persons to be fed and the necessary space requirements for service, food preparation, cooking, storage, refrigeration, employee facilities, etc.

Where the construction is new, the kitchen equipment engineer, working in close cooperation with the architect, and whenever possible with the owner or management, advises on the space allocation, its relative location and works out a harmonious and efficient relationship between all departments of the feeding establishment.

After the proper space allocation has been determined, the kitchen equipment is then planned. The floor plan showing the actual layout of equipment is prepared.

* Presented at the Thirty-fourth Annual Meeting of International Asssociation of Milk and Food Sanitarians, Inc., Milwaukee, Wis., October 16–18, 1947.

At this stage the most careful study is made affecting the operation of the complete storage, food preparation, and food service installation. The trained kitchen equipment designer assumes the roll of an industrial engineer, since on large installations vast quantities of bulk foods must be efficiently handled into the storage areas, from there into the preparation areas, into the cooking areas, thence to food service, and on to consumption. Here the problem does not end, as dishes and waste materials must be efficiently and effectively handled, properly stored or disposed of, with a minimum of traffic lines, and a minimum of traffic congestion.

After the layout of equipment has been completed, the necessary provision is made for the roughing in of the necessary plumbing, heating, electrical, and ventilation requirements.

Following the preparation of roughing in drawings, detailed specifications for equipment involving storage, preparation, and cooking are prepared. These specifications must be thoroughly descriptive, must specify materials to be used, and general construction detail. The type of specification and construction will vary greatly with the type of feeding establishment and must fall within budgetary requirements.

The problem of planning, is, of course, simplified where new construction is involved. More often, however, installations are made in existing buildings or altering or additions to existing installations. In these situations, the kitchen equipment engineer is often sorely taxed to work out an efficient and effective layout. Existing space conditions must be carefully studied and consideration given to existing plumbing, heating, and electrical lines, as well as other services. Problems involved in such installations are so varied as to beggar description. Alternate layouts must be studied and consideration given to every possible factor to produce a satisfactory and acceptable layout. The overall space allocation must be carefully studied, existing partition walls used wherever possible. The final decision must be the best decision and the one most nearly correct to produce an effective installation. The final layout of the kitchen equipment itself is so closely tied in with the construction that it is most costly to make changes after installation. For example, a counter improperly placed or improperly planned means an expensive alteration and more often than not a complete replacement. The greatest possible ingenuity is involved in perfect planning, so that the final result will leave no regrets on the part of the operator, the architect, and the equipment engineer.

It is important to understand the fundamental nature of kitchen equipment. The equipment engineer recognizes two forms of kitchen equipment:

(1) *Fixed Equipment*, such as is commonly purchased by the manufacturer of kitchen equipment and involving such items as dishwashers, ranges, ovens, broilers, stock kettles, steamers, mixers, peelers, etc. It is the responsibility of the kitchen equipment engineer to select such items of standard equipment as fit the requirements and budget for a given installation. For example, ranges and dishwashers respectively have their given capacities and output and it is the responsibility of the kitchen equipment engineer neither to over-equip nor under-equip for a given requirement.

(2) *Fabricated Equipment*, such as is normally produced in the manufacturing plants of the kitchen equipment manufacturer, involving counters, back bars, cook tables, soiled and clean dish tables, plate warmers, steam tables, etc.

The kitchen equipment engineer is invariably connected with a fabricator or distributor of food service equipment, and since fabricated equipment generally forms, by far, the major proportion of an installation, I shall without burdening you with too much detail, give you a few fundamental thoughts on this subject. I shall briefly discuss the following, as they affect and are affected by food service equipment:

I. Factors affecting cost of equipment.
II. Operation and maintenance of equipment.
III. Sanitation.
IV. Fundamental principles of construction involved in good fabricated food service equipment.

1. Factors Affecting Cost of Equipment

The basic cost of materials entering into fabricated food service equipment—stainless steel, light structural sections, galvanized iron—has increased but nominally during the past ten years, stainless steel in particular having suffered but a negligible increase in price. True, other materials entering into the production of fabricated food service equipment have increased in price considerably, particularly such items as castings, forgings, and stampings, but these form relatively minor components. It is reasonable to state, therefore, that the major item of material, stainless steel alone more than any other product, affects the cost of fabricated equipment. We shall see how this factor is to be considered in the proper design of fabricated equipment.

Labor Cost, on the other hand, particularly the skilled labor required to build equipment, has, during the past ten years, increased more than 100 per cent.

It should be understood, therefore, that in any consideration of a properly drawn specification, the factors involving the relatively small increase in the cost of material and the high increase in the cost of labor must be carefully and seriously considered. How do these factors affect a given set of specifications? It is obvious that complicated, unnecessary construction should be avoided and, wherever possible, gadgets and unnecessary details should be eliminated. The progressive manufacturer of fabricated equipment has made every effort possible to counter-balance his greatly increased labor costs through improved manufacturing methods. Hand operated machines have been replaced by heavy power driven machinery, on which the heaviest gauges of material can be efficiently and economically handled. Construction methods had to be modified, dies, tools and welding fixtures designed and installed to produce fabricated equipment more rapidly. Improved shearing, forming, and welding techniques were developed in an effort to counter-balance the abnormally high labor rates affecting our industry. The prime factor now is not emphasis on material, but emphasis on construction detail and all factors which eliminate high labor costs. It is obvious, therefore, that working in light gauge stainless steel to effect a saving in cost of material is not always economical, since working in light materials involves backing up light stainless steel with heavier steel sections, additional framing, additional welding, and obviously higher labor costs, altogether out of proportion to what has been saved in the material. If a question should arise as to whether a top of a wide unit, involving a large span, should be made of #16 gauge, #14 or #12 gauge, the decision should not rest with the saving in cost between the lighter and heavier material, but what will be the extra cost in labor to produce the lighter top? How much additional reinforcing will be required? To what extent will the lighter top require closer spacing of bracing and therefore more bracing? What will be the effect on the cost of welding? How much more buckling will occur through use of the lighter sections, and how much additional labor will be required to remove this buckling and warpage? These are the factors which the well trained kitchen equipment engineer knows how to handle.

2. Operation and Maintenance of Equipment

Paralleling the high labor costs of the highly skilled factory labor required to build equipment is the very high cost of the operating and maintenance help used in and about a food service equipment installation. It is important, therefore, that the kitchen equipment engineer design all fabricated equipment to afford a minimum cost of operating that equipment. This, of course, involves proper construction detail, but likewise emphasizes the proper planning and layout of equipment. It is easy to understand how important it is, within a given piece of fabricated equipment having an abnormally long length, that it be so designed as to afford a minimum of travel between sections of that given piece of equipment. Consider also the confusion that may arise on the other side, say of a large serving counter, because service sections have not been placed in proper sequence, or the confusion and chaos that can result in the area between an improperly planned large serving counter and a back bar installation. Now more than ever must the kitchen equipment engineer pay close attention to the elimination of unnecessary personnel in the preparation and serving areas, and unless equipment is properly planned and designed, the cost of operation can run to abnormally high figures. It is important, too, that the equipment be specified, designed, and built to withstand normal and rough usage about a kitchen. Not always is the highest type of kitchen help obtainable. Equipment which cannot stand up results in inconveniences, as well as in costly repairs. Where the overall equipment is light and flimsy, or where metal of sufficient thickness has been used but has been poorly put together the cost of maintenance can reach staggering proportions. It is important, therefore, that the kitchen equipment engineer, from the very beginning, plan the equipment layout to reduce operating costs within the preparation and service areas, as well as to reduce maintenance costs through proper selection of materials, proper design, and proper craftsmanship.

