Before we consider the future of our Association, let us briefly review the past. When I first became a member in 1929 the Association was known as the International Association of Milk Inspectors, later the name was changed to the International Association of Milk Sanitarians, and of course our new name is INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS. The membership has steadily increased over the years until now we find that the Association is too large for all officials to be part time and yet not large enough to support adequately full time employees. However, this problem is with us and we have only one of two ways to overcome it: stop growing and live within our means and have only part-time employees (and this I know you do not want), so that leaves us only one course to pursue—grow and go forward. The big question is HOW?

As your President I feel it my duty to present to you one way for us to expand within our means. But first I want to say the Association does not belong to the officials but belongs to you members. Therefore it is only through you that the Association's constitutional by-laws can be changed so that your officials can serve you in a greater capacity.

I propose for your consideration the idea of making it possible for our part-time Secretary-Treasurer to have a full-time assistant to take care of the
increased clerical work that has accrued because the Association is growing. To me this seems to be the less expensive way to give the needed services to the Association. As we go forward, and when the income and expenses will justify same, I believe the Secretary-Treasurer position should be a full-time job, other officers remaining as at present.

There is a second problem—The JOURNAL—which needs attention, and changes should be made soon. The editorial staff is overloaded because all these positions are part-time. I suggest that a full-time person be added here as soon as possible and when this is done, the JOURNAL be published monthly.

We cannot create full-time positions with our present limited income. For those of you who did not attend the Business Meeting at Columbus, Ohio, it was decided by the majority present, that the dues should be raised to $5.00 per annum. Since returning to St. Louis and thinking this matter over, I would like to offer for your consideration the following: (a) That the affiliates of the Association be described in the new by-law in a more clarified manner; (b) Each affiliate be required to send two member-representatives to the annual meeting. I should suggest their Secretary-Treasurer and one delegate. (c) That the local Association, if possible, pay all expenses of these two members to our annual Association meeting. The elected delegate be required to hold an active membership card in the International. (d) Membership dues in the International Association for all members not a member of a local affiliate, to be $5.00 per year. International members, who are also local affiliates, pay $2.00 dues to the local Association and $3.00 to International, totaling $5.00. Both kinds of memberships would receive the JOURNAL. (e) At least 50¢ or more of the $2.00 local membership fee should be set aside for expenses of the two members sent to the annual meeting. (f) We have International members who are members of more than one affiliate. Such members should pay local dues of only $2.00 when joining the second or more of the local affiliates, because the $3.00 International dues was paid by the first Association and only one JOURNAL to each member.

As you know, the Executive Board is considering changes in our present by-laws for your consideration at a future time, and if the new by-laws are to be adequate and cover our present needs, we must have your help.

I offer the above to you and ask some member of each local affiliate to bring up this subject for discussion at a local meeting, and have your Secretary write your suggestions to Dr. J. H. Shrader, editor, and send me a copy. We officials will be guided by what you decide and will have a new constitution for the Association at the next annual meeting.

Let me close by saying we need more income and more members in order to give you the desired service. Look around you for a friend who is not a member and invite him or her to become a member of the International. Before the next annual meeting, let each of us send in the name of a friend as a new member. The Association belongs to you and we need your help.

Here's wishing you a Happy and Prosperous New Year to all members everywhere, of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS.

MILTON R. FISHER, President
**BIOGRAPHY OF MILTON REID FISHER**

Born in Paducah, Kentucky, January 26, 1900, he attended the public schools there and St. Mary's Academy, and graduated from the Reidland High School.

He attended the Ohio State University at Columbus, Ohio, and graduated in June, 1925, receiving the degree of Doctor of Veterinary Medicine. He is a member of Alpha Psi Fraternity. Immediately after graduation, he accepted a position in charge of meat and milk inspection for the City of Paducah, Kentucky. Paducah was the first city in the State of Kentucky to adopt the Meat and Milk Inspection Ordinance. He is a member of Alpha Psi Fraternity. Immediately after graduation, he accepted a position in charge of meat and milk inspection for the City of Paducah, Kentucky. Paducah was the first city in the State of Kentucky to adopt the Meat and Milk Inspection Ordinance. He is a member of Alpha Psi Fraternity.

He served as President of the National Milk Sanitarians Association from 1930 to 1932, and was Past President of the Missouri Milk Sanitarians from 1928 to 1929. He was Secretary-Treasurer of the American Milk and Food Sanitarians for several years, and was a member of the Council of the American Public Health Association, and a member of the International Association of Milk and Food Sanitarians, Inc.

The resolution adopted at the 36th Annual Meeting of the International Association of Milk and Food Sanitarians, Inc. assembled in Columbus, Ohio on October 21, 1949

WHEREAS: the broad aspects of Sanitation and the need for a comprehensive National Sanitation Program have been ably presented to this Association at this meeting, and

WHEREAS: the active interest and concerted action of all individuals and organized groups in the community is needed to secure the full benefits of Sanitation

**RESOLUTION ADOPTED**

**WHEREFORE BE IT RESOLVED:** 1. That an expanded sanitation program on a nation-wide basis is needed and should be developed as soon as possible; and

2. That the National Sanitation Foundation in collaboration with official and voluntary organizations and agencies, be urged to stimulate and further develop such a nation-wide sanitation program; and

BE IT FURTHER RESOLVED: that a copy of these resolutions be sent to the National Sanitation Foundation and that the resolutions be spread upon the minutes of the Association.

**RESOLUTION ADOPTED AT THE 36TH ANNUAL MEETING OF THE INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC. ASSEMBLED IN COLUMBUS, OHIO ON OCTOBER 21, 1949**

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WHEREAS: the active interest and concerted action of all individuals and organized groups in the community is needed to secure the full benefits of Sanitation

**THE SANITIZING OF MILKING MACHINES**

**A. C. DAHLBERG, F. V. KOSIKOWSKY, H. W. SEELEY AND A. A. LEVENTHAL**

**Department of Dairy Industry, Cornell University, Ithaca, N. Y.**

Recent advances in the development of new water softening, washing, wetting and sterilizing compounds have renewed interest in simplified procedures for sanitizing milking machines.

There is need for such consideration for the task of washing milking machines is an important labor item on the farm. If the rubber parts of the average milking machine were to be taken apart completely after each milking, scrubbed with a brush and reassembled, the task presumably might be done in about 15 minutes per day for two single units. This would require about 91 hours per year or 9 days per farm, the equivalent of the services of about 750 men on New York State farms. This washing time would equal about 13 percent of the total time the machines are in use so that 1 hour would be spent washing for every 8 hours milking. Actually, few dairymen today take the milking machines entirely apart after each milking and this has not been generally done since milking machines were introduced on farms in this country.

In 1946, when this study was commenced, it was believed that sanitizing milking machines might be further simplified by the use of the complex phosphates for water softening, and the new surface active compounds for softeners and germicides. The idea was not new even when the study was started. For several years Rudnick (9) had completely replaced the customary alkaline washing and water softening compounds with a surface active detergent in the rinse wash procedure followed by dry storage. Jensen (5) preferred the combination of a surface active detergent with a neutral water softener, sodium hexametaphosphate. Both investigators eliminated pre-rinsing the machines with clear water as their methods consisted of rinse washing with the warm detergent solution followed by rinsing with water at 180-200° F. and dry storage between milkings. However, boiling water was required which is not available in most farm dairies.

It was not the purpose of this study to investigate the properties of water softeners, nonionic surface, active detergents, or quaternary ammonium compounds (cationic germicides), as there is much information in recent literature and in the files of manufacturers. This study was limited to the possible application of this knowledge in the sanitizing of milking machines. During the years of this study many detergent-sterilizing compounds have been offered to dairy farmers and their sales have increased enormously.

The warm water flush rinse of milking machines immediately after milking removes most of the fresh milk from the tubes. The tubes might then be rinsed with a sanitizing solution containing both the detergent and germicide. The quaternaries do not rapidly lose their strength and the presence of a wetting agent ensures intimate contact with the equipment. Then dry storage would seem feasible. Suction rinsing of the machines with warm water, preferably containing a good sterilizing agent, just before use would be recommended. This
and liters of sterile water were drawn from to be used in each solution. He in­
be satisfactory.

beef extract - glucose-skim milk agar

of pounds and procedures on three farms

semiweekly and took samples.

solutions or weighed out the powder

chine pail by operating the milking

was iced and immediately

this water were iced and immediately

milkings dry or in a solution rack or

were immediately flush rinsed with a

in a sink of solution. The machines

were completely disassembled and

brushed and scoured every seven days.

the metal parts were inverted on a

rack to dry. All machines were flush

sterilizing solution just before milking.

In view of the fact that the natural

cleanliness of the machines varied from

barn to barn it was thought most en­
lightening to present the data by barns

as well as by methods. The approxi­
mate details of the several washing

procedures are presented to assure an

understanding of the results. Final

approved procedures will be given

later.

Two quaternary ammonium com­

pounds and one nonionic detergent

which seemed to be most active in

the dairy field were selected for this

study.

Method 1. Instructions for wet rack

storage in lye solution after rinse wash­
ing in solution of washing powder.

Directions: Rinse wash by drawing a pail

of warm water through each milker immedi­

ately after milking. Rinse pails and other

equipment. The same rinse water should

not be used for more than one unit. Discard

water. Rinse wash by drawing through

the pail of warm water solution. Brush

pail inside. Dump washing solution

into sink and wash pail and milker equip­

ment with water and wash powder solution

and fill with 0.4-0.5 percent lye solution.

Rinse pails and equipment with water and

sterilize in hot air sterilizer. Just before

milking rinse pails by drawing through a

pail of warm water.

The bacteriological samples were

taken before this warm water rinse.

Every seven days the milkers were

completely disassembled, scrubbed,

scoured, and examined to assure good

rubbers and cleanliness.

Method 2. Instructions for wet rack

storage in chloroform solution. This

method was identical to method 1 ex­

cept that 300 p.p.m. of chlorine re­

placed lye.

Method 3. Instructions for wet rack

storage in quaternary or detergent­

quaternary solution after rinse washing

in washing powder or detergent-quater­

nary solution. The directions were

identical with method 1 except that lye

was always omitted and sometimes

the washing powder solution was omitted.

If the tubes were stored in a rack with

a quaternary solution, they were previ­

ously rinse washed with a washing

powder solution but where the tubes

were stored in a rack with a detergent­

quaternary solution they were previ­

ously rinse washed in that same solu­

tion. These solutions were generally used

in 1-4,000 dilution.

Method 4. Instructions for dry

storage. In all instances except one

the milkers were rinse washed with

the sterilizing solution according to the

routine of method 1 but instead of fill­

ing the tubes with lye they were hung

up to dry.

Method 5. Instructions for wet sink

storage in quaternary or detergent­

quaternary solution after rinse washing

in washing powder or detergent­

quaternary solution. This method was

identical with method 3 except that

the entire teat cup assembly was filled

with solution as it was submerged in

a warm solution of the sanitizing ma­

terial in the wash sink where it was left

between milkings. The sanitizing

solution was replaced 3 times each

week and the used solution served for

washing utensils.

Method 6. Instructions for dry

storage after soaking and daily brush­
ing in hot sanitizing solution. The

basis for this procedure was recom­

mended to the authors by J. F. Jansen

of Sheffield Farms. It consisted of

the usual rinse wash procedure and

was identical to method 5 except that

the teat cup assemblies were taken

apart for soaking in warm water and

then submerged in the hot solution of

sanitizing agent for 1/2 to 1 hour. The rubbers

and metal parts were then brushed and

hung up to dry between milkings.

It should be observed that in all

methods the milkers were rinse

washed with warm water just before

use (after bacteriological samples had

been taken) and that the sanitizing

agents were not rinsed out of the tubes

between milkings even with dry

storage.

RESULTS

Preliminary experiments of 1946.

At the beginning of these experiments

the three barns were using the rinse

wash procedure with wet rack storage

in a lye solution. The lye storage was

continued for three summer months on

two of the milker units at the Cornell

barn while samples for bacteriological

analyses were taken semi-weekly. The

total counts varied from 1 to 7,500 per

ml of sterile water used for rinse wash­
ing and the average for each unit was

1,800 and 2,200. Table 1. The rubbers

were clean so it is obvious that an ex­

cellent job of sanitizing was being done

by lye.

At the same time in the Cornell barn

two units were rinse washed in quater­

naries (1-4,000 solution of di-isobutyl

phenoxy ethoxy ethyl dimethyl benzyl

ammonium chloride)—triton (1-4,000

solution of an ethoxylated polyether

alcohol rinse followed by dry storage

with the tubes wet with this sanitizing

solution. The bacterial counts were

higher, average 16,800 and 5,700 for

the two units, and the tubes were not

absolutely clean, Table 1. It was ap­

parent that the nonionic detergent qua­

ternary solution was not as effective as

lye and for this reason the two qua­

ternaries were tried with wet rack

storage as was used for lye. The sec­

ond quaternary was alkyl dimethyl ben­

yl ammonium chloride used in a 1­

4,000 dilution. It is obvious that wet

rack storage with quaternaries was

more effective than dry storage but

the quaternaries did not give as good

results as lye, Table 1.

At the Warren barn the quaternary

2-triton rinse and dry storage results

are presented in detail to show that a

week elapsed before the very bad re­

sults of this method of washing and
stereilized was observed, Table 2. A careful scrubbing of the tubes reduced the bacterial count from over a million to less than 100,000 but such counts were still unsatisfactory. Then two of the milker units were rinsed with quaternary 1 in a tetrasodium pyrophosphate solution followed by dry storage. The bacterial counts remained too high and the rubber tubes were dirty.

At the Red Barn the quaternary 2-triton rinse and dry storage was first used. The data, Table 3, show that on the 8th day one of the milker units was high in count and thereafter all the milkers were high in count and dirty.

The bacterial flora of the milking machines were chiefly of the *Pseudomonas* genus as clearly shown by the yellowish green color of the entire medium in the plates. A severe outbreak of mastitis occurred and the veterinarians isolated *Pseudomonas* as the predominating organism in the udder so this bacteria was assumed to have caused the disease. The seriousness of the trouble prompted the complete laboratory cleansing of all rubber and metal parts, the former by boiling in lye and the latter by scrubbing and heat sterilization. The same method of sanitizing was followed but the concentration of the quaternary was increased to 1-

<table>
<thead>
<tr>
<th>Range of Bacterial Counts</th>
<th>Miller 1</th>
<th>Miller 2</th>
<th>Miller 3</th>
<th>Miller 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>13</td>
<td>190</td>
<td>200</td>
<td>260</td>
</tr>
<tr>
<td>Maximum</td>
<td>8,500</td>
<td>6,800</td>
<td>9,900</td>
<td>17,700</td>
</tr>
<tr>
<td>Ave. of 15 Samples</td>
<td>1,500</td>
<td>2,200</td>
<td>16,800</td>
<td>5,700</td>
</tr>
</tbody>
</table>

Wet Rack Storage in Quat. 1

| Minimum                   | 30,000  | 12,300  | 16,300  | 10,200  |
| Maximum                   | 8,500   | 4,300   | 3,900   | 3,800   |
| Ave. of 6 Samples         | 3,500   | 5,300   | 3,650   | 3,900   |

Age 1, Triton Rinse and Dry Storage

| Minimum                   | 3,100   | 3,100   | 3,100   | 3,100   |
| Maximum                   | 6,800   | 6,800   | 6,800   | 6,800   |
| Ave. of 15 Samples        | 4,850   | 4,850   | 4,850   | 4,850   |

Quat. 1-Triton Rinse and Dry Storage

| Minimum                   | 3,600   | 3,600   | 3,600   | 3,600   |
| Maximum                   | 6,300   | 6,300   | 6,300   | 6,300   |
| Ave. of 6 Samples         | 4,950   | 4,950   | 4,950   | 4,950   |

Quat. 2-Triton Rinse and Dry Storage

| Minimum                   | 3,600   | 3,600   | 3,600   | 3,600   |
| Maximum                   | 6,300   | 6,300   | 6,300   | 6,300   |
| Ave. of 6 Samples         | 4,950   | 4,950   | 4,950   | 4,950   |

The rubber tubes were dirty and after June 20 a general clean up of the equipment was undertaken. Tests showed that over 98 percent of these bacteria were destroyed by pasteurization in milk.

1. **TABLE 1**

2. **TABLE 2**

3. **TABLE 3**

4. **TABLE 4**
Sanitizing of Milking Machines

Sanitizing powder was found to be a good nonionic detergent. The final mixture which included soda ash, tetrasodium pyrophosphate, and sodium pyrophosphate was known as a quaternary. A high alkalinity was known that high pH alone would have noticeable germicidal action, but at warm temperatures and would be high enough to overcome the growth of Pseudomonas which normally grows at pH 9.5. This sanitizing powder went into solution readily and the solution was not hard on the hands.

The Cornell sanitizing powder was used as the exclusive powder in the Cornell barn to wash the milking machines by the normal procedure followed by wet rack storage in a solution of the same powder. All of the dairy equipment was washed with a solution of this powder. The bacterial counts on the milkers for the entire summer reached a high individual count of 7,000 per ml of sterile rinse water and the averages for each unit were 2,600 or less. Pseudomonas bacteria did not develop in the milking machines and the rubber parts were clean, Table 4.

At the Warren barn an alkaline solution consisting of equal parts of tetrasodium pyrophosphate, soda ash, and Pseudomonas pyrophosphate was used at the rate of 1 ounce for 3 gallons of water as a rinsing solution. It was used at the rate of 1 ounce in 1 gallon of water to give a pH of 11 in the solution used in wet rack storage. No nonionic detergents, wetting agents or quaternaries were used. The results, Table 5, showed rather good counts which averaged about 5,000 or 6,000 per ml, and the highest count was 11,700. The rubber tubes were clean so the results were good but they could have been better. When the Cornell sanitizing powder replaced the old style washing compound the bacterial counts were reduced in half and the cleanliness was improved.

The Reed barn data, Table 6, did not fully confirm the results at the Cornell and Warren barns. The use of the simple old style washing powder as a washing solution and the tubes in the barn to wash the milking machines by the normal procedure followed by wet rack storage gave high counts. It was assumed that much of the strength of the alkali cleaned the rubber parts and was not available for sterilization. Then a commercial liquid sanitizer containing nonionic detergent and quaternary ammonium compound was used exclusively as a rinsing solution and as a sterilizer in the wet rack storage. The bacterial counts increased to an average of 200,000 and 162,000 per ml of sterile water rinse and Pseudomonas was prevalent.

**Table 5**

| Bacterial Counts per ml. Made on Five Liters of Sterile Water That Had Been "Milking" Through One Single Milking Machine Unit at the Warren Barn in June, July, August, and September, 1947 |
|-----------------|-----------------|-----------------|-----------------|
| **Range in Bacterial Counts** | **Milkers 1** | **Milkers 2** | **Milkers 3** | **Milkers 4** |
| Minimum | Maximum | Ave. of 4 Samples |
| 9,400 | 11,700 | 10,100 |
| 5,000 | 5,500 | 5,600 |

**Table 6**

| Bacterial Counts per ml. Made on Five Liters of Sterile Water That Had Been "Milking" Through One Single Milking Machine Unit at the Reed Barn in June, July, August, and September, 1947 |
|-----------------|-----------------|-----------------|-----------------|
| **Range in Bacterial Counts** | **Milkers 1** | **Milkers 2** | **Milkers 3** | **Milkers 4** |
| Minimum | Maximum | Ave. of 4 Samples |
| 126,000 | >150,000 | >147,000 |
| 126,000 | 146,000 | 89,000 |
| 170,000 | 275,000 | 162,000 |

1 Commercial liquid sanitizer containing detergent and quaternary ammonium compound, sold in New York State for cleaning and sanitizing milking machines. Dilutions according to directions. The rubber tubes were dirty. An outbreak of mastitis developed.

2 Pseudomonas prevalent. The rubber tubes were fairly clean but not acceptable.

There was every reason to believe that the other quaternary used in this study would have given equally good results at a rate of 1 ounce per 3 gallons of water. The sanitizing solution had a concentration of quaternary of 1-5,600, the pH of the solution was 10.5, and the destruction of test organisms (E. coli and S. aureus) occurred in about 1/4 to 1/2 the time required for a solution of the quaternary in water at 20°C. In some of the experiments the sodium carbonate in the Cornell barn was replaced by wet rack storage. This changed the pH of the solution to 9.5. As the results in the barn were identical with those obtained with the carbonate powder the data were presented together in the interest of simplicity. It was hoped that this pH alone would have noticeable germicidal action at warm temperatures and would be high enough to overcome the growth of Pseudomonas which normally grows at pH 9.5. This sanitizing powder went into solution readily and the solution was not hard on the hands.

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of Pseudomonas predominated. The rubber tubes became dirty and another mastitis outbreak occurred attributed to *Pseudomonas* by the veterinarians.

The Cornell sanitizing powder was then used exclusively at the Reed barn. The bacterial counts remained high but the proportions of *Pseudomonas* decreased and the rubber tubes became cleaner but were not acceptably clean. Finally, the Cornell sanitizing powder was used for the rinse wash and a 0.4-0.5 percent lye solution was used in the wet storage. Instantly, the bacterial counts became reasonably satisfactory, *Pseudomonas* bacteria were not observed, and the rubber tubing became clean. These results are interpreted to mean that when sanitary measures are only fair, the Cornell sanitizing powder was not effective enough to clean up the situation without special instructions and attention to cleaning details, but the lye was sufficiently active to do a good job.

It was thought that the data of 1947 showed that nearly neutral or slightly alkaline nonionic detergent-quaternary solutions were not good enough cleaners or sterilizers for milking machines. The alkaline washing and water softening compounds compatible with the new detergent-quaternary compounds improved cleaning and sterilizing and tended to eliminate the *Pseudomonas*.

**Experiments in 1948.** During the final summer of the experiments an endeavor was made to try the procedures that appeared to show promise of being valuable. The tube became dirty, the milking machines fell apart during milking, and the bacterial counts were too high until the procedure had to be discontinued

The Cornell sanitizing powder was again used with the rinse wash procedure and storage of the teat cup assemblies in a solution of the powder in a clean wash sink. Immediately, the bacterial counts dropped, the tubes and metal parts became clean even though not brushed and the numbers of *Pseudomonas* decreased. However, the rubber parts were so slippery that the machines fell apart during milking. Consequently, the rinse wash procedure was continued with dry storage. Now the milkers remained clean but the bacterial count increased and was not satisfactory.

At the Reed barn the milkers were sanitized by the procedure employing rinse washing and wet sink storage in solutions of the Cornell sanitizing powder. To reduce the slippery condition of the tubes, the rubber was saturated in the solution before milking in warm water. The bacterial counts were consistently low, the rubber tubes were very clean, and the metal parts were clean and shiny, Table 8. Following 2 months of excellent sanitation the Cornell sanitizing powder was replaced by the commercial liquid sanitizer. The rubber and metal parts were soon only reasonably clean, the bacterial counts increased to an average of 16,900 to 27,100 per ml. in each unit, and *Pseudomonas* predominated, Table 8.

At the Reed barn the rinse wash procedure was used with wet rack storage in a solution of a commercial liquid sanitizer. As a matter of fact, the barn was using this procedure prior to the beginning of the experiment.

**Table 8**

| Bacterial Counts per ml. Made on Five Liters of Sterile Water That Had Been Milked Through One Single Milking Machine Unit at the Warren Barn in June, July, August, and September, 1948 |
|-----------------|-----------------|-----------------|-----------------|-----------------|
|                  | Milker 1        | Milker 2        | Milker 3        | Milker 4        |
| Range of Bacterial Counts | Minimum         | Maximum         | Ave. of 9 Samples | Minimum         |
| Daily Brush in Solution of Cornell Sanitizing Powder and Dry Storage | 5,800           | 6,100           | 5,400           | 5,000           |
| Wet Sink Storage in Solution of Cornell Sanitizing Powder | 28,000          | 35,000          | 30,000          | 27,000          |
| Rinse Wash in Solution of Cornell Sanitizing Powder and Dry Storage | 28,000          | 35,000          | 30,000          | 27,000          |
| Maximum         | 12,000          | 12,000          | 9,800           | 9,800           |
| Ave. of Samples | 28,000          | 25,000          | 19,200          | 22,000          |

| Minimum         | 5,500           | 6,400           | 3,000           | 3,000           |
| Maximum         | 12,900          | 11,800          | 11,000          | 10,000          |
| Ave. of Samples | 28,000          | 25,000          | 19,200          | 22,000          |

*Rubbers and metal very clean but somewhat slippery which was relieved by an hour soak in warm water before milking.*

*Rubbers reasonably clean. *Pseudomonas* predominated.*

The milking machines were not clean, the bacterial counts were too high, average per milker 46,800 and 44,500, and *Pseudomonas* predominated. After one month this procedure had to be discontinued as 3 cases of mastitis developed with *Pseudomonas* predominating in the udder, Table 9.

Five lots of 5 liters of sterile water were "milked" through one single unit to gain some idea of the bacterial contamination in the teat cup assembly. The 5 total bacterial counts were 32,000, 9,000, 5,000, 4,000, and 5,000. The sterile water rinses washed out of the one unit a total of 275,000,000 bacteria or an average count of 10,000.
Sanitizing of Milking Machines

The study was conducted to evaluate the effectiveness of different sanitizing methods and agents in maintaining the cleanliness and sterility of milking machines. It involved soaking an hour in a hot solution of Cornell sanitizing powder, brushing daily, and dry storage. The procedure showed that the daily soaking disappeared. The slippery rubbers were very troublesome so in two weeks, the former procedure of soaking and brushing daily in a hot solution of Cornell sanitizing powder and dry storage was again tried. Now the results were very satisfactory, Table 9, which showed that the daily soaking in hot sanitizing solution and brushing followed by dry storage was very good for clean rubbers but it was not sufficiently effective to clean up dirty rubbers as previously found at the Reed barn, Table 9.

At the time the commercial liquid sanitizing agent was used in the Reed barn, eight colonies were found on one agar plate and they all proved to be Pseudomonas. Laboratory tests were made by Barber (1) on these cultures using the 2 quaternaries employed in this study and four detergent-sterilizing sanitizers, one of which was the "commercial liquid sanitizing" used in this milking machine work. He tried the cultures in waters of varying hardness with and without added organic matter, for water hardness and organic matter decrease the activity of the quaternaries. He found that in soft water free from organic matter the quaternaries in 1-5,000 dilution at 23 to 25°C killed Pseudomonas in less than two to five minutes and in hard water, 30 mg, in less than two to 15 minutes.