3. SANITATION

More and more will we be confronted by ordinances and codes regulating eating establishments. While such ordinances and codes are of general application, in time to come they will be specifically applied to food service equipment. From now on, the kitchen equipment engineer must place great emphasis on his thinking to achieve satisfactory results in this most important direction. One need only read the literature of The National Sanitation Foundation, insofar as it affects our industry and with specific reference to dishwashing equipment, to realize the importance of sanitation—not only in the dishwashing machine, but in all of the fabricated food service equipment which concerns our industry. The problem of maintaining equipment in a clean and sanitary condition is the instant problem of the kitchen equipment engineer. Unless equipment is designed and specified to afford simplicity in cleaning and maintenance of sanitary conditions, it can never be expected that such equipment will be so maintained despite any codes or regulations that may be imposed upon feeding establishments. Briefly, it is not the code alone, but the simplicity in the design of equipment to meet code requirements that will produce the desired result. I regret to state that there is virtual disregard today for the building of equipment so designed and constructed to afford ready accessibility for cleaning. Cabinets and enclosures are often so poorly designed as to make it utterly impossible to reach interiors. Shelves are rigidly fixed, doors are not removable, understructures are built with excessive light structural framing affording inaccessible crevices, nooks, and corners to harbor dirt, filth, and vermin, so that in an establishment of medium size, on the food service equipment alone, thousands of inaccessible corners and crevices are prevalent. With the high cost of labor and the scarcity of skilled kitchen help, equipment is not cleaned as often as it should be for the reason that the equipment itself presents obstacles against ease in cleaning. Often, no thought whatever is given to the design of a given piece of equipment from the standpoint of what happens to it after it leaves the fabricator's plant. How will the equipment be cleaned? What accessibility is there to all parts of it? I refer now to the most simple elementary forms of construction wherein it is possible to design equipment so that ready access IS available to every inside and outside corner. I repeat again that it is of the utmost importance that the kitchen equipment engineer, who is responsible for the design and fabrication of kitchen equipment from now on be more fully concerned with such phases of design and construction that will afford sanitary maintenance of equipment at the lowest possible cost and with the least amount of back-breaking effort. The problem is simple, feasible, and attainable, but the will to accomplish it must be strengthened and emphasized. The cost of redesign and retooling will be high, but the progressive kitchen equipment fabricator must face the problem sooner or later. Why not start right now?

In the past, but little attention has been given to the problem of sanitation at the site of the installation of food service equipment. Pieces of equipment are made in short sections with inaccessible spaces between them. Equipment is butted against walls with no possibility of cleaning in the rear of equipment. In other words, a myriad of inaccessible areas remain to collect, harbor, and retain dirt, filth, and vermin. It is possible to so design equipment as to keep such inaccessible spaces down to a minium, or to reduce them entirely, and from now on this sadly neglected condition will have to be studied and remedied, properly planned for, and the plans scrupulously carried out.

4. Fundamental Principles of Construction Involved in Good Fabricated Food Service Equipment

The fundamental principles of good fabricated equipment obviously involve considerations of first cost, operation and maintenance, and sanitation. I could not possibly attempt to cover such design and construction factors in this paper, but presentation of a *few* of the highlights will doubtless start constructive thinking along proper channels to achieve the desired result. I shall outline just a few elementary fundamental principles in construction detail:

(a) Consider any type of *enclosed cabinet,* whether heated or unheated. Just what would you look for? The cabinet should, by all means, be self-supporting, without the need of internal bracing by means of angles and channels, and, of course, should be made of a substantial gauge of stainless steel. The back and ends and part of the front should be formed of one piece wherever possible, with corners not too sharply broken. Sliding doors should be of overhead roller bearing type, readily and instantly removable, so that the entire interior of the cabinet may be exposed to view. The doors should preferably be of double wall box construction, thereby eliminating inaccessible recesses. Closed channels at the bottom should be avoided to prevent the accumulation of dirt and filth. The door itself should run free of the bottom and top guides, and not rub nor scrape nor grate against the retaining sections. The door should be guided ton and bottom by means of independent clips on the uppermost of which are mounted the roller bearings. Handles should be of flush type and self-locking. With the doors readily removable, the intermediate shelf or shelving and bottom of the cabinet are immediately and fully exposed to view. The intermediate shelf or shelves should likewise be readily removable, and the bottom shelf, if over steam coils, should also be removable. We now have a cabinet readily accessible for rapid cleaning, simple and easy operation, and maintenance. Wherever possible and the budget permits, the cabinet and doors should be insulated and the rolling doors sound deadened to avoid radiation of heat and unnecessary clatter and noise. The external faces of the cabinet should be free of trim, thus avoiding a myriad of dirt catching crevices, making it so much simpler to wipe the exterior of the cabinet clean.

(b) I wish to emphasize the importance of *rounded corner construction.* It should be so obvious that a piece of equipment built with fully rounded corners is simple to clean, and since it is simple to clean, the equipment will be kept clean. The first cost is negligible when compared with the daily repeated high cost of cleaning square cornered equipment. It is the equipment itself, through improper design, which offers resistance to cleanliness and sanitation. Sinks, drainboards, soiled and clean dish tables, upturned flashings and splashbacks etc., should, in all cases, have either fully rounded or slightly rounded corners, and all intersections at corners be fully coved.

Not only will this afford greater ease in cleaning and maintenance of equipment, but it is important to emphasize that sharp corners accumulate dirt. Dirt invites corrosion, particularly on stainless steel, and corrosion is often apt to be progressive. In time, the corrosion could go right through a corner. True, round corner and coved construction is costlier in the beginning, but it soon pays for itself in savings of operations and maintenance, let alone the feeling of pride which we all have in clean food preparation and serving areas.

(c) Great strides have been made in the welding, grinding, and finishing of *pipe and tubular understructures* for tables, soiled and clean dish tables, and other equipment. Angle construction should be avoided and likewise pipe and rail fitting construction are undesirable. It is now possible to build understructures of pipe legs with longitudinal tubular cross bracing and pipe runners of all-welded design. Care should be exercised that the excess weld metal be ground smooth and polished, and the entire structure, where of stainless steel, polished to a high lustre. It is possible to accomplish this with modern techniques of assembly, welding and grinding. Such substitutes as tack welding in spots only and not finishing the welds, leaving crevices at joints, should be considered as unacceptable. Each crevice left with improper welding and finishing invites the accumulation of dust and filth. Wiping cloths catch in these crevices, making cleaning difficult. Improperly finished welding, in addition to forming dirt catching pockets, is often the cause of lacerated fingers and hands.

Consider, for a moment, how simple it is to take a cloth and instantly wipe clean the tubular understructure of a table, or of a soiled and clean dish table. The work requires minutes to do, instead of hours against what would be required on improperly built equipment.

Good sanitary construction not only invites cleaning because it is simple to do, but creates a sense of pride in keeping equipment as it was when installed. If the above elements are considered and incorporated in the design, specifications and building of a given piece of equipment, the important factors outlined in this paper will have been achieved, namely reasonably low first cost, ease and low cost of operation and maintenance, and good sanitation.

In conclusion, I realize that I was not expected to cover the entire field of kitchen equipment engineering. I have touched upon a few high spots. I know that this group does not have to be impressed with the importance of proper sanitation. That is your concern and your profession. If I have pointed out weaknesses in our industry, it is not because I am critical. If I have thrown light on a hitherto neglected phase of the food service equipment industry, I know that some good will result from my effort. That is one of the reasons why I accepted the invitation to address you. Insofar as the writer personally is concerned with respect to these engineering aspects, it is the chief concern of his company to build equipment that *will* meet the highest possible standards with particular respect to sanitation. Our investment in retooling is enormous and I hope that the results will be commensurate with the effort and cost.

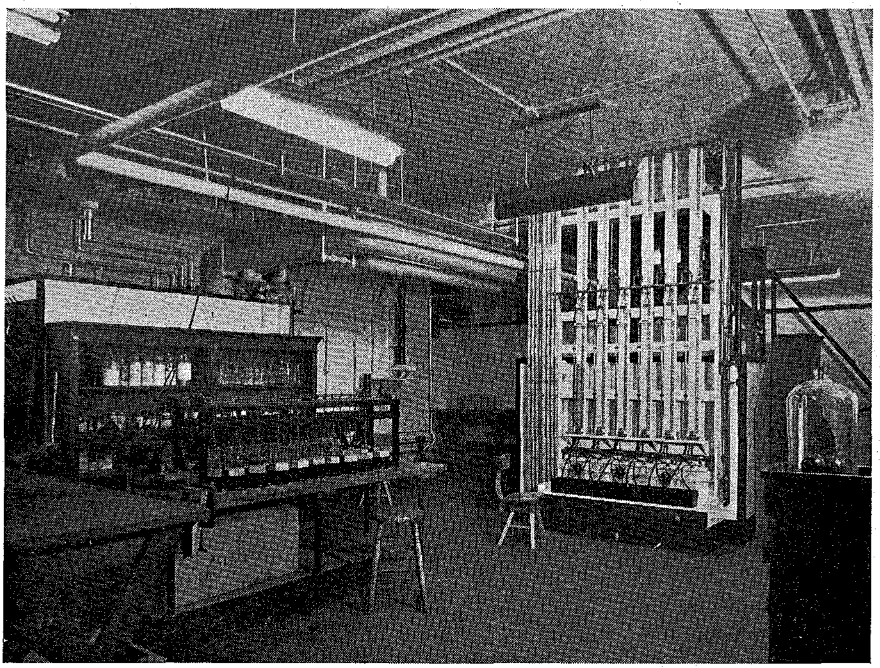
WILLIAM THOMPSON SEDGWICK LABORATORIES OF SANITARY SCIENCE DEDICATED AT M.I.T.

Professor William Thompson Sedgwick was one of the early pioneers in the development of our modern concepts of sanitation. A fitting memorial to him has been completed by the Massachusetts Institute of Technology in the form of four fine laboratories for study and research in Sanitary Science.

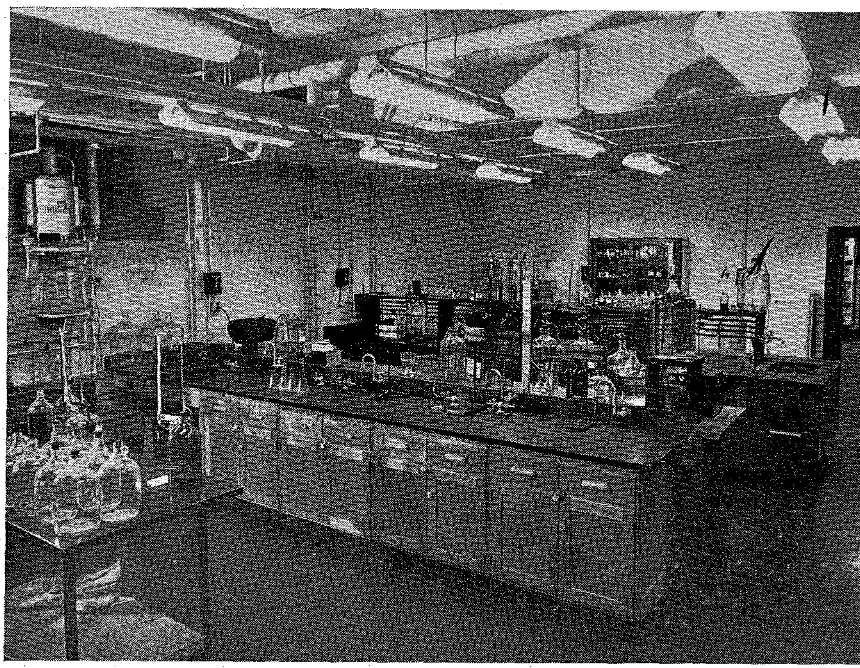
A public dedication of these "William Thompson Sedgwick Laboratories of Sanitary Science" was made in an impressive program, December 3, 1947, attended by a large number of former associates and students of Professor Sedgwick and persons interested in sanitation and public health.