TABLE 9

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<thead>
<tr>
<th>Bacterial Counts Per ml of Five Liters of Sterile Water That Had Been &quot;Milked&quot; Through One Single Milking Machine Unit at the Reed Barn in June, July, August, and September, 1948</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range of Bacterial Counts</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Ave. of 10 Samples*</td>
</tr>
<tr>
<td>Daily Brush in Solution of Cornell Sanitizing Powder and Dry Storage</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Ave. of 3 Samples*</td>
</tr>
<tr>
<td>Wet Sink Storage in Solution of Cornell Sanitizing Powder</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Ave. of 4 Samples*</td>
</tr>
<tr>
<td>Daily Brush in Solution of Cornell Sanitizing Powder and Dry Storage</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Ave. of 4 Samples*</td>
</tr>
</tbody>
</table>

*Rubbers dirty. Pseudomonas bacteria predominated. Three cases of mastitis attributed to Pseudomonas.
*Rubbers fairly clean. Pseudomonas present. One case of mastitis attributed to Pseudomonas.
*Rubbers clean but slippery. Few Pseudomonas present.
*Rubbers clean. Few Pseudomonas present.

Hard water with 0.5% per cent ice cream mix required from less than two to more than 60 minutes to kill these bacteria. These results compared with less than 0.3 or 1 minute in hardwater and four to eight minutes for hard water with 0.5% per cent ice cream mix for coliform bacteria. The solution of the commercial liquid sanitizing agent, pH 8.4, never killed all Pseudomonas in any of the cultures within 60 minutes, the duration of the test. On the other hand, the two detergent-sterilizing powders that made solutions of pH 9.7 and 9.6 destroyed these bacteria in hardwater free from organic matter in less than 1 to 16 minutes and with organic matter in less than 1 to more than 30 minutes.

Discussion

The original hope and expectation of this research was to establish that a solution of nonionic surface-active detergent and quaternary ammonium sterilizer might be combined to prepare a solution that would sanitize milking machines by rinsing and washing followed by dry storage. This hope was not realized, and the new detergent-sterilizers did not appear to revolutionize milking machine sanitation even though their careful and intelligent use appeared to be a definite advance in milking machine sanitation.

A good standard for excellence of sanitizing the rubbers of milker units was a lye solution as introduced by Farfitt (6,7). It never failed in these experiments to cleanse satisfactorily and sterilize all rubbers or metal parts with which it came in contact irrespective of other details of sanitizing, Tables 1, 3, 6, 9. The nearly neutral new nonionic detergent-quaternary sanitizing solutions failed to cleanse or sterilize as effectively as lye, especially when the rubbers were stored dry, Tables 1, 2, 3, 6, 7, 8, 9. The lack of consistent sterilization by the nearly neutral quaternaries was not explained but there are ample data in the literature to show that these compounds are not too effective in the presence of organic matter and are least effective against Pseudomonas which proved to be most troublesome in these trials.

It should be noted that the duration of the experiment was an important element in the testing of methods for sanitizing milking machines. These studies were conducted in June, July, August, and September under warm summer conditions. Laboratory tests need verification in dairy barns and for a week or 10 days a bad method may yield good results, especially if the machine was under a perfect condition at the beginning of the trial. Tables 2 and 3. Contrariwise, a good method may fail to give excellent results because the rubbers were in such poor condition at the start of the trial. A method that will clean up dirty equipment must be very effective, Tables 7 and 9.

Commercially, detergent-sterilizing solutions were very effective when used with due consideration to existing knowledge and practice. The experience of the years could not be discarded on the assumption that the new products revolutionized sanitizing procedures. The nearly neutral nonionic detergent-quaternary solutions were not good peptizers of dirt and in the presence of dirt were poor sterilizers. Daily disassembly and brushing of test cup assemblies did not give perfect results with such solutions even when prepared from a commercial liquid sanitizer. By far the best results were obtained when good alkaline washing compounds compatible with the quaternary were present. These powders should dissolve easily and the solution should not injure the hands. The alkaline pH of 10.5 helped to dissolve fat and proteins, to enhance the sterilizing action of the quaternary, and to check the growth of Pseudomonas. In fact, a solution of pH 11 was fairly effective alone as a sanitizing agent. Table 5. It is probable that only a dry sanitizing powder, rather than a liquid sanitizer stock solution, can contain enough of the alkaline compounds to...
give a diluted sanitizing solution of a sufficiently high pH.

The important procedures to observe in good sanitation are numerous. Prompt rinsing after milking by drawing a pail of warm water through each milker removed most of the fresh milk. Also, the sanitizing solution in warm or preferably hot water should be more effective than in cold water for both cleansing and sterilizing. Dry storage could be satisfactory only if the sanitizing agent were not rinsed out after soaking in a hot alkaline detergent-quaternary solution, preferably with daily brushing. For wet storage, lye and alkaline detergent-quaternary solutions proved effective. Storage between milkings in a sink of alkaline detergent-quaternary solution or daily disassembling, soaking in the hot alkaline detergent-quaternary solution with brushing and dry storage, or storage in lye solution were all very effective sanitizers. It was not possible to discard good sanitary procedures and obtain satisfactory results by rinsing with improperly pasteurized and re-

contaminated milk as the carrier. From July 1 to October 15 there were over 400 cases of diarrhea, each 24 occurred in infants in a hospital with ten deaths. The epidemiological data, the very poor sanitary condition of the two pasteurization plants and the milk, and the bacteriological data all indicated Pseudomonas in milk as the cause. As P. aeruginosa produced by Pseudomonas, the above treatment for this poisoning was given to the diarrhea patients with “miraculous results”. Control measures based upon these conclusions eliminated the epidemic within three weeks.

Pseudomonas bacteria do grow fairly well at low temperatures and are destroyed by proper pasteurization. They grew and increased in numbers in the nearly neutral nonionic detergent-quaternary solution.

Much emphasis has been given in various writings to the control of thermooric bacteria by the quaternary ammonium compounds. In the research herein reported occasional tests were made for thermooric bacteria and thermoduric thermoduric bacteria and thermo­

"durable bacteria were very easily con­

1. Before each night's milking, rinse the milker by sucking one 12-quart pail of warm water, preferably containing 200 p.p.m. of chlorine, through each unit. Empty the pail and drain teat cap assemblies.

2. Immediately after the night's milking, brush each milker unit with one pail of warm water by drawing it through the machine and rock milker unit. Brush pail, lid, and all utensils immediately. Discard the rinse water.

3. Take one 12-quart pail of warm or hot water (preferably hot), add correct amount of washing powder, and stir. More than the recommended amount is of no value and is wasteful. Suck this solution through each milker with rocking. Brush pail and dump washing into sink. Brush outside of rubber and all utensils.

4. Place the rubber milker unit on the rack, fill tubing level full of end teat cups and 0.4-0.5 percent by solution. Leave until next milking. Wash utensils and invert on clean rack to dry.

5. In the morning, repeat steps 1, 2, 3, and 4.

Note: Always lift the teat cups in and out of the solution being sucked through them to obtain the most effective cleansing action.

The lye solution of 0.4 to 0.5 percent concentration to be used in the lye solution is prepared by one 13 ounce can of lye in 1 gallon of water to make the stock solution of which 1/4 can is used in each gallon of water.

Every seven days the milker units should be completely disassembled. Inspect, soak rubber in the lye solution for a half-hour. Brush thoroughly in a washing powder solution. Lye is corrosive on metals and hard on the hands and skin.

To obtain maximum length of life of the rubber it is preferable to have two sets for each milker and use them in alternate weeks.

Instructions for Wet Rack Storage in Lye Solution After Rinse Washing with a Hot Solution of Washing Powder

1. Before each night's milking, rinse the milker by sucking one 12-quart pail of warm water, preferably containing 200 p.p.m. of chlorine, through each unit. Empty the pail and drain teat cap assemblies.

2. Immediately after the night's milking, brush each milker unit with one pail of warm water by drawing it through the machine

and rock milker unit. Brush pail, lid, and all utensils immediately. Discard the rinse water.

The used sanitizing solution should still be clean and can be used for other cleaning purposes.

Instructions for Wet Rack Storage in Alkaline Detergent-Quaternary Sanitizing Solution After Rinse Washing with a Hot Solution of the Same Washing Powder

1. Make up the solution of the alkaline detergent-quaternary sanitizing powder according to manufacturer's directions.

2. Follow the instructions for wet rack storage in lye solution, but use the detergent-quaternary solution of the washing powder solution and the lye solution.

Instructions for Dry Rack Storage Following Disassembling, Soaking, and Brushing with a Hot Solution of an Alkaline Detergent-Quaternary Sanitizing Powder

1. Before the night's milking, rinse the milkers by sucking one pail of warm water, preferably containing 200 p.p.m. of chlorine, through each unit. Empty the pail and drain teat cap assemblies.

2. Immediately after the night's milking, brush each milker unit with one pail of warm water by drawing it through the machine and rock milker unit. Brush pail, lid, and all utensils immediately. Discard the rinse water.

3. Take one 12-quart pail of warm or hot water (preferably hot), add correct amount of detergent-quaternary compound, and stir. More than the recommended amount is of no value and is wasteful. Suck this solution through each milker with rocking. Brush pail and dump washing into sink. Brush outside of rubber and all utensils. This cleans and sterilizes the rubber and utensils for the morning's milking. Hang up milker units in a clean place. Store utensils inverted on a clean rack to dry.

The used sanitizing solution should still be clean and can be used for other cleaning purposes.

4. In the morning, repeat steps 1, 2, and 3.

5. Immediately take one 12-quart pail of hot water, add correct amount of sanitizing powder, and stir. Suck this solution through each unit. Empty the pail and drain teat cap assemblies.

6. Place solution in a clean wash sink and put milkers in the solution to soak for at least 30 minutes to dissolve milk out of the pores of the rubber. Protect the air by the solution does not enter behind teat cups. Inact this soaking until washed is most important. Disassemble sufficiently to permit thorough brushing of rubbers and utensils.

7. After washing, assemble the machines and hang up in a clean place. Wash and brush the milk utensils in the warm or hot water after brushing and air drying.

Store inverted utensils in a clean place.

Note: Always lift the teat cups in and out of the solution being sucked through
them to obtain the most effective cleansing action.

Every seven days the milker units should be completely disassembled. Inspect, soak, rubbers and metal parts in hot sanitizing solution for a half hour, then brush, scrub, and clean thoroughly in this solution.

To obtain maximum length of life of the rubbers it is preferable to have two sets for each milker and use them in alternate weeks.

Should the rubbers become slippery this condition can be improved by soaking a half hour in hot water.

**Conclusion**

The sincere desire and effort to have clean and sterile milking machines on the part of the persons responsible for sanitizing them was as important in obtaining clean sterile milkers as the method by which it was accomplished.

A week or 10 days were required before a poor method of sanitizing milking machines showed unsanitary conditions with high bacterial contamination and unclean milker rubbers. This was true especially if the rubbers were in excellent condition before the start of the test. It was evident that very thorough cleaning and sterilizing was necessary to clean up unsanitary rubbers and occasionally more than an ordinary good routine procedure of daily sanitizing was required.

The new nearly neutral nonionic detergent and quaternary ammonium compounds represent a distinct advance in milking machine sanitation providing they were used in conjunction with known good sanitary procedures. Used together they were not good solvents of dirt on milker rubber tubes; unclean rubbers were not satisfactorily sterilized by the quaternary ammonium compounds alone or in combination with the nonionic detergent. However, the combination proved quite effective with brush washing in a hot solution.

Storage of equipment with constant contact with the wet sanitizing solution was generally more effective than dry storage. A lye solution in the milker teat cup assemblies on a rack was a very effective solvent cleaner and sterilizer. Chlorine solution was not as satisfactory as lye but a water softening alkaline solution of nonionic detergent-quaternary sanitizer was almost as good as lye as a solvent cleaner and sterilizer. The nonionic detergent-sanitizer was very effective as a solvent cleaner and sterilizer when the milker teat cup assemblies were submerged in a sink of the solution, but the rubbers were too slippery for practical use. A half to one hour soaking in the hot solution with daily brushing and dry storage was very effective with the detergent-sanitizer solution if the solution also contained water softening, alkaline washing compounds. The hot soak increased the solvent cleaning action by the alkaline solution and the sterilization by both the alkali and the quaternary. Without the high pH, approximately 9.5-10.5, in the washing solution the quaternaries not only failed to destroy *Pseudomonas* but growth occurred. These bacteria are known to produce bitter flavors in dairy products and mastitis in dairy cattle.

A formula was presented for a satisfactory detergent-quaternary sanitizer for both cleaning and sterilizing. It contained trisodium pyrophosphate, trisodium phosphate, sodium carbonate, a nonionic surface active detergent, and a quaternary ammonium compound. The solution of this powder (1 ounce per 3 gallons of water) had a pH of 10.5, dissolved readily in cold water, and was easy on the hands. It cleaned well as a solvent and by brushing. It was presented to indicate the type of sanitizer powder that was most effective in the dairy barns in this investigation.

**References**

1. Barber, Franklin W., National Dairy Research Laboratories, Oadale, L. I., N. Y.
   Private communications, January 1949.

(Continued on page 24)

**Report of the Committee on Sanitary Procedure, 1949**

The 1948 report of the Committee on Sanitary Procedure inferred considerable optimism concerning accomplishments in prospect during the current year. In some respects, that optimism has not been justified by developments. In fact, one phase of the program of the Committee has suffered a set-back. The publication of the 1948 report of the Committee in the September-October, 1949, number of the Journal, the date of issue being within two weeks of the date of this meeting, makes the situation inexplicable.