The "William Thompson Sedgwick Laboratories of Sanitary Science" comprise a series of four laboratories at M.I.T. briefly described as follows:

a. The *Sanitary Engineering Laboratory,* contained in a room 24 × 40 feet, equipped with a rapid sand demonstration and experimental laboratory filter unit, a small trickling filter unit, a chlorinator, an enclosed sludge digestion unit with temperature control, and other facilities for laboratory studies and research in the principles of treatment of



Sanitary Engineering Laboratory



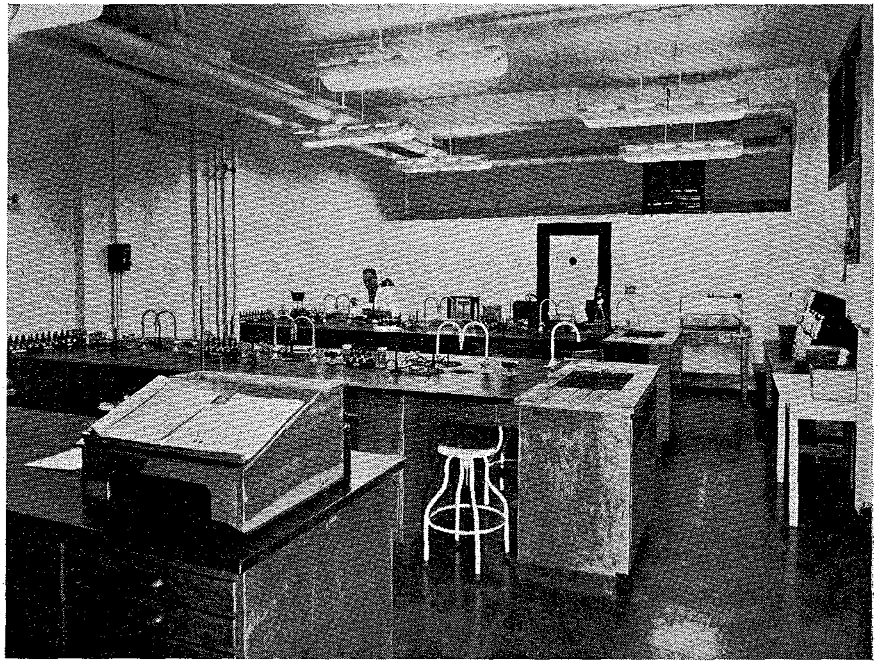
Sanitary Chemistry Laboratory

water, sewage and industrial wastes. Professor A. A. Thomas, Assistant Professor of Sanitary Engineering, M.I.T., is director of this laboratory.

b. The *Sanitary Chemistry Laboratory,* contained in a room about 24 × 33 feet equipped with two steel student work benches with spaces for 14 students, a balance table with 4 precision balances, a Kjeldahl nitrogen distillation unit, a large 103° C. drying oven, fume hood, a refrigerator, a walk-in 20° C. incubator 12 × 6 feet with sensitive temperature control, and a complete assortment of spectrometer, potentialmeter, pH units and other instruments and supplies necessary for laboratory instruction in the modern concepts of Sanitary Chemistry. Dr. C. N. Sawyer, Associate Professor of Sanitary Chemistry, is the laboratory director.

c. The *Sanitary Chemical Research Laboratory,* for research workers in Sanitary Science, equipped with two work benches, desks, a fume hood and instruments needed for research work. This laboratory has ready access to the other laboratories.

d. The *Sanitary Bacteriology and Bacteriological Research Laboratory,* occupying a space 19 ×65 feet divided into (1) a preparation room, (2) a store room for sterile supplies, glassware and media, and (3) a main laboratory containing two student work benches, an instructor's bench, two walk-in incubators, one 37° C. and one 32° C., Quebec colony counters, centrifuge, water bath, analytical balance, and other facilities suitable for bacteriological analysis of water, sewage, air, shellfish, milk, foods, swab-rinse preparations from eating and drinking utensils, and the physical and chemical analyses, including the phosphatase test, for the sanitary examination of milk supplies. Dr. M. P. Horwood, Professor of Sanitary Science, has direction of the bacteriological and public health work.



Sanitary Bacteriology Laboratory

These memorial laboratories are part of the facilities for the program of instruction of Course XI, Sanitary Engineering, at M.I.T. This course was set up in 1890, with the active cooperation of Professor Sedgwick, and has functioned continuously since that date.

Since March, 1944, the Course XI Sanitary Engineering subjects comprise a graduate school program leading to the degrees of Master of Science and Doctor of Science in Sanitary Engineering. Undergraduate work in Civil Engineering or in Chemical Engineering constitutes a proper preparation for this graduate program.

The Course XI Sanitary Engineering instructional program includes both Sanitary Science and Public Health subjects as well as Sanitary Engineering subjects. It is one of the very few programs of study where a student may obtain all of his special training in engineering and sanitary science, both in classroom and laboratory work, within one department offering a carefully coordinated series of subjects given by a staff, each well qualified in his special field.

The Sanitary Engineering program at M.I.T. includes a series of 21 subjects of Sanitary Engineering and Sanitary Science available to students interested in preparing themselves for careers in Sanitary Engineering, in the operation or management of sanitary facilities such as water supplies, sewage works, sanitation of milk, and food processing and the like, or in the fields of environmental sanitation or public health.

A series of nine subjects taught by Professors Stanley and Thomas relate to the general principles and engineering design aspects of water, sewage and industrial wastes, treatment processes, and treatment works.

A series of five subjects taught by Dr. C. N. Sawyer cover the application of Sanitary Chemistry to the fundamental chemical and biochemical reactions involved in the treatment of water, sewage, and industrial wastes and the laboratory tests to properly control the operation of such works.

A series of five subjects taught by Dr. M. P. Horwood cover the application of bacteriology, chemistry, and biochemical reactions involved in the sanitary examinations, inspections, and regulations incident to the satisfactory control of environmental sanitation and the public health. These subjects include the study and laboratory practise in making sanitary examinations of water, milk, food, dining and kitchen utensils, and the application of the principles of Sanitary Science to the handling and treatment of such water, milk, and food supplies.

Aralac Casein Fibre Plant Sold by National Dairy

L. A. Van Bomel, president of National Dairy Products Corporation, has announced the signing of a contract for the sale of the company's Aralac plant at Taftville, Conn., to the Virginia-Carolina Chemical Corporation of Richmond, Va., and that National Dairy plans to discontinue operations in the casein fibre field.

Aralac, a protein textile fibre made from milk casein, has been used principally in the manufacture of felt hats and upholstery and as a blend in the production of clothing textiles.

"We are discontinuing the manufacture and sale of Aralac, even though this project resulted in a substantial profit to the Company," Mr. Van Bomel stated. "Development of other more profitable uses for skim milk products has resulted in a marked increase in the cost of casein from which Aralac is made."

The Virginia-Carolina Chemical Corporation, it was explained, has found the Taftville plant suited to its plan to produce fibres from vegetable protein, which is in adequate supply from domestic agricultural sources, rather than from casein.

The sale involves 39 acres of land at Taftville in the town of Norwich, Conn., a one-story and basement factory building and other auxiliary structures, machinery and equipment.

Society of American Bacteriologists

The annual meeting of the Society of American Bacteriologists will be held in Minneapolis, Minnesota, May 10 through 14, 1948, with headquarters at the Nicollet Hotel. There will be sessions on general agriculture, industrial and medical bacteriology, as well as immunology and comparative pathology.

Excerpts from Annual Report of Chief of Bureau of Dairy Industry, 1947

Use of Penicillin and Management Methods to Control Mastitis

A mastitis-free dairy herd is a rarity, if in fact one exists. Through the years, the Bureau of Dairy Industry herd has had its share of mastitis. Up to 1942 a constant effort was made to keep mastitis at a minimum by management methods designed to obviate the predisposing causes of the disease and to relieve its painful and disturbing results. Frequent milking, massage, and the application of hot water proved reasonably effective in getting rid of the acute symptoms and restoring milk secretion. But the infecting organisms were not eleminated; they remained in the udder, ready at any time to flare up into an acute attack of mastitis.

This was the condition in 1942 when a program was set up to survey the mastitis situation in the herd and to determine the practicability of eliminating the offending organisms, by treating the infected udders, and thus keep mastitis under control.

At the start, quarters found to be infected were treated with infusions of sulfa drug preparations. Sulfanilamide and sulfadiazine were used singly and in combination. The sulfa drug preparations were effective in 68 to 77 percent of the quarters treated. Penicillin was effective in 37 to 44 percent of the quarters treated when a total of 50,000 units was given in a single infusion or divided between two infusions on successive days. When the total number of units was doubled and given in four infusions of 25,000 units each, the effectiveness was 76 to 78 percent.

Penicillin in sufficient dosages appears to have given as good as or better results than the sulfonamide preparations used. It is much easier to prepare and to administer. There have been no unfavorable reactions. No significant declines in milk production have resulted from treatment with either the sulfonamides or with penicillin. Raising the total dosage from 50,000 to 100,000 units and increasing the number of infusions from one or two to four nearly doubled the effectiveness of penicillin, but raising the total dosage to 250,000 units or more did not appear to be justified.

Any dairyman can use the strip cup, and there are quick and simple tests that enable him to detect abnormalities in the milk and latent mastitis before the condition becomes acute.

The Bureau's practice is to treat the inapparent cases as well as those that have progressed to the clinical stage. Most of the infections have thus been eliminated before serious damage to the udder occurred. Organisms associated with mastitis still are found in the milk from many of the cows, but clinical cases are rare and the resulting interference with milk production has been largely eliminated.

Treatment of the udder is not the whole answer to the control of mastitis, however. Good management, proper milking procedures, sanitation, and constant vigilance must be practiced if success is to be achieved.

Thyroprotein Feeding

Although thyroprotein can now be obtained on the open market for feeding to dairy cows, much more must be known about the effects of the drug on the health of the cow and on the economy of milk production, throughout the lifetime of the cow, before the thyroprotein feeding can be recommended as a general practice.

Milk-production records for the first lactation indicate that cows of low-producing ability cannot be made into good producers by feeding thyroprotein, even though production may be increased somewhat. Average cows fed thyroprotein (1 gm. per cwt.) and enough extra nutrients to meet their requirements will probably produce more than they would without thyroprotein.

Cows that received thyroprotein, beginning 50 days after calving, showed a tendency toward higher butterfat percentages in the milk after thyroprotein feeding was initiated. This trend was much more pronounced in the second lactation than in the first.

The Bureau investigators emphasize the fact that, in order to sustain the initial increase in milk production obtained by feeding thyroprotein, it is necessary to feed at least 25 percent more nutrients along with the thyroprotein. The economy of this procedure is uncertain, since individual cows show varying degrees of response to the drug. Thus costs and returns will vary from cow to cow and from one condition to another.

ALFALFA SILAGE OR BARN-CURED HAY MAKES MORE MILK PER ACRE THAN FIELD-CURED HAY

To determine the most efficient way of harvesting and preserving forage crops for milk-production purposes, results with three cuttings of alfalfa (two in 1945 and one in 1946) are now available to show the relative advantages of harvesting and storing the crop as wilted silage, field-cured hay, and barn-cured hay.

Summarizing the results for the three cuttings, the investigators found that significantly larger amounts of dry matter, protein, and carotene were saved for feeding when the crop was made into silage than when it was made into either barn-cured hay or field-cured hay. Making the silage required very little additional labor or use of machinery.

In feeding trials, cows consumed the same amount of dry matter in each of the three types of roughage and produced practically the same amount of milk on each roughage, but they gained more weight on the silage. The milk produced on the silage was also highest in vitamin A.

On an acre basis, however, because of the greater saving of dry matter and protein, the silage-making method produced 12 percent more milk than the field-curing method; and the barn-curing method produced 8 percent more than the field-curing method. The field-cured hay in these experiments was cured without being rained on.

PROGRESS MADE IN STUDY OF UNIDENTIFIED NUTRIENTS IN MILK

Studies have been under way in the Bureau of Dairy Industry for a number of years to determine what unidentified nutritional factors occur in milk.

Progress to date may be summarized as follows: The results have demonstrated (1) that a still-unidentified nutrient (X) occurs in milk and certain other foods and feeds and that it does not occur in the cereal grains, in cereal flours or their byproducts, in oil meals, and in certain other foods and feeds; (2) that X is essential for normal growth and development, at least in the rat, and promotes fattening as well as growth; (3) that X has a very potent effect on the performance of animals receiving lactose in their diet; (4) that X has a particularly potent effect on the growth, development, and even the survival of animals fed diets containing high percentages of protein; (5) that preparations of X can be made that are effective in doses of only a few micrograms daily; (6) that X may be deficient in the basal rations used in various biological assays for known nutrients; and (7) that serious reproduction failures occur on diets that are apparently adequate in their content of all known nutrients.

Results from other laboratories indicate that a factor which possibly is the same as X is required by animals other than the rat, including the monkey.

PHOSPHATASE TEST MODIFIED FOR USE ON OTHER DAIRY PRODUCTS

Methods have now been developed by the Bureau of Dairy Industry for testing almost any dairy product to determine whether the milk or cream from which it was made had been pasteurized adequately. The method in each case is a modification and adaptation of the phosphatase test commonly used to determine the adequacy of pasteurization of whole milk.

The test depends on the fact that all normal milk contains the enzyme phosphatase and that this enzyme is destroyed by heating at a temperature a few degrees higher than that required to destroy the most resistant pathogenic organisms found in milk. Since the modified methods give an accurate and quantitative measure of the amount of the enzyme remaining in the milk, or in the product made from it, it can be used as a reliable index of adequate pasteurization.

Procedures have been developed for applying the test successfully and easily to Cheddar cheese, Swiss cheese, and other hard cheeses; process cheese and cheese spreads; cottage cheese and other soft, unripened cheeses; cheese whey; milk; chocolate milk; cream; buttermilk; ice cream and sherbet; butter; and goat's milk.

VITAMIN C RETARDS OXIDIZED FLAVOR

In some instances milk held under refrigeration or in a frozen state develops an off-flavor which has been described as "oxidized." The components involved and the causative reactions are not known.

When milk contains air the oxygen in the air reacts with the ascorbic acid (vitaman C), which is present in all fresh milk. The ascorbic acid disappears through its reaction with oxygen, forming dehydroascorbic acid, and the milk tends to develop an oxidized flavor. Experiments showed that this reaction could be delayed either by removing the oxygen from the milk, or by adding ascorbic acid, or by doing both, and the freshness of the milk would be retained over a longer period.