The Committee has met twice during 1949, in joint sessions, with the Sanitary Standards Sub-Committee of the Dairy Industry Committee, and representatives of the Milk and Food Branch of the U. S. Public Health Service, first, in New York, on April 5 and 6, and also on October 18 and 19, here in Columbus. At these two joint meetings the proposed standards for Electric Motors and Motor Attachments, "Sanitary Standards for Seamless and Welded Tin-Coated Can-Type Milk Strainers", "Sanitary Standards for Stainless Steel Automotive Transportation Tanks for Milk and Fluid Milk Products", and "Sanitary Standards for Fittings Used on Milk and Milk Products Equipment" have been approved. The first named three have been submitted for publication in the Journal as 3A Sanitary Standards.

A sub-committee has for several years been working toward the development of a procedure for determining, with reproducible results, the holding-time of HTST pasteurizing units, with special emphasis upon the instruments and connections necessary to the conduct of the salt-solution conductivity test, so as to avoid factors favoring erroneous results. It will be recalled that, through the efforts of Past-President Tiedeman and President Fuchs, the National Sanitation Foundation, together with several dairy equipment manufacturers, made possible a research study at Cornell University with equipment provided by several members of the Dairy Industry Supplies Association. The study was conducted by Dr. Wm. Jordan and Dr. R. E. Holland, and was reported at the Philadelphia meeting of the Association.

"A Procedure for Determining the Holding Time of High-Temperature Short-Time Pasteurizers" is being submitted to the Sanitary Standards Sub-Committee of the D.I.C., with the recommendation that it concur in fixing the proposed standards for the conduct of this test so that it may eventually have the status of a 3A method.

The sub-committee is to be continued for the study of the thermal wave test procedure.

The development of rigid standards for the salt-conductivity timing determination constitutes the first project initiated and wholly carried out except for final joint-concurrence, under the auspices of this Committee, as now constituted. Messrs. Weber and Dall, who have nursed this project to prospective fruition, and Messrs. Corsh, Thomas, and Wainess, who served on this sub-committee for shorter intervals, deserve the thanks and commendation of the Association.

Committee reports have, for the past several years, included references to the utilization of a 3A symbol to identify equipment conforming to 3A Sani-
uty Standards. In the more recent reports, registration of the design for such a symbol was discussed. It is a prerequisite for the registration of a mark or symbol that it be in use on a commodity or fabricated article transported across state lines in trade. Such utilization of the symbol by its holder, to our knowledge, occurred prior to the 1948 Annual Meeting; consequently, no action toward registration had at that time been taken in the name of the Association.

Early this year a fabricator of storage tanks for milk or milk products made inquiry regarding the 3A symbol, and requested permission to stamp or emboss it upon the name plate to be displayed on each tank. Permission was granted, with the understanding that the Committee would be provided with data concerning inter-state shipments of tanks so identified, necessary to satisfy application for registration requirements. Subsequently, two other tank fabricators have requested permission to employ the symbol in like manner.

Utilization of the symbol by the first user appeared to satisfy the missing prerequisite for the filing of an application for its registration. With supporting data, the attorneys initially consulted were instructed to file an application for registration in the name of the Association. It was not until then that the Committee learned that due to an amendment in Federal patent legislation, which became effective quite recently, registration of a mark or symbol covers only its display on the type of equipment listed in the application—in our case, storage tanks. If we could establish use of the symbol on weigh cans and receiving tanks, both of which might be considered by the Patent Office classification milk "receptacles", one application might cover the equipment covered by the first two sanitary standards adopted. However, the types of equipment covered by the other sanitary standards thus far adopted would fall into at least four other classifications, for each of which separate registration of the symbol is necessary, but possible only after utilization of the symbol on it can be established in the application. The cost of each completed registration may be expected to approximate $100.

This situation has been considered at length by the Executive Board, and measures are being taken to avoid delay in the registration of the symbol, so as to provide the Association with an equity in it, and to obviate the necessity for multiple registration, will be further explored.

It was suggested in the 1948 Report that affiliated state associations establish committees on sanitary standards, and the logical functions of such committees were set forth. During the current year one such affiliate—the New York State Association of Milk Sanitarians—has taken action and has formed such a committee. Your chairman has personally appeared before two affiliate associations to advocate such action and has been informed that it has been taken in one case. The Executive Board has approved a proposal that formal requests for the organization of such committees be sent to the officers of all affiliates which cannot be reached personally.

In this connection we might point out the great service that committees on sanitary standards of affiliate organizations can render to this work. In the course of only the past five years our Committee on Sanitary Standards has lost several outstanding members. Replacements are necessary. Such men should be experienced, that is, have a detailed and complete acquaintance with the design and construction of milk-handling equipment, and must have the confidence of the Association membership at large. Work on this subject in the affiliates would operate admirably as a sort of proving ground, so to speak, where men would be able to acquire the experience necessary for the exacting work involved in drafting standards which satisfy justifiable sanititation ideals at reasonable cost.

The formulation of sanitary standards results in no starting develop-
SANITARY STANDARDS FOR STAINLESS STEEL AUTOMOTIVE TRANSPORTATION TANKS FOR MILK AND FLUID MILK PRODUCTS

Formulated by
INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS
UNITED STATES PUBLIC HEALTH SERVICE
THE DAIRY INDUSTRY COMMITTEE
As of October 19, 1949

SANITARY STANDARDS

It is the purpose of the IAMFS, USPHS, and DIC in connection with the development of the 3A Sanitary Standards program to allow and encourage full freedom for inventive genius or new developments. Milk Transportation Tank specifications heretofore or hereafter developed which so differ in design, material, construction, or otherwise as not to conform with the following standards, but which, in the fabricator's opinion are equivalent or better, may be submitted for the joint consideration of the IAMFS, USPHS, and DIC, at any time.

3A STANDARDS

Milk Transportation Tanks conforming to 3A Standards, comply with the following in design, material and construction.

A. Material

1. Inside Lining: The inside lining shall be of 18-8 stainless steel with a carbon content of not more than 0.12%.

2. Fabrication

   1. Welds: All inside and outside seams shall be welded. All inside welds shall be ground smooth and polished to a #4 finish or better. All outside welds of jacket shall be smooth. All weld areas and deposited metal shall be substantially as corrosion resistant as the parent metal.

B. Insulation

   Insulation material shall be of a nature and amount sufficient to prevent in 18 hours an average temperature rise of greater than 2°F in the tank full of water when the differential between the temperature of the water and that of the atmosphere is 30°F.

   Public Health Reason: Insulation is necessary to maintain temperatures that will retard bacterial growth.

C. Size of Tank

   The height of the vertical axes of the inner shell of the tank shall be not less than the minimum heights shown in the following tables:

   Tanks Having Uniform Vertical Axes

<table>
<thead>
<tr>
<th>Gallons</th>
<th>Height (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over 500 gal. and up</td>
<td>500 gal.-36</td>
</tr>
<tr>
<td>2,000 gal.</td>
<td>2,000 -40</td>
</tr>
<tr>
<td>2,800 gal.</td>
<td>2,800 -42</td>
</tr>
<tr>
<td>3,500 gal.</td>
<td>3,500 -44</td>
</tr>
</tbody>
</table>

   Tanks Having Varying Vertical Axes

<table>
<thead>
<tr>
<th>Gallons</th>
<th>Height (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over 500 gal. and up</td>
<td>500 gal.-36</td>
</tr>
<tr>
<td>2,000 gal.</td>
<td>2,000 -40</td>
</tr>
<tr>
<td>2,800 gal.</td>
<td>2,800 -51</td>
</tr>
<tr>
<td>3,500 gal.</td>
<td>3,500 -55</td>
</tr>
</tbody>
</table>

D. Openings

   1. Outlet: The outlet shall be of the flange type, stainless steel, located to provide complete drainage of the tank or compartment thereof. The minimum diameter shall be 2".

   2. Outlet Valve: The outlet valve shall be of the compression type, close coupled, or a material substantially as corrosion-resistant, that is non-toxic and non-absorbent. The valve body shall be so designed that it can be mounted on the tank with either single service or block tin gaskets. If a block tin gasket is used, it should be scraped in and smoothed off after the valve body is drawn up tightly in its permanent and fixed position.

   Public Health Reason: Close coupling avoids the formation of a pocket in which bacterial growth may occur. Interchangeability of gaskets permits the removal of the valve body for cleaning.

   3. Outlet Valve Dust Cover: The entire valve assembly shall be suitably encased in a metal cover which shall be dustproof and tamperproof by means of sealing facilities.

   Inside finish of cover shall be smooth.

   4. Manhole Assembly: Manhole shall be a minimum 15" x 20" oval or minimum 18" in diameter, with 18-8 stainless steel ring.
5. Vent Opening: Air vent opening shall not be less than 1 1/2" diameter, and, if not located under the dust cover, shall have a separate cover which shall conform to the standards for the dust cover.

6. Fill Connection: A fill connection with sanitary cap shall be provided.

7. Manhole Dust Cover: Smooth rubber gasket shall form seal between dust cover and deck plate and shall be removable. Locking device on dust cover shall be designed to provide tight seal against gasket. Deck plate shall be aluminum in the case of aluminum jacketed tanks and stainless steel in the case of steel jacketed tanks. Deck plate shall form an integral part of the insulation cover, and shall be continuously welded to same and shall be self-draining. Dust cover shall have suitable provisions for the use of a sealing device to prevent tampering.

E. Agitators

When specified, tank or each compartment thereof shall be equipped with a built-in agitator having a removable shaft and blade. Agitator shaft and blades shall be of stainless steel and of sufficient size and speed so as to provide adequate agitation of product. Agitator shaft at point of entry into tank shall be protected from external contamination.

1. Alternate Agitation: Compressed air may be used, in which event the air is filtered through single service filters from which position it is conveyed to the milk in sanitary pipe and fittings. Air should be applied in such manner as would prevent the backing-up of milk to the air filter.

Where air compressors are made part of the truck and tank structure, such compressors must be equipped with an air filter both on the suction and discharge sides.

F. Access to Top of Tank

If the manhole is on top of tank, the tank shall be provided with a ladder on each side.

C. A. ABELE, Chairman-CSP of IAMFS

A. W. FUCHS, In Charge—MF-USPHS

E. H. PARFITT, Chairman—SSS-DIC

Sanitizing of Milking Machines

(Continued from page 18)


SANITARY STANDARDS FOR ELECTRIC MOTORS AND MOTOR ATTACHMENTS

Formulated by
INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS
UNITED STATES PUBLIC HEALTH SERVICE
THE DAIRY INDUSTRY COMMITTEE

As of October 19, 1949

It is the purpose of the IAMFS, USPHS, and DIC, in connection with the development of the 3A Sanitary Standards program, to allow and encourage full freedom for inventive genius or new developments. Electric motor specifications which are developed and which so differ in design, material, construction or otherwise, as not to conform with the following standards, but which in the opinion of the manufacturer or fabricator are equivalent, or better, may be submitted at any time for the consideration of IAMFS, USPHS, and DIC.

3A Sanitary Standards for Electric Motors and Motor Attachments

These standards are to apply to motors not otherwise enclosed, for use in connection with milk and food processing equipment when prescribed in 3A Sanitary Standards for such equipment.

These motor standards are intended to apply to motors as made available for new equipment, and are not intended to apply to motors to replace serviceable ones now in use.

Public Health Reason—Motors of a sanitary design, which can be mounted in a sanitary manner on food and milk processing equipment, and which are enclosed in a manner that will prevent the entrance of roaches and other insects and the escape of oil or grease, can be maintained more easily in a clean and sanitary condition.

A. Electrical and Mechanical Design

1. These standards shall apply to motors and motor attachments, for horizontal and vertical, two-bearing motors and gear motors in fractional and integral horsepower sizes, which shall conform to the National Electrical Manufacturers Association (NEMA) Motor and Generator Standards which are applicable.

2. Motors of ratings up to and including the following shall be in totally enclosed non-ventilated frames:

<table>
<thead>
<tr>
<th>Rpm (Syn.)</th>
<th>3000</th>
<th>1800</th>
<th>1200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyphase-HP</td>
<td>2</td>
<td>2</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Single-phase-HP</td>
<td>1 1/2</td>
<td>1 1/4</td>
<td></td>
</tr>
</tbody>
</table>

Motors having ratings higher than the above may be (a) totally enclosed non-ventilated, (b) splashproof, or (c) totally enclosed fan-cooled. Where splashproof or totally enclosed fan-cooled motors are used, screens shall cover all openings.

3. Temperature rise shall be in accordance with NEMA Standards, as follows:

   Totally enclosed non-ventilated motors: 55° C. rise, continuous duty.

   Totally enclosed fan-cooled motors: 55° C. rise, continuous duty.

   Splashproof motors: 50° C. rise, continuous duty.

4. Insulation: All motors shall be provided with high moisture-resistant insulation such as is commonly used in motors subjected to high humidity conditions.
5. Thermostats: Thermostats may be mounted inside motors, as an optional item, where it is desired to prevent a condition of overheating from stoppage of ventilation or other causes.

B. Sanitary Design

1. Frame: The frame shall have a smooth external surface without fins, pockets, crevices or sharp corners. A radius of \( \frac{3}{4} \)", or larger, shall be provided at all inside corners on external surfaces having angles less than 135 degrees.

All ventilating openings shall be designed for the removal of screens of the same construction as specified under subsection 6 of this section.

Terminal leads of all motors where they pass through the motor frame into the conduit terminal box, shall be sealed with a suitable compound which will prevent the entrance of roaches or other insects.

If drainage holes are provided, they shall be screened as described in subsection 5 of this section, or equipped with porous plugs or similar devices.

External surfaces of the motors shall be self-draining for any position of mounting.

2. Foot or base-mounted motors may be of four types:
   a. Flat-bottom base which has a continuous contact surface for mounting on a continuous flat surface.
   b. Base with a continuous contact surface at outside edges for mounting on a continuous flat surface.
   c. Foot-mounted motor without pockets or connecting webs with individual feet in same plane.

Note: A necessary cleaning space required under the motor housing shall be provided by whichever mounts the motor (\( \frac{3}{4} \)" minimum required).

d. Foot-mounted motor with connecting webs between feet forming cavities under the frame.

Note: A necessary space required under the motor housing to provide inspection and cleaning shall be provided by whoever mounts the motor (\( \frac{3}{4} \)" minimum required).

3. End Shields and Attached Gear Housing: End shields, gear housings and other motor attachments and accessories, shall have a smooth exterior surface without fins, pockets, crevices, or sharp corners. A radius of \( \frac{3}{4} \)", or larger, shall be provided at all inside corners on external surfaces having angles less than 135 degrees.

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External surfaces of the motors shall be self-draining for any position of mounting.

3. Foot or base-mounted motors may be of four types:
   a. Flat-bottom base which has a continuous contact surface for mounting on a continuous flat surface.
   b. Base with a continuous contact surface at outside edges for mounting on a continuous flat surface.
   c. Foot-mounted motor without pockets or connecting webs with individual feet in same plane.

Note: A necessary cleaning space required under the motor housing shall be provided by whoever mounts the motor (\( \frac{3}{4} \)" minimum required).

4. Vents: Vents in the gear housings, or where otherwise provided, shall be of the normally closed type, opening only when air in the gear casing expands. Such vents shall prevent entrance of water or liquid into the gear case.

5. Ventilating Openings: Ventilating openings in end shields, gear housings, etc., shall be effectively screened against the entrance of roaches and other insects.

6. Screws: Screws shall be constructed of corrosion-resistant perforated metal with openings not over \( \frac{3}{4} \)" in diameter or slots not over \( \frac{3}{4} \)" wide. They shall be located and mounted so as to be readily removable for cleaning. The screws shall be tight fitting.

7. Screws, Nuts, Bolts and Studs: Cap screws used to fasten end shields, gear covers, screens, etc., to motor frames shall be hexagonal head type. Washers are necessary for mechanical reasons, or as an aid in eliminating open cracks. If studs or through bolts are used, crowned nuts covering all threads shall be used.

(Slotted, countersunk, or socket head cap screws or set screws are not acceptable.)

8. Bearings and Bearing Seals: The bearings shall be designed to effectively prevent leakage of oil or grease to the exterior. Seals shall be provided to close shaft openings in end shields or gear cases. Such seals shall be designed to effectively prevent leakage of oil or grease during ordinary operation.

9. Material and Finish: Exteriors of the motors shall be of corrosion-resistant material or shall be rendered corrosion-resistant by plating or by baked or air dried lacquer or enamel. Chrome plate shall be used only on castings of brass or bronze.

C. Fittings and Accessories

1. Fittings: All fittings, plugs, screws, nuts, caps, washers, and gauges provided to facilitate inspection, lubrication and cleaning of bearings and housings shall have corrosion-resistant finish. All fittings shall be self-draining for any position of mounting.

2. Conduit Terminal Boxes: Conduit terminal boxes, if used, shall have smooth external surfaces, shall be of such shape as to permit easy cleaning, and shall have no concave or flat horizontal surfaces which might permit accumulation of liquid or dirt.

Conduit terminal boxes shall either (1) fit tightly against the motor frame so that no open crack or crevice is formed, or (2) shall be mounted such that the back of the box shall not be less than \( \frac{3}{4} \)" from the motor frame at any point to permit cleaning behind the box. The nipple or spacer between the terminal box and frame, shall have no exposed threads.

D. Nameplates

Motors shall have a nameplate of corrosion-resistant material with nameplate data called for by the NEMA Motor and Generator Standards. Nameplate data shall be permanently readable. The nameplate shall fit the frame and be attached to eliminate cracks and crevices.

C. A. Abele, Chairman-CSP of IAMPS
A. W. Fuchs, Chairman, Dairy Industries Supply Association
E. H. Parfitt, Chairman, US-PHOS
H. S. Fielder, Chairman, DISA

Type "O" Foot-and-Mouth Virus Identified in Mexican Outbreak

The recent outbreak of active infection of foot-and-mouth disease in Chihuahua, State of Mexico, reported on October 24, was caused by a virus type which had not been present before in the current Mexican plague. The infection since 1946 has been entirely from the foot-and-mouth disease virus Type "A". The new virus was caused by Type "O" virus.

Immunity built up in susceptible animals against infection from Type "A" virus is not effective against exposure to Type "O". In the event Type "O" should become widespread in Mexico, it probably would be necessary to provide a bivalent vaccine—one that would develop a resistance to both types of virus.

There are three types of foot-and-mouth disease virus known. Types "A" and "O" are the ones most frequently present in European outbreaks of the disease. Type "C" occurs frequently in Mediterranean areas, and all three types are present in South America.

Investigations are continuing in an attempt to discover the source of Type "O" virus in Mexico.
SANITARY STANDARDS FOR SEAMLESS AND WELDED TIN-COATED CAN-TYPE MILK STRAINERS

Formulated by
INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS
UNITED STATES PUBLIC HEALTH SERVICE
THE DAIRY INDUSTRY COMMITTEE
As of October 19, 1949

It is the purpose of the IAMFS, USPHS, and DIC, in connection with the development of the 3A Sanitary Standards program, to allow and encourage full freedom for inventive genius or new developments. Seamless and welded tin-coated can-type milk strainers which are developed and which so differ in design, material, construction, or otherwise, so as not to conform with the following standards, but which in the opinion of the manufacturer or fabricator are equivalent or better, may be submitted at any time for the consideration of IAMFS, USPHS, and DIC.

Strainers shall be sized and designed for use with single service straining material of not less than 6 1/2" diameter or 1 square, 6 1/2" on each edge, and shall be so made as to insure all milk passing through the straining material. Wire gauze type strainers are not acceptable.

A. Materials

The strainer shall be constructed of mild open hearth steel (24-gauge minimum for 14-quart or larger; 26-gauge minimum for smaller sizes). The tin shall be of commercially pure quality for application by the hot dipping method.

B. Construction

1. The seat (ring) or area, of the strainer which holds the straining material in place shall be sufficiently rigid to resist denting.

2. Perforated or slotted disks in the bottom of the strainer are acceptable. Wire grids are not acceptable.

3. The smallest diameter of all holes in the grid shall be 3/16". The smallest width of slots shall be 3/8". Burrs shall be removed from all holes and slots before tinning. No holes or slots in bottoms shall be within 1/16" of outer edge.

4. Domes or baffle plates shall be provided, shall have smooth contours to permit ease in cleaning and shall be so constructed as to prevent milk from directly hitting the straining material while being poured.

5. No two plates in a strainer, which are soldered or fixed in place, shall be closer together than 4".

6. Handles on strainer are not acceptable. (Hole for hanging permissible.)

7. The handle on the dome shall be welded in place and shall be sufficiently high to facilitate thorough cleaning. Minimum clearance between handle and dome shall be 1 1/2".

8. With the exception of "working corners", where sharp radii are required to eliminate by-passing of milk, all other radii shall be sufficiently large to facilitate easy cleaning.

9. Strainers shall be completely and smoothly tinned by the hot dipping method, after all fabrication has been completed. Tinning must produce a commercially smooth, plane, and even surface.

C. A. ABBELE,
Chairman—CSP of IAMFS
A. W. FUCHS,
In Charge—MF-USPHS
E. H. PARFITT,
Chairman—SSS-DIC

Conference on Polluted Waters

On January 27, 1950, there will be held in El Paso, Texas, a conference on polluted irrigation waters. This meeting is being sponsored jointly by the Environmental Health Study Section, National Institutes of Health, Public Health Service, Federal Security Agency; the El Paso Texas Health Department, and the Texas State Health Department.

The program will be devoted to discussions of general problems on irrigation waters in several western and southwestern states. Current research relative to the incidence and behavior of pathogenic organisms in irrigation waters, vegetable washings, and soils; discussion of epidemiological aspects of sewage polluted irrigation waters; in addition, papers will be presented on the utilization of waste water; impounding and use of water of the Rio Grande; machines for vegetable washing; present standards for irrigation water; and use of sewage sludges for soil improvement.

All persons interested in this phase of environmental health are cordially invited to attend the meeting. Copies of the program will be sent at a later date, upon request.

Inquiries should be addressed to:
Mr. IRVING GERRING, Executive Secretary
Environmental Health Study Section
Division of Research Grants and Fellowships
National Institute of Health
Bethesda 14, Maryland

Washington State Institute
of Dairying

The Nineteenth Annual Institute of Dairying will be held at Pullman, Washington, March 6-11, 1950. Special sessions for producers and fieldmen, for milk inspectors, general sanitarians, milk processors, and manufacturers of ice cream, butter, cheese, and concentrated milk products. Nationally known guest speakers. Dairy products judging and scoring contests open to the world. Excellent prizes and diplomas. For further information write Professor H. A. Bendixen, Department of Dairy Husbandry, State College of Washington, Pullman, Washington.

Sol Pincus Resumes Consulting Practice

Sol Pincus announces the resumption of his practice as consultant sanitary engineer after six months in Europe, during which he served the World Health Organization as consultant on sanitary problems of various countries, and helped set up its Section of Environmental Sanitation. His address is 11 Park Place, New York 7, N. Y.
REPORT OF THE COMMITTEE ON FOOD HANDLING EQUIPMENT, 1949

The activities of your committee on F.H.E. during the past year has had no direct influence on the improvement in the sanitary design of equipment used in the food industries and on the sanitary quality of the products processed therein. Although tangible progress is not in evidence, significant progress has been made.

This Association is warranted in being proud that it has had the vision to see the need for uniform requirements in the sanitary design of food handling equipment and the modesty to realize that this goal could not be reached without the spirit and performance of collaboration with others desiring to reach the same goal.

Because similar thinking had not been crystallized in other national sanitation-minded groups to the point where they had formed comparable committees, we called upon our President and Executive Committee to extend to such groups our desire to explore with the possibility of such a program and the means of making it successful. The credit for the progress which has been made (the first step is good assurance that others will be taken) should be given to our President and Executive Board. Mr. Fuchs was instrumental in arranging for a meeting of minds around a conference table last June.

The two Co-Chairmen represented the Committee on Food Handling Equipment at this meeting held at Ann Arbor, Michigan, on June 15. Messrs. Fuchs, Shradar and Tiedeman also represented our Association. The purpose of the meeting was to explore the possibilities of organizing a coordinated program of all parties and organizations interested in securing improvements in the sanitary design and construction of food handling equipment.

This exploratory meeting was highly successful as reported by the National Sanitation Foundation in its Sanitation News, Vol. 4, No. 1, July 1949.

"SET STANDARDS FOR EQUIPMENT"

"A committee comprised of a cross section of representatives from all the official organizations in the field of sanitation has been formed to establish standards on food equipment.

The committee will act as a subcommittee of the National Sanitation Foundation and the Sanitation Council of the National Sanitation Foundation.

"Groups which participated in organization of the new committee were: the Engineering Section of the American Public Health Association; United States Public Health Service; International Association of Milk and Food Sanitarians; National Association of Sanitary Engineers; Conference of Municipal Public Health Engineers; and Conference of State Sanitary Engineers.

"The committee plans to meet the industry representatives in the near future. Standards set by the committee will be used by the Foundation in its testing laboratory."

With the organizational phase of this program well established, it is hoped that some constructive work will be started in the near future.

C. W. WEBER, Co-Chairman
C. A. ABELE, Co-Chairman
PAUL DE KONG
LEWIS DORSON
F. H. DOWNS, JR.
JOHN PAULUEN
W. A. MACKEY
JEROME TRICHTER

THE OCCURRENCE OF PROTEUS SPP. IN RAW AND PASTEURIZED MILK

Arnold J. Zaret, D.V.M., Raymond N. Doetsch, Ph.D., and P. Arne Hansen, Ph.D.

Department of Bacteriology, University of Maryland, College Park, Maryland

Many investigators in the past have isolated members of the Proteus group in feces of humans and animals. Recent investigations include those of Cope and Klander (1) who isolated Proteus rettgeri from the feces of 83 adults with proven or suspected enteric diseases; Rustigian and Stuart (2) found Proteus in 36.3 percent of 110 normal fecal specimens; Neter (3) recovered Proteus spp. from 40 percent of the fecal samples of 50 healthy infants; and Craige (4) isolated Proteus spp. in the feces of many dogs with enteric disorders.

In a general survey of the occurrence of Proteus spp., Proctor (5) noted that these organisms were rarely or never isolated from the following habitats: throats of normal individuals, or from soil, dust, fresh water ponds, insects, or canneries. On the other hand, the recovery from packing house waste and the feces of white mice and white rats was frequent.

In spite of the acceptance of Proteus as an intestinal habitant, little work has been done on its occurrence in milk. In those instances where investigations were carried on, however, it was found that the recovery of Proteus from milk was of sanitary significance. Groot (6) concluded that only slowly handled pasteurized milk contained organisms of this genus. MacCaulay (7) stated that Proteus occurred in raw milk only when the udder or the hands of the milkers were improperly cleansed.

Since these two investigations on milk were carried out, however, the description and the classification of the genus has undergone a considerable change. The group, as it is recognized today, consists of four species (8). Each of these is capable of attacking urea rapidly, with the resultant formation of ammonia. Many organisms which were previously classified as Proteus were eliminated from the group on the basis of inability to attack urea. On the other hand, new species were added to the genus due to the possession of this characteristic as well as the other genus prerequisites. Considering, then, the alteration in the description, as well as the members of the genus Proteus, a re-investigation of the occurrence of these organisms in milk was considered desirable.