Nearly all the free oxygen can be removed by spraying the warm milk into a chamber under high vacuum (deaeration). The addition of ascorbic acid to milk does not affect its flavor and, within reasonable limits, the greater the quantity of ascorbic acid added, the greater is the flavor-stabilizing effect. It was found also that the sooner the fresh milk is fortified with ascorbic acid, pasteurized, homogenized, deaerated, and cooled, the better it will keep.

The rate of disappearance of ascorbic acid decreases and the rate of development of the oxidized flavor is retarded as storage temperature decreases.

Fresh milk normally contains some ascorbic acid, but it is largely destroyed by processing. Milk containing 20 milligrams of ascorbic acid per liter was used as the control in this experiment, and enough ascorbic acid was added to each of three different lots to increase the concentration by 25, 50, and 100 percent, respectively. The milk was dried and evaluated for keeping quality. In every case the control was the poorest, and the keeping quality of the experimental lots was improved proportionately to the amount of ascorbic acid added.

Other studies were made to determine the relationship of the chemical structure of a compound to its antioxygenic activity. Phenolic compounds were added to oil to test their antioxygenic effect on the fat. It was observed that the presence of hydrogen atoms, as well as the position and numbers of hydroxyl groups, on the phenolic compounds strongly affected their activity. As a result of these studies, it is now possible to predict the relative values of various phenolic compounds as antioxidants in whole milk powder.

It was also discovered that antioxidants do not exhibit strong activity until the fat has been slightly oxidized, a fact of importance to the understanding and practical use of antioxidants.

METHOD FOR RECOVERING PROTEINS FROM CHEESE WHEY

Approximately 7 billion pounds of cheese whey is now fed to animals or wasted. This whey contains approximately 70 million pounds of protein of high nutritional value as human food.

Recovery of the whey protein is effected by adjusting the acidity of the whey, heating it to near boiling temperature, and precipitating protein curd by adding sour whey or acid. About 3.5 pounds of protein can be obtained from 100 pounds of whey. Under conditions of careful handling, the curd can be stored for several weeks at low temperatures and it will withstand shipment over a period of several days without spoilage.

The whey protein curd has a pleasant but not a pronounced flavor. It is practically sterile, but the lactic acid bacteria common in cheese starters grow well in it. When the curd is salted and a good lactic starter and cream are added, and it is stored for a day or two at 50° F. to permit development of sufficient acid and a well-blended flavor, it produces a very satisfactory type of cottage cheese.

METHOD FOR MAKING ALCOHOL FROM WHEY

An efficient process for fermenting the lactose (milk sugar) in whey to ethyl alcohol has been developed.

Previous to the war the Bureau scientists had shown that alcohol could be produced from whey, and subsequently a search was made for yeast strains which would perform the fermentation process more efficiently. One of the many lactose-fermenting yeasts tested, *Torula cremoris*, proved exceptional in that it completed the fermentation in 55 hours. By using this yeast and regulating the temperature and acidity of the fermenting whey, yields of alcohol between 84 and 90 percent of those theoretically possible were obtained. About 3 gallons of 95-percent alcohol can be expected from 100 gallons of whey.

The equipment required is relatively inexpensive. The alcohol can be made as a byproduct of cheese or casein manufacture, using waste steam to concentrate the alcohol. The slops remaining are very nutritious, since they contain the protein and vitamins of the whey and the nutritious elements of the yeast, and make an excellent byproduct feed for livestock. Thus a former waste product which was hard to dispose of may become an asset and a valuable source of useful products.

METHODS FOR MAKING PROTECTIVE COATING MATERIALS FROM LACTIC ACID

Some of the results of research with lactic acid in making protective coatings for metals, as replacement material for tin, were announced by the Bureau of Dairy Industry during the early part of the war. This research has now been completed, and the final results are of two-fold interest to the dairy industry. Lactic acid, which is the principal ingredient in the coating materials that have been developed, can be made from milk; and the coatings can be used in place of tin on milk cans, cottage cheese pails, and cans for evaporated and condensed milk.

Four public service patents have been issued covering the Bureau's work on the lactic acid resins and protective coatings, and four more patent applications are pending.

Lactic acid can be converted into a viscous, rather inert, resinous material by removing the water. This resinous lactic acid, combined with oils, metals, or various substances, gives products that, when coated on metal and baked, are highly resistant to water, steam, and acids, and they are sufficiently resistant to alkalies that the coated surfaces may be washed with hot solutions of soap or other common detergents.

Of the many types of coatings made, those containing lactic acid and oil and those containing lactic acid and metals have the greatest number of useful properties.

To make the first, one part of castor or linseed oil is heated with two parts of polymerized lactic acid and a trace of an accelerating substance until a brown elastic resin is obtained. This resin is dissolved in an organic solvent, such as benzol, applied to the metal surface, and baked on. The coating adheres well to glass and metals, including aluminum, and is tough, highly flexible, and resistant to all deteriorating influences except strong solutions of alkalies. A number of commercial firms have tested this coating and verified the Bureau's findings as to its characteristics.

The second type of coating is made by the reaction of 1 or 2 percent of a metal, such as aluminum, chromium, or iron, with polymerized lactic acid. These coatings are baked on the metal surface. Though easier and cheaper to make, the coatings are somewhat less resistant than those containing oil. They are suitable for decorative purposes, especially when colored with pigments.

Low Storage Temperatures Delay Thickening of Sweetened Condensed Milk

Since age thickening of sweetened condensed milk limits the time it may be held in storage, studies were conducted in the laboratories of the Bureau of Dairy Industry to determine the effect of storage temperatures on the viscosity of the milk. The milk became as thick in 4 days of storage at 131° as it did in 643 days at 60°. In other words, thickening increased in proportion to increases in storage temperature, the relationship being logarithmic with respect to time.

The milk could have been held 4,950 days at 30° without becoming too thick for satisfactory use. These results indicate clearly the importance of low temperatures for satisfactory storage over long periods.

It was also determined that sweetened condensed milk packed in barrels thickens more slowly than milk packed in small cans.

Composition of Crystalline Deposit in Canned Milk

Aged evaporated milk frequently contains a crystalline deposit in the bottom of the can, which although harmless is a nuisance in infant feeding because of the tendency of floating crystals to plug the hole in the nipple of the baby's bottle. The principal constituent of the crystals was found to be calcium citrate, but small amounts of calcium and magnesium phosphate were also present. The calcium citrate was present with the greater part of its water of crystallization. Factors affecting the growth of the crystals are now under study.

Simple Key for Identifying Lactobacilli Developed

In connection with studies made a few years ago, concerning the possible rôle of lactobacilli in the ripening of Cheddar cheese and the use of certain species in assaying vitamins in cheese and other dairy products, bacteriologists of the Bureau of Dairy Industry discovered that many of the strains they were using had been incorrectly identified by other workers and that not all species of the genus *Lactobacillus* were alike in their requirements for riboflavin (vitamin B_2).