For the quantitative detection of Proteus in milk, it was necessary to develop a selective pour plate medium for this genus. Investigations by two of the authors have resulted in such a medium (9). The preparation, urea-ricinoleate agar, was found to give approximately 100 percent recovery of Proteus spp. Tests performed upon 19 organisms commonly found in milk resulted in the growth of only 3 in urea-ricinoleate agar. These were Pseudomonas aeruginosa, Aerobacter aerogenes, and Escherichia coli. Further experimentation with mixed cultures indicated that the presence of a vastly superior number of Escherichia coli did not interfere with the complete recovery of Proteus spp.

The sole change in the medium as it was originally described (9) has been the addition of crystal violet at a final dilution of 4 x 10⁻⁵. Sterilization of urea-ricinoleate agar was also found to be unnecessary due to its inhibitory properties.
METHODS

Twenty samples of raw milk and 20 samples of pasteurized milk were examined for the presence of Proteus organisms. The raw milk was obtained from 10 different farms as shipments arrived at the pasteurizing plant of the University of Maryland dairy. Each can of pooled milk was stirred, and samples were collected aseptically at establishments in College Park, Maryland. These samples of milk represented three different methods of processing: pasteurization with no other treatment; pasteurization and homogenization; pasteurization, homogenization, and ultra-violet radiation.

All milk samples were refrigerated until tested. Refrigeration never exceeded one hour. The raw milk was tested at dilutions of 1, 10\(^{-1}\) and 10\(^{-2}\) in urea-ricinoleate agar and violet-red bile agar (Difco). The pasteurized milk was tested at dilutions of 1 and 10\(^{-2}\) in the same media. In addition, 0.1 ml of each sample was pipetted onto S.S. agar (Difco) and streaked. All plates were inoculated in triplicate. The violet-red bile agar plates were incubated for 18 hours, S.S. agar plates for 24 hours, and urea-ricinoleate agar plates for 36 hours at 37 C.

Violet-red bile agar was used to correlate the occurrence of coliform organisms with Proteus in milk. S.S. agar, on the other hand, was used to confirm the finding of Proteus in urea-ricinoleate agar, the former medium having been found to be very efficient in the recovery of Proteus (10).

The occurrence of concentrically ringed red colonies in urea-ricinoleate agar was considered presumptive evidence for Proteus spp. This was confirmed by picking representative non-lactose fermenting colonies from S.S. agar plates and inoculating into nutrient broth tubes. After incubating for 24 hours at 37 C, a loopful from each tube was streaked on nutrient agar slants and incubated for 24 hours at 37 C. Gram stains were made, and 0.5 ml of urease test medium (BBL) was inoculated heavily from each agar slant. The presence of Proteus was confirmed by the production of ammonia within 7 hours by a Gram-negative organism.

RESULTS

Of the 40 milk samples examined, only one was positive for Proteus. This was raw milk sample (3A), in which Proteus was found as high as the 10\(^{-1}\) dilution. On the other hand, 19 samples of raw milk and 9 samples of pasteurized milk contained coliform organisms. The results are tabulated in Table 1.

DISCUSSION AND CONCLUSIONS

Based on the findings of many investigations that Proteus organisms are primarily of fecal origin, it is apparent that milk sample (3A) was contaminated with human or animal excreta. As indicated by Groot (5) and Maccolini (7), such milk was probably improperly handled.

It is questionable, however, whether Proteus can be used as the sole index for fecal contamination of milk. Neter (3) found Proteus in only 40 percent of 50 samples of normal human (infant) feces examined. This was the highest recovery from human feces reported by any investigator in recent years. Assuming that this figure applies to all human feces, less than half of the milk contaminated with feces would be positive for Proteus. Furthermore, the method used for the determination of these organisms in excreta has been by streaking on selective agar plates, usually after preliminary enrichment. Since direct counts have never been made for Proteus in feces, the concentration per gram in Proteus-positive feces is not known. Should this concentration be low, it would be necessary, perhaps, to examine several milli-
The use of *Proteus* spp. as an index of fecal pollution in milk is appropriate from one point of view: each member of the genus is primarily of fecal origin. Species differentiation, therefore, is unnecessary; each species is of sanitary significance. From this consideration, a *Proteus* index is more efficient than a coliform index for fecal pollution. The media recommended for the counting of coliform organisms in milk do not differentiate between *Escherichia coli* and *Aerobacter aerogenes*. Although the latter organism occurs in feces occasionally, it is predominantly of soil and vegetation origin; thus, its occurrence in milk should be of little sanitary significance. This necessitates the performance of various biochemical tests to determine which of the coliform organisms are present in order to ascertain fecal contamination. The use of *Proteus* organisms as a sanitary index would present no such difficulty. By means of *urea-ricinoleate* agar, 100 percent recovery of *Proteus* is obtained, and the characteristics of colonies produced necessitate no further biochemical tests.

**SUMMARY**

Forty samples of raw and pasteurized milk were examined for the presence of *Proteus* by plating on *urea-ricinoleate* agar. One sample of raw milk was positive for *Proteus*.

The merits of *Proteus* as an indication of fecal contamination in milk are discussed.

**REFERENCES**

Sanitation may be defined as the adoption or carrying out of hygienic measures designed to protect or to secure health. Proper sanitation is not only good economy, but also of primary importance in producing a high quality product.

Federal law requires frozen food packers to give careful attention to all aspects of sanitation. The Food, Drug, and Cosmetic Act of 1938 under Section 402 (a) 4 holds special significance for processors since it rules that any food may be deemed to be adulterated "if it consists in whole or in part of any filthy, putrid, or decomposed substance, or if it is otherwise unfit for food." Section 402 (a) 4 holds special significance for processors since it rules that any food may be deemed to be adulterated "if it has been prepared, packed, or held under insanitary conditions whereby it may have become contaminated with filth, or whereby it may have been rendered injurious to health." Foods which are adulterated within the meaning of the sections quoted are subject to seizure if shipped in interstate commerce.

On this basis, modern plant sanitation is no longer simply a matter of good housekeeping, but requires the practice of combining general cleanliness and tidiness with adequate technical control of micro-organisms and infestation. In nearly every condemnation of a food plant considered to be insanitary, emphasis has been placed upon one or more of the following: (1) the presence of rats and/or mice; (2) the presence of flies and/or other insects; (3) filthy toilets; (4) polluted water; (5) decomposed or insect infested raw materials; (6) improper or insufficient cleaning of equipment; (7) improper disposal of waste material; and (8) unhygienic personal habits of employees.

The dairy industry has been most progressive in outlining and studying the many sanitary problems connected with their particular field of the food industry.

Likewise, much credit must be given to The National Canners Association for fostering and promoting sanitation in their industry. As early as 1913, they appointed a Committee on Sanitation which recommended a set of sanitary requirements for canneries. In 1923, they adopted a most comprehensive Sanitary Code and during the past 10 years they have issued a series of publications on sanitation.

It is regrettable that the frozen food industry has not been as active in establishing similar regulations.

PERSONNEL TRAINING

One of the basic points underlying sanitary problems in the processing and distribution of frozen foods is the lack of education on the part of producer and distributor. Starting at the top of the ladder it is most difficult to convince management of the need for sanitary conditions, especially so in regard to the everyday cost of a good "clean up" crew. Practical sanitarians do not ask for a tile-walled palace, for one can keep even a harned in a tidy condition. Likewise the good old-fashioned mop, if properly used, is just as effective as the modern cleaning devices. Hence to a considerable degree, the cost of maintaining a sanitary food plant can be simple or elaborate, depending on the assets of the company and within those limits it almost a guarantee of repeat sales and profits. In addition there is always the personal satisfaction of knowing that he has done a good job.

Plant superintendents and other supervisory personnel have a tendency to be over cost conscious and attempt to cut corners in every way possible. To keep operating costs at a minimum but it is no longer good economy when food is packed under insanitary conditions resulting in consumer complaints and possibly even sanction by the Food and Drug Administration. Condemnation procedures can be mighty costly legal problems.

Getting down to the working clean-up crew itself, there is always the tendency to assign old, decrepit, and otherwise poor labor to these jobs. A good clean-up crew requires the service of strong, able-bodied men, as their job is a tough assignment. These men should be given a thorough "on the job" training program and should be made to realize their responsibility. They must have pride in their work and be taught that their job is not menial but very essential to the production of a high quality product. When they do this well they should be complimented on their work and, otherwise, they should be told wherein they failed and be taught how to do a good job.

The clean-up crew foreman should be above the average intelligence for supervisory personnel. Unless the plant is a large one he need not be a graduate sanitarian, but he should be well versed in sanitary techniques, including its various ramifications. In these same small plants it is anticipated that there is a food technologist or plant sanitarian who has full knowledge of the underlying principles of sanitation and a knowledge of microbiology and bacteriological technique through which one can locate the hidden danger spots of possible contamination.

DISTRIBUTION

Education is also needed on the part of the distributor of frozen foods. It might be reasoned that sanitary problems here seem to fall more in the category of quality control but the two are so closely related, each influencing the other, that it is usually impossible to draw a line of demarcation between the two.

Distribution starts with the time the frozen product leaves the packers' hands.
and ends when the same package is sold to the housewife or institutional user. This covers a long range of handling involving shipping, warehousing, shipping again, and finally retailing, and during each of these steps there are problems of a sanitary nature. In shipping, care must be taken to select a suitable type of refrigerator car or refrigerator truck, namely one that will not permit excessive increases in temperature thereby resulting in bacterial growth and spoilage.

Refrigerated storage rooms should be properly constructed of impervious materials and be held at the proper temperatures required by the product in storage. All frozen foods should be held at a temperature of 0° F. or below. Under no condition should frozen foods be stored at a temperature higher than 5° F. Cold storage rooms should be free of all foul and bad odors at all times. Containers of frozen foods should be properly stacked, but never directly on the floor of the holding room. Straps of wood, commonly known as dunnage, should be laid on the floor, or floor racks should be used so that the first layer of cases is about 2 or 3 inches above the floor. Low temperature holding rooms should not be overloaded, and should be kept clean at all times. Broken packages and containers should be kept in barrels or crates and be kept separate from the rest of the piles.

The Refrigeration Research Foundation, under the able direction of H. C. Diehl, has done much to foster these principles and to educate the warehousemen throughout the country in the proper handling of frozen foods.

The retailers need to be educated on the proper handling of frozen foods. Frozen foods are perishable products and therefore must be kept at low temperatures at all times. Many a retailer has been known to place frozen foods in non-refrigerated locations and later to refreeze the thawed or partially thawed product. Retail cabinets must

be kept in a sanitary condition and be kept free of broken and soiled packages. A good appearing cabinet containing orderly stacks of frozen merchandise does much to increase sales.

Sanitation

Another problem facing the packer is the selection of a suitable detergent to do a particular job. Many purchasing agents are at the mercy of high pressure salesmen due to the fact that they do not know where to turn to obtain information on the relative value of the many types that are on the market.

Unfortunately the frozen food industry has never seen fit to support studies of this nature, in contrast to the dairy industry who are much on their toes, that we often learn of a new detergent through studies that have been made to determine its suitability and adaptability to the sanitary problems of the dairy industry.

Even within the frozen food industry there are examples of progressiveness and regressiveness. The fish freezing industry has long appreciated the value of chlorination, yet only in very recent years have packers of fruits and vegetables shown any interest in such sanitary measures.

Some problems of sanitation arise before the products are delivered to the processing plant. For instance in the case of shellfish, the quality of the water from which they are taken is of primary importance. From a bacteriological standpoint, shellfish waters must meet the same standards as those for drinking water. Some frozen shellfish are given no heat treatment and are eaten raw. One big problem in fish handling is the use of forks. A satisfactory product is obtained as long as the forking is confined to the head, but the procedure is most insanitary when the fish is stabbed through the viscera.

Some vegetable raw material delivered to the plant may be infested with insects, such as worms and plant lice on broccoli and brussels sprouts. Careful inspection is necessary to prevent products in these conditions from being packed. Besides rejection at the plant, measures should be taken to keep infestation down to a minimum long before the product is harvested.

The problem of rodent control is not one of easy solution, as the use of poisons is dangerous in food producing establishments. Sewage disposal is another problem that is difficult to solve as most freezing plants have a seasonal operation and therefore the expense of settling tanks and the like is hard to justify. Like in all food plants, the frozen food processing plant has the usual problems of plant sanitation, water supply and personal hygiene.

Some sanitary problems of the frozen food industry fall in the field of the analytical laboratory. Berries are subject to mold growth if held prior to freezing, especially during warm and humid weather. The presence of mold might not be visible to the eye yet the finished product could well be subject to seizure by the Food and Drug Administration. If a packer has a food technologist on his staff he can check his raw material, but by what method? The Association of Official Agricultural Chemists gives methods for the detection of mold and rot fragments but the methods are most unsatisfactory. There is an excellent thesis problem for some graduate student.

Many packers run bacteria counts on their finished products, but unfortunately the industry has never agreed on a standard method, nor is there any agreement on what the count should be and still fall within the realm of good sanitary practice. One maximum count cannot be set for all frozen products any more than one could use the acceptable count for milk as the acceptable count for water. Off flavors are detected by taste tests only. Maybe some day it will be possible to have a chemical method.

The sanitary problems in the processing and distribution of frozen foods are many and varied. Only by continual research and education can they be solved and even then it will require considerable time. In the mean time it is hoped that the packers and distributors will adhere to the basic principles of sanitary practices.