The identification and differentiation should be based on a correlation of characteristics, not on any single characteristic, and a relatively simple key to the species of the genus has now been developed. It is based chiefly on correlations of such characteristics as limits of temperature for growth, colonial type, production of gas, percentage of acid formed in milk, rotation of acid, and fermentation of certain carbohydrates.

The results of these studies make possible the rapid and reliable identification of the lactobacilli that occur normally in milk, as well as in many cheeses made from raw milk and in many other products, or that are being used in the manufacture of fermented milk, lactic acid, and other products.

Thirty-fifth Annual Meeting

PHILADELPHIA, PA., Oct. 21–23, 1948

Hotel Bellevue-Stratford

JOURNAL of MILK and FOOD TECHNOLOGY

(*including* MILK and FOOD SANITATION)

Official Publication of the

International Association of Milk and Food Sanitarians

(Association Organized 1911)

The JOURNAL OF MILK AND FOOD TECHNOLOGY (including MILK AND FOOD SANITATION) is issued bimonthly beginning with the January number. Each volume comprises six numbers. Published by the International Association of Milk and Food Sanitarians at 374 Broadway, Albany 7, N. Y. Executive Office, 23 East Elm Avenue, Wollaston 70, Mass.

Subscriptions: The subscription rate is $2.00 per volume. Single copy, 50 cents.

Correspondence regarding business matters, advertising, subscriptions, reprints, etc., should be addressed to Wm. B. Palmer, 374 Broadway, Albany 7, N. Y., or 29 North Day Street, Orange, New Jersey.

Manuscripts: Correspondence regarding manuscripts and other reading material should be addressed to the Editor, J. H. Shrader, 374 Broadway, Albany 7, N. Y., or 23 East Elm Avenue, Wollaston 70, Mass.

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Association News

Metropolitan Dairy Technology Society

The new meeting place of the Metropolitan Dairy Technology Society is the Stonewall Inn, located at 51 Christopher Street, which is not only more convenient and more desirable for meetings but the food is far superior to that which has been offered by the Hotel George Washington and the cost to the members is a flat $2.00 which includes the tip. Stonewall Inn is a "stone's throw" from the Broadway Seventh Avenue and the Eighth Avenue subways. It is also convenient to the Holland Tunnel.

Sol Pincus

Formerly Sanitary Engineer with the U. S. Public Health Service and more recently Deputy Commissioner and Senior Sanitary Engineer with the New York City Department of Health, announces the opening of his offices for the practice of Sanitary Engineering, Public Health Investigations and Reports, 11 Park Place, New York 7, N. Y.

The Fifth Annual Dairy and Food Inspectors' and Sanitarians' School

Michigan State College, East Lansing, Mich.

April 5–9, 1948

The Dairy and Food Inspectors' and Sanitarians' School furnishes an opportunity for the busy worker in these fields to secure the latest information on many aspects of food inspection with a minimum of time and expense. The School was inaugurated originally for dairy officials only, but by popular demand, a section of the program running concurrently, was established last year for food inspectors as well. This arrangement is being continued for the 1948 School. Considerable effort has been expended in bringing together well qualified speakers on the several subjects suggested by those in attendance last year. The program committee feels confidently that the 1948 program is righ in subject matter of incalculable value to those charged with the responsibilities of protecting public health through better sanitation and control.

The School, lasting a full week, will be conducted as a course—not as a convention. Opportunity will be afforded for discussion, questions, and exchange of ideas. An examination will be given at the end of the School covering the various subjects presented. Later, all the material presented will be made available, in mimeographed book form, to all registrants.

It is hoped that many dairy and food sanitarians may avail themselves of the opportunity for in-service training which the several organizations have provided.

For information, write to the Director of the Institute of Short Courses, by Wednesday, March 31st.

MONDAY, APRIL 5

Morning

Tower Room, Union Building,
G. M. Trout, Chairman

8:30 Registration (Ball Room, Union Building)

9:30 What to Get Out of a Conference:
Introductory Remarks—G. M. Trout
Psychological Aspects of Learning—Guy H. Hill
Advantages and Limitations of Quaternary Ammonium Compounds as Sanitizing Agents—W. L. Mallman

11:30 Lunch

Afternoon

Tower Room, Union Building,
W. L. Mallmann, Chairman

1:10 *Assembly*
Diseases of Animal Origin Transmissible to Man with Special Reference to Organisms of the Salmonella Group—Arthur Wolff

2:40 *Dairy* (Organization Room, Union Building) Don Murray, Chairman
Comparison of Resazurin and Microscopic Tests—A. L. Bortree
Influence of Temperature on Multiplication of Thermoduric and Thermophilic Bacteria—Frank R. Peabody
Problems Confronting the Dairy Inspector and Sanitarian—H. J. Dunsmore
Foods (Tower Room, Union Building) W. L. Mallmann, Chairman
Supplying Hot Water for Cleaning and Sanitation—M. B. Mackay
Possibilities of Building, Equipment, and Supplies Replacements—A. W. Farrall
Installation of Hoods and Grease Filters in Food Establishments—Kenneth Robinson
Problems Confronting the Food Inspector and Sanitarian—Henry G. Kowalk

Evening

7:30 No scheduled meeting

TUESDAY, APRIL 6

Morning

8:30 *Dairy*—P. S. Lucas, Chairman
Distribution of Brucellosis According to the Modes of Infection—I. F. Huddleson

Michigan's New Pasteurization Law —F. M. Skiver

Foods—Leonard H. Blakeslee, Chairman

Sanitation Facilities and Inspection of Poultry Processing Plants—James A. Davidson

How and What to Look for When Inspecting Meat and Poultry—James Steele

10:30 *Assembly*—R. E. Marshall, Chairman

Ventilation and Air Conditioning in Food Establishments, Kitchens, Dairy Plants—L. G. Miller

11:30 Lunch

Afternoon

1:10 *Assembly*—Grey Turney, Chairman

"No Handstripping" — Technicolor Film — L. E. Bober, Babson Bros., Chicago

Legal Procedures in Securing Court Evidence and in Presenting Cases of Infraction.—Marvin J Salmon

2:40 *Dairy*

E. coli: A Panel Discussion—Earl Weaver

a. What Is the Significance of *E. coli* in Sanitary Milk Control —C. N. Stark

b. Seasonal Distribution of Positive *E. coli* Tests Among Plants—John M. Sherbeck

c. Tracing *E. coli* Contamination to Its Source—A. L. Bortree

d. How to Proceed When Milk from Certain Plants Persistently Shows Positive Coliform Tests—C. J. Babcock

Foods

Dishwashing: A Panel Discussion—John Hepler

a. Advantages and Disadvantages of Mechanical Dishwashers in Sanitizing Dishes — W. L. Mallmann

b. The "Seeing-Is-Believing" Program in Dish Sanitation Education of Restaurant Operators—C. W. Anderson

c. Field Tests for Supervised and Nonsupervised Hand Dishwashing—David Kahler

d. A City Department of Health Program on the Improvement of Mechanical Dishwashing—W. L. Mallman

Evening

7:30 Entertainment (Forestry Cabin)

WEDNESDAY, APRIL 7

Morning

8:30 *Dairy*—R. R. Palmer, Chairman

Detroit's New Milk Ordinance—R. R. Palmer

Use of DDT with Barn Whiting—Fred Meyer

What the Army Learned About the Effectiveness of Milk Ordinances—C. J. Babcock

Foods—R. E. Marshall, Chairman

Fundamentals of Food Hygiene—W. O. Brinker

Problems in Salvaging Food Products —Miles A. Nelson

Principles of Bakery, Restaurant, and Kitchen Design and Layout—Mabelle S. Ehlers

10:30 *Assembly*—G. M. Trout, Chairman

Effective Safe Methods for Plant and Municipal Rodent Control—Miles D. Pirnie

11:30 Lunch

Afternoon

1:10 Group Picture—West Entrance Auditorium

1:30 *Assembly*—F. W. Fabian, Chairman

"Antu", DuPont film on rat control—D. W. Hayne

Opening the Question Box (15 minutes)—F. W. Fabian

Inspection of the Manufacture and Retailing of Ice Cream—P. H. Tracy

Ice Cream Bacteriology—C. N. Stark

3:30 *Dairy*

Sediment Testing of Milk: A Panel Discussion—P. S. Lucas

a. Merits and Shortcomings of the Various Procedures for Making Sediment Tests—K. G. Weckel

b. Does Sediment Testing Secure Cleaner Milk Production or Merely Improved Straining?—E. H. Parfitt

Foods

Problems in Locker Use and Inspection: A Panel Discussion—D. E. Wiant

a. Factors Affecting Nutritive Values of Frozen Foods—Pauline Paul

b. Locker Food Problems—J. Manley Card

c. Bacteria Population of Frozen Foods — Effect of Initial Counts, Freezing and Thawing—Henry G. Kowalk

Evening

7:30 No scheduled meeting

THURSDAY, APRIL 8

Morning

8:30—*Dairy*—A. L. Bortree, Chairman
Effect of High-Temperature Short-Time Pasteurization on Thermophilics, Thermodurics and E. coli—T. J. Mucha
How to Secure Effective Can Washing—P. H. Tracy
Limitations of Modern Cleaners and Sterilizing Agents—H. A. Trebler
Foods—F. W. Fabian, Chairman
Conditions Which Make Possible an Outbreak of Staphylococcic Food Poisoning—H. F. Stafseth
Establishing and Carrying Out of a Sound Public Health Program—John Hepler

10:30 *Assembly*—Earl Weaver, Chairman
The Role Processors Should Play in a Quality Improvement Program—E. H. Parfitt

11:30 Lunch

Afternoon

1:10 *Assembly*—Grey Turner, Chairman
"Dishwashing Dividends"—Film by National Sanitation Foundation—W. L. Mallmann
Opening the Question Box—F. W. Fabian
The Proper Approach in Selling Yourself and Your Program—Sherwood C. McIntyre

2:40 *Dairy*
Cheese: A Panel Discussion—J. Robert Brunner
a. Basic Principles and Heat Treatments Involved in the Manufacture of the More Common Hard and Soft Varieties—K. G. Weckel
b. Health Factors Which Must Be Considered in Cheese Manufacture—F. W. Fabian
c. Spoilage in Cottage Cheese; Causes and Prevention—J. M. Jensen
d. Labelling and Packaging Requirements—F. M. Skiver

Foods
Sanitary Problems in Food Processing Plants: A Panel Discussion—R. E. Marshall
a. Inspection Services—Miles A. Nelson
b. Maintaining Good Housekeeping—W. F. Robertson
c. Waste Disposal—E. F. Eldridge

Refrigeration in Restaurants and Retail Food Establishments
a. Fruits and Vegetables—R. E. Marshall
b. Meat, Milk, Fish and Leftovers—John Veenstra

Evening

6:00 Banquet—Union Building

FRIDAY, APRIL 9

Morning

8:30 *Assembly*—J. M. Jensen, Chairman
Fly and Roach Control in Food Establishments—E. I. McDaniel
The Role Control Officials Should Play in a Quality Improvement Program—R. R. Palmer
Current Literature Which Should Be of Interest to Inspectors and Sanitarians—G. M. Trout

10:30 Open Panel Discussion—F. W. Fabian

11:30 Lunch

Afternoon

1:10 *Assembly*
Examination—R. R. Palmer, Miles A. Nelson

New Members

ACTIVE

Adelson, I. Jack, Box 1498, Ketchikan, Alaska
Axelsen, J. H., City Health Dept., City Hall, Ann Arbor, Mich.
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"Doctor Jones" Says—*

All this well-organized public health work that's being done today—the way we just sort of take it for granted: I wonder how many people ever stop to think that it wasn't much over a hundred years ago that nothing was being done.

Of course, as early as 1830 most of the larger cities had what they called boards of health.[1] But they were appointed politically and practically never did anything except when epidemics were threatening. Then, because they didn't understand the diseases they were dealing with, their drastic regulations often did more harm than good. In fact, one New York City mayor, when cholera was around, refused to call the board together: said it was "more to be feared than the pestilence."

The worst situations, in those days, were in the cities, where a lot of people were crowded together. In the 1840's New York had grown from 300,000 to half a million; Buffalo from 18,000 to 42,000; Chicago from 5,000 to 30,000—and so on. The poorer sections of typical American cities were a mess: narrow, muddy streets; tumbledown tenements; outside privies; inadequate drainage; slaughterhouses and fertilizer plants adding to the general stench.

It was the doctors, mainly, that were responsible for stirring things up and getting something started. The American Medical Association, when it was first organized in 1847, made sanitary surveys of ten or twelve cities. A couple of years later the Massachusetts medical society was instrumental in getting a commission appointed to make a survey of the state. Those surveys brought out how bad the conditions were and led to a beginning, at least, of what today we call environmental sanitation.

In those days they laid the communicable diseases largely to filth. Years later, when they found out about bacteria and the part they played in the spread of disease (and that's practically been within my time) then they could apply their sanitary measures intelligently and expect some results.

The understanding of the bacterial causes of disease, that was a turning point: the real beginning of modern public health. But we've got to hand it to the old boys—the pioneers—that worked largely in the dark yet, by luck or instinct, kept headed mostly in the right general direction. The trails they blazed have become broad highways.

* *Health News,* New York State Department of Health, N. Y., December 15, 1947.

[1] Historical data from "The Beginnings of the Public Health Movement in the United States," by Howard Kramer, *Bulletin of the History of Medicine,* May–June, 1947.

(Continued from preceding page)

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