New Dairy Industry Department in Florida

A new department has been created at the University of Florida and the Florida Agricultural Experiment Station on which both dairy manufacturing and dairy production activities have been combined. It will be known as the Department of Dairy Husbandry and Dairy Manufactures.

Dr. E. L. Fouts, who has been Dairy Technology at this institution since 1940, has been named head of this new department. He has received degrees from Purdue University, Oklahoma A. and M. College, and Iowa State College. He has had considerable practical experience in dairying in several sections of the United States.

The production staff members are Dr. R. B. Becker, Dr. Sidney Marshall and Prof. P. T. Dix Arnold. The members of the manufacturing staff are Prof. L. E. Mull, Prof. W. A. Kienke, and Prof. L. R. Arrington.
MILK and FOOD SANITATION

THE "5 MINUTE" RESAZURIN TEST FOR DETERMINING THE QUALITY OF RAW MILK

J. C. BOYD AND H. C. HANSEN
Department of Dairy Husbandry
University of Idaho, Moscow, Idaho

The sale of large amounts of butter, cheese, evaporated milk, and milk powders to government agencies has caused many milk processing plants in the West to adopt a policy of manufacturing only one grade of products. These products are designed to meet the grade specifications of the buying agencies.

Under such a policy, milk which is of such poor quality that its use may jeopardize the quality and grade of the finished products is rejected and returned to the producer.

The success of such a procedure depends upon the ability of milk graders to distinguish quickly and accurately between those cans of milk which will not injure the quality of the manufactured product, and whose which will. Thus, there is a need for a biological test that gives the end point quickly enough to be an aid to the milk grader in making these determinations.

The 10-minute resazurin test which has received government approval in Great Britain since 1942 (12) has many of these qualities.

Barkworth and associates (2) compared the 10-minute resazurin test with the sense of smell and taste on boiling, titratable acidity, and pH, and concluded that the 10-minute resazurin test was the best suited for rapidly weeding out unsatisfactory milk at the receiving platform. The authors emphasized the value of the flexibility of the test. Jones and Barkworth (9) found a significant correlation between the 10-minute resazurin test and the titratable acidity of milk and concluded that the 10-minute test is more closely affected by changes in acidity than the methylene blue test.

Golding (6) compared the 10-minute resazurin test with the standard plate count and concluded that the test had real value in detecting very poor quality milk.

Unfortunately the above studies used a resazurin dye concentration and a color standard commonly used in Great Britain but which differs somewhat from the standards recently approved as the standard method in the United States (12).

Davis (4) studied a 5-minute resazurin test and classified all milks which turned lilac, mauve, or pink as poor quality. The dye concentrations and incubation temperature used, however, differ from those now accepted as standard in the United States (13).

This report deals with a study conducted to determine the value of "5-, 10-, or 15-minute" resazurin tests for the platform grading of raw milk.

EXPERIMENTAL PROCEDURE

Comparisons of a 5- and 10-minute resazurin test with the methylene blue test, direct microscopic count, and titratable acidity were made at the laboratories at the University of Idaho. The milk samples used were taken from milk patrons delivering milk to the local milk bottling plant. In most cases, it was necessary to incubate the samples before they would bring about a change in the resazurin dye in 5 minutes.

Additional comparisons of a 5-, 10-, and 15-minute resazurin test with the methylene blue test and direct microscopic count were made in the field at a representative milk processing plant which manufactures butter and milk powders.

The resazurin test was conducted using "prepared" sterile dry vials (7). These vials were prepared at the State College of Washington and are the same as are being offered for sale to the milk processing plants. The samples were incubated at 98°F. (±1°F.) and grades were determined using the Munsell resazurin color grades (10).

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Comparison of the samples taken in the field, which reduced the resazurin dye to the "B Grade" (color PBP 7/5.5 to PBP 7/8) in 5, 10, and 15 minutes, with the reduction time of methylene blue is summarized in Table 1.

These results show that based on a 5-minute incubation period, 32.9 per cent of the samples reduced methylene blue in 20 minutes or less and an additional 46.8 percent reduced methylene blue in 1 hour. Thus 79.7 percent of the samples, which reduced resazurin to "B Grade," in 5 minutes, reduced methylene blue in 1 hour or less.

A comparison of the samples taken in the field which reduced the resazurin dye to "C Grade," in 5, 10, and 15 minutes, with the reduction time of methylene blue is shown in Table 2.

These results show that of samples reduced to "C Grade" in 5 minutes, 84.2 percent reduced methylene blue in 20 minutes or less and an additional 15.7 percent reduced methylene blue in 1 hour. No samples retained the blue color over 1 hour.

These results show that a 5-minute incubation period is more accurate in picking out very poor quality milk, as determined by the methylene blue test, than a 10- or 15-minute incubation period.

Direct microscopic counts were made of those milk samples which reduced the resazurin dye to B and C Grades in 5 minutes. The results are shown in Table 3.
"5-Minute" Resazurin Test

TABLE 2
Comparison of a Resazurin Grade of "C" After 5, 10, and 15 Minutes Incubation With Methylene Blue Reduction Time

<table>
<thead>
<tr>
<th>Incubation time</th>
<th>No. of Resazurin grades</th>
<th>20 minutes</th>
<th>1 hour</th>
<th>2 hours</th>
<th>3 hours</th>
<th>over 3 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 minutes</td>
<td>57</td>
<td>C</td>
<td>80.2</td>
<td>17.5</td>
<td>0.0</td>
<td>2.1</td>
</tr>
<tr>
<td>10 minutes</td>
<td>92</td>
<td>C</td>
<td>93.2</td>
<td>39.1</td>
<td>8.3</td>
<td>3.8</td>
</tr>
<tr>
<td>15 minutes</td>
<td>131</td>
<td>C</td>
<td>93.0</td>
<td>8.3</td>
<td>3.8</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Of the samples reducing the resazurin dye to "B Grade" in 5 minutes, the lowest direct microscopic count was 2,000,000 per ml, the highest 63,000,000 per ml, and the average of 64 samples 31,149,000 per ml. Of the samples reduced to "C Grade" in 5 minutes, the lowest direct microscopic count was 2,000,000 per ml, and the highest 193,000,000 per ml, and the average of 59 samples was 46,470,000 per ml. The majority of the samples (71.9 percent) had direct microscopic counts between 21,000,000 and 60,000,000 per ml.

Of the 84 samples which did not change from the original blue color of the resazurin dye in 5 minutes, no samples had a titratable acidity of over 3.7 percent.

TABLE 3
Comparison of Resazurin Grades After Five Minutes Incubation With Direct Microscopic Counts

<table>
<thead>
<tr>
<th>Direct microscopic count</th>
<th>Lowest bacterial count</th>
<th>Highest bacterial count</th>
<th>Average bacterial count</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC</td>
<td>2,000,000 per ml</td>
<td>63,000,000 per ml</td>
<td>13,129,000 per ml</td>
</tr>
<tr>
<td>BC</td>
<td>2,000,000 per ml</td>
<td>63,000,000 per ml</td>
<td>13,129,000 per ml</td>
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<td>63,000,000 per ml</td>
<td>13,129,000 per ml</td>
</tr>
</tbody>
</table>

Of the samples analyzed in the field, 282 samples retained the original blue color of the resazurin dye beyond the 15-minute incubation period. These samples, 0.0 percent reduced methylene blue in 20 minutes or less, 1.06 percent reduced methylene blue in 1 hour, 8.51 percent in 2 hours, 10.99 percent in 3 hours, and 79.43 percent retained the blue color of methylene blue after 3 hours' incubation.

The titratable acidity of the milk is shown in Table 4. Of the 84 samples which did not change from the original blue color of the resazurin dye in 5 minutes, no samples had a titratable acidity of over 0.02 percent calculated as lactic acid. The titratable acidities of samples which reduced the resazurin dye to the "B Grade" in 5 minutes, 79.4 percent reduced methylene blue in 1 hour or less and 91.4 percent reduced methylene blue in 2 hours or less. Of the samples reduced to the "C Grade" in 5 minutes 100 percent reduced methylene blue in 1 hour or less.

Direct microscopic counts of the samples which reduced the resazurin dye to "B Grade" in 5 minutes show that the majority of the samples, 71.9 percent, had direct microscopic counts between 21,000,000 and 60,000,000 per ml.

Of the samples which retained the original resazurin blue color for 15 minutes or longer, 79.44 percent retained the blue color of methylene blue for 3 hours or more. No samples which retained the resazurin color for 5 minutes more had a titratable acidity calculated as lactic acid, of over 0.20 percent.

Numerous studies have shown that the resazurin dye is sensitive to the reducing action of yeasts, bacteria, or substances associated with leucovorin (5, 11, 8, 1). Previous work at this station (3) on the 1-hour resazurin test showed that approximately 17 percent of the samples reduced in 1 hour were reduced by abnormal conditions other than bacterial content. The ability to include abnormal milks caused by mastitis, colostrum, or late lactation is regarded as some advantage. Others regard it as a disadvantage.

To the laboratory technician, fieldman, and milk producer, this feature of the resazurin test tends to cause considerable confusion. Unless the resazurin test is supplemented by tests such as the direct microscopic count or others, determining just what condition in the milk is causing the reduction may be difficult.

The quality test that should be used will, of course, depend upon the quality of the milk supply. The "5 minute" resazurin test, as described, is of value only in those areas where much of the milk will reduce methylene blue in 3 hours or less. The authors, should be supplemented with a direct microscopic analysis.

REFERENCES

RECENT PROGRESS IN MASTITIS CONTROL

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University of Wisconsin, Madison, Wisconsin

BOVINE mastitis is a widespread important disease of dairy cattle in Wisconsin. It involves the milk production gland and results in low production and poor quality milk. Mastitis is caused by an infection of the udder with bacteria. Since it is an infectious disease, it can be controlled or prevented by proper application of the principles of quarantine and sanitation combined with good milking methods. These principles of control can be applied on the average dairy farm with a small investment in time and money. Mastitis control will result in more milk and will pay the dairyman big dividends for the small amount of time spent.

Now, what can a dairyman do to control mastitis? In discussing this problem, we will consider first, herds which are free of the disease. Many Wisconsin herds are in this fortunate condition. They have no cows giving abnormal milk except occasional infected quarter following an injury to the teat. These herds which are free of mastitis have cows eight, ten, or more years old in heavy production. They are not bothered by blind quarters. Dairymen in such herds can keep them free of mastitis by raising their own replacements. If animals must be purchased, they should be heifers before they are milked for the first time. Cows which have lactated are dangerous to a clean herd, even if they appear to be normal. Mastitis is spread from herd to herd by transfer of infected cows, many of which appear to be all right at the time they were purchased.

Any cow which is milking or has passed through a lactation is a potential carrier to a mastitis-free herd and should not be introduced.

If a new dairy herd is to be assembled, there is the same danger that mastitis will be introduced with infected cows as in a herd already established. The best way to start a herd of dairy cows is to buy heifers before they freshen for the first time. Purchase of milking cows from sales dealers, or other sources will often result in a serious mastitis problem.

The other type of dairy herd which we have to consider is the herd affected with mastitis. This would include most of the herds in Wisconsin. The disease can be controlled in these herds, and in some cases eradicated by good husbandry practices with the help of expert assistance by the local veterinarian.

If a dairyman finds that some of his cows are affected with mastitis, there are several procedures which will aid in the control of the disease. The first important step is the accurate detection of the affected animals. Daily use of the strip cup is of great value. The dairyman should milk the first stream from each quarter into the strip cup and watch for flakes, clots, or thick milk. The occurrence of any of these abnormalities is an indication of mastitis and the milk from such a quarter should be kept out of the market supply. In addition to the strip cup, laboratory tests may be of great aid for detecting infected cows. The local practicing veterinarian may be equipped to do these laboratory tests or he will know where laboratory service is available.

When the mastitis-affected cows in a herd are accurately detected the next step in control is proper milking order. Heifers are usually free of mastitis and should be milked first. Older cows which are apparently normal may then be milked next, and the cows affected with mastitis last. This milking order makes it easier to maintain if the animals are arranged in the order of milking: heifers in one group, clean cows next, and affected animals in a group at the end of the milking line.

Sanitary precautions are necessary to reduce the spread of infection from cow to cow. The teat cups of the milking machine can be disinfected between cows by dipping them in a solution of compatible water, and then in a solution of chlorine solution. This chlorine solution should contain about 20% parts per million of available chlorine. The proper strength solution can be obtained by mixing according to the directions on the bottle of hypochlorite powder. Just after the milkers' hands are dipped into the chlorine solution a towel may be moistened with it, and used to wipe off the teats of the cow. At the end of the milking period the teat cups of the milking machine are rinsed with clean water and then the cups are hung up in a rack and filled with a one-half percent lye solution. This solution can be prepared by adding one level tablespoon of lye to a gallon of water in a glass or earthenware container. The lye solution is allowed to stand in the teat cups until just before the next milking. The teat cups are then rinsed out with clear water.

These sanitary precautions seem somewhat detailed but they can be accomplished in a few minutes per day when they are made a part of the regular routine. They can be done in about the time required to milk one affected cow by hand.

In addition to detection, milking order, and sanitation in the dairy barn, the handling of the cows is quite important for mastitis control. Milking should be done rapidly, regularly, and thoroughly, and the milking machine must be removed as soon as the milk stops flowing. If the milk is not removed completely, or if the machine is allowed to draw on the empty teats, serious injury may result. Quarters severely affected with mastitis will benefit if milked several times a day.

Stalls of adequate size, and plenty of bedding will help avoid injuries to the teats which are often followed by mastitis. If the cow is allowed plenty of time to get to her feet, she will not be as likely to tread on her own teats.

The correct feeding of affected cows will aid in the control of mastitis. The concentrates or grain mixture should be reduced or eliminated from the feed during the active stages of the disease. Cows which have mastitis in a mild form may become worse if fed large amounts of concentrates, and will often produce little or no abnormal milk if fed only small amounts of concentrates.

Another procedure which will aid in the control of mastitis is the sale of severely affected cows for slaughter. Animals which do not respond to treatment or those affected in two or more quarters are dangerous cows because they may spread the disease to the other animals in the herd. They are seldom profitable producers. If these animals are replaced by heifers, the worst part of the problem of mastitis will be solved.

CONTROL BY TREATMENT OF AFFECTED COWS

Proper treatment of cases of mastitis by a veterinarian will aid in control of the disease. Developments of the last few years have shown that treatment can solve the immediate problem of mastitis in some herds. Many animals affected with the disease can be treated...
successfully with the new germ-fighting drugs. Treatments will help to bring the mastitis cow back into normal production and prevent her from spreading the disease to clean or normal animals. These treatments have both a curative and a preventive value.

In order to get the best results from treatment, the proper dose of the right drug must be employed. The several forms of mastitis should be treated differently to obtain maximum benefit. No one drug or combination of drugs is effective against all types of mastitis. Each farm has its own mastitis problem, making the treatment of mastitis difficult for the average dairyman. Some dairymen are treating their own cows and have had good results.

Many others have been disappointed in their treatments, probably because they used the wrong kind of treatment for the type of mastitis in their herd. It is better to call the local veterinarian to make an accurate diagnosis and to administer the proper treatment.

There are many things a dairyman can do to help his cows recover from mastitis. He should separate the affected cows from other animals and milk them last. If the grain or concentrate feed is reduced, such an animal will have a better chance to respond to treatment. It is helpful to milk the affected quarters out frequently. In severe cases of mastitis, milking five or six times a day is advisable. After aid recovery, treatment by injecting drugs into the gland, milking should be stopped for 12 to 24 hours so the drug will have a chance to act.

Cold packs or ice packs on the udder may be helpful in severe acute or gangrenous mastitis. They are ordinarily used on animals only one or two days during the early stages of the disease. Massage of an affected quarter will help to reduce the swelling. It is better to rub firmly toward the teat. By means of alternate rubbing and stripping, one can remove much of the abnormal material from the uterus.

Drugs can be administered to cases of mastitis either by mouth or into the affected quarter. Veterinarians may prescribe drugs such as the sulfonamides or penicillin. These sulfonamides are usually given in large doses once or twice a day for two to four days. The whole body of the cow, including the udder, become infused with the drug. Other germ-fighting materials are injected into the udder through the end of the teat. This drug is usually given in this manner. It spreads around through the quarter injected. The teat may be infected with a foul-smelling exudation or a suspension in oil. A new method of giving penicillin is in the form of a bougie, which looks like a matchstick. A bougie is inserted into the teat and it then dissolves, releasing the penicillin into the milk. These bougies are about as good as any other form of penicillin for mastitis.

Chronic mastitis due to streptococci is the most common type of the disease. There are other forms of mastitis. Some cases of mastitis should be treated with a course of penicillin given at a regular interval. In tests made by the Department of Veterinary Science of the University of Wisconsin, penicillin given in this way cured about seventy percent of affected quarters. Most of the quarters which are not cured are improved by treatment. An occasional cow with chronic mastitis shows no benefit from treatment. The animals which are cured are still susceptible to the disease and they can be reinfected if they are exposed to an infected cow. Penicillin has proved to be of great value in herds where the chronic form of mastitis is causing difficulty.

Cases of the acute or rapid type of mastitis are often not benefited by penicillin. For these cases a veterinarian will use one of the sulfonamide drugs. These drugs are usually given by mouth, but they may be injected directly into the quarter. Both penicillin and sulfonamides may be used in severe cases of mastitis. It is important to call a veterinarian early for these cases of acute mastitis because the quarter may become damaged beyond repair in two or three weeks.

The mastitis which develops following an injury to the end of the teat is always serious. As soon as such an injury is discovered, it should be covered with carbolated vaseline and with adhesive tape to prevent infection. Milking must be thorough, but with a minimum of manipulation of the teat. Dilators or teat tubes are dangerous and are to be used only when absolutely necessary. If a small swelling is found in the gland above the injured teat, the quarter is affected with mastitis. Prompt treatment is necessary then to prevent loss of the quarter. These cases of mastitis following an injury are always a hard problem to handle. The milk must be removed regularly and the wound on the end of the teat must be allowed to heal.

In addition to penicillin and the sulfonamide, streptomycin appears to be valuable for cases of acute mastitis. This drug has recently become available to veterinarians. When we learn the proper dose for various types of mastitis, we may be able to save some of the cases which are now lost.

Certain other drugs have been used for mastitis but are not recommended at the present time. Tyrothricin, silver oxide, and radium are all too irritating for the lactating mammary gland. They can be used during the dry period, but even then they are no better than penicillin and the sulfonamides. The treatment of mastitis is not simple, and some cases do not improve. It is much better to prevent mastitis by good milking and sanitation than to treat the disease after it has attacked a herd. If a herd is free of mastitis, it may be kept free by adding only heifers before they freshen. Rapid and thorough milking, moderate feeding and disinfection of the hands, the teat cups, and the cow's udder will help. A milking order of heifers first, clean cows next, and infected cows last will keep mastitis from spreading. In cases which occur in spite of careful sanitation, the local veterinarian can help them by proper treatment.

FIELD RESULTS

During the past ten years the University of Wisconsin's Department of Veterinary Science has cooperated with a number of dairy herds in the vicinity of Madison in an effort to help control mastitis. Veterinarians in the mastitis research project have examined and tested the cows in these herds over a period of years. Dairymen have been assisted in establishing control programs for mastitis. The herds have been re-examined at intervals to determine if mastitis was being controlled. New drugs for the treatment of the disease were used as soon as they became available.

This work with farm herds was made to determine the value of control methods for mastitis. The dairy herds selected were those in which the owner or herdsman was interested in controlling the disease. Most of the herds had a serious mastitis problem when they were first started on a control program. The results from some of these herds will be described.

The first herd to be mentioned was a small purebred herd studied over a period of 6 years. On the first examination a difficult mastitis problem was discovered. Nineteen out of 23 were infected with streptococci and 6 were giving abnormal milk. A control program was established in which the clean cows were milked first and the milkers dipped their hands in a chlorine solution between each cow. Silver oxide and tyrothricin treatments were given during the dry period and they produced little benefit. After two years there were still 12 infected cows in the herd, but the worse cases had either been cured by treatment or sold. Only one animal was giving abnormal milk at this time. The disease had spread...
fewer new cases than before the control
program was not carefully carried out.
The dairyman was then advised to re­
place the older infected cows with hom­
raised heifers. He did this gradually over the next 2 years, but the infection
continued to spread. A test at the end of
the fourth year disclosed 9 infected cows
out of 21 in the herd. Penicillin treat­
tment was started and six of the 9 infected cows were cured. No abnormal
milk was produced in this herd for a
period of several months after treat­
ment with penicillin. Two years after treatment, 7 infected and 2 of these were producing abnormal milk.

The results from this herd demon­
strate the value of rearing good heifers
for replacements. In spite of treatment
the disease spread to other animals in
the herd. Penicillin treatment cured the
majority of the infected cows, but did not prevent reinfection. As long as in­
fected cows remained in this herd, they
endangered the other animals. In this
herd, however, control was achieved and there was very little ab­
normal milk after penicillin treatment.

The next herd we will mention was
a larger group of 60 dairy cows. On
the first examination in 1943, 40 cows
had a streptococcic infection in their
udder. Twelve were giving abnormal
milk. A good program of sanitation
and segregation was begun by the new
herdman. Some infected cows were left in the herd and new cases of mastitis
continued to appear, but there were
fewer new cases than before the control
program was established. When penicil­
in treatment became available, this herd
was one of the first to be treated. Immedi­
ately before treatment 20 cows were
infected. Penicillin treatments were
given to all these and about half were
cured. Nine months later the infection
spread so that 24 cows had mastitis
streptococci. Yearly penicillin treat­
tments reduced the incidence to a very
low level but some reinfection occurred
between times. After several series of
treatments in this herd, cases began to
appear which were not benefited by
penicillin. Two of those cases were
found to be caused by staphylococci, a
different type of infection than usual
for the herd.

This herd illustrates the value of a
combination of penicillin treatment and
a herd sanitation program. Even both
of these did not prevent new infection
in the herd. The results here indicate
that cases resistant to treatment may
appear after extensive use of penicillin.

Mastitis was partially controlled by a
combination of good sanitation and
penicillin treatment.

The mastitis in these 2 herds just
described was the type which usually
responded to penicillin. A third herd
of 35 Holsteins was not so lucky. The
owner bought new milking cows and added four milking
cows to his herd. One of these de­
veloped mastitis soon after she was bought
and put into the herd. The disease soon
spread to 12 of his animals and all be­
came severely affected. These cows
were much sickier than in the ordinary
types of mastitis. They developed large
joints, became lame, and stopped giving
milk. The owner was advised to sell
the affected cows for slaughter and to
milk his younger animals first. Penicil­
in treatment did not cure them and
several sulfonamide drugs also failed to
help.

It is unusual for the more severe
types of mastitis to spread rapidly as in
this herd. If the first case had been
separated from the other cows and
milked last the owner might have
avoided most of his trouble with mastitis.

In another herd in which nine cows
were affected with mastitis, the dairy­
man called his local veterinarian. This
veterinarian recognized that it was a
type of mastitis which should be treated
by a sulfonamide drug. Treatment
was continued and all the cows
recovered except two, each of which
lost one quarter. These two had been
severely affected before treatment was
begun. The results in this herd demon­
strated the value of calling a local ve­
terinarian for an accurate diagnosis and
treatment of mastitis. Many cases of
mastitis such as in this last herd will
not be helped by penicillin, but will
respond to sulfonamides.

Other herds have been studied by
veterinarians from the mastitis project
of the University of Wisconsin. Each
herd has been a different problem and
required special measures for preven­
tion of the disease. Mastitis has been
controlled in the herds in which the
dairyman was interested in control and
was willing to follow the proper san­i
tary measures. In herds in which the
dairyman was careless the disease has
usually not been controlled. The most
important control steps for a dairyman
to take are as follows: use the strip cup
daily to detect cows with mastitis, milk
the cows rapidly and in the order of
heifers first, clean cows next, and in­
fected cows last, and call the local ve­
terinarian for accurate diagnosis and
treatment of mastitis cases.

Devices for Testing Dishwashing
Machines

Patents for two "foolproof" devices
for testing dishwashing machines have
been awarded Paul J. DeKoning, as­
istant professor of mechanical engi­
neering at Michigan State College.

One machine sprays a liquid mix­
ture of food particles on a revolving
piece of china. The plate is then
washed in the establishment's dis­
washing machine. If the plate is un­
washed, streaks or spots appear.

The second machine shines light on
the revolving plate after it has been
washed in the dishwasher. Reflections
of light from the spinning plate are
registered on a meter by a photo­
electric cell. Clean plates reflect
brightly, and unclean or partially clean
plates reflect diffused light.

Dr. W. L. Mallmann, MSC pro­
fessor of bacteriology, directed exten­sive research on the project, and turned
mechanical details of invention over to
DeKoning.

The patents will be assigned to the Na­
tional Sanitation Foundation, Ann
Arbor, Mich., which launched study
of the problem in 1945 and financed
the research project at Michigan State
College.

The machines will probably retail at
$150 to $200 each.

Nelson Appointed Medical Director
of FDA

Dr. Erwin E. Nelson has been ap­
pointed Medical Director of the Food
and Drug Administration, effective in
January. He succeeds Dr. Robert T.
Stromberg who resigned to become Di­
rector of the Division of Therapy and
Research and Secretary of the Council
on Pharmacy Chemistry of the Ameri­
can Medical Association.

Since 1947 Dr. Nelson has served as
Chief of the New-Drug Section of the
FDA's Division of Medicine, and earlier
organized their Division of Phar­
macology. He took his A.B., A.M., and Ph.D. degrees at Missouri,
his M.D. at Michigan, and additional
work at the Johns Hopkins University
and at Munich. He taught at Michi­
gan and Tulane and was Director of
Research at the Wellcome Research
Laboratories.
NEW BOOKS AND OTHER PUBLICATIONS


This edition has been greatly expanded over the first edition, 1940, which carried 60 figures, 96 tables, and 541 pages. The new index runs 58 pages as compared with 34 in the first edition. New chapters are added on new processes of saccharification, the production of 2,3-butanediol, the isonic and itartaric acid fermentations, and especially one of the many new quantitative data on food values. The various tables on food values are known book has added much new material, such as references to persons who have to calculate nutritional requirements, pages 65 to 112. Part IV has the tables of food composition, arranged conveniently and give values for 100 grams, per ounce, per pound, and per 100 calories. These have been greatly expanded from previous editions. Pages 113 to 339. A table of 65 references to the literature gives supplementary information.


Increased interest in grades, standards, and quality of dairy products has made a wider coverage of the field desirable. Products now included are milk, butter, cheese, ice cream, cream, fermented milks, evaporated and condensed milk, and dry milk solids.


This book describes the development of freeze-drying (freezing by sublimation of ice), and brings together the technical knowledge that is widely distributed in "over 300 scientific and engineering publications" within the past ten years. Although originally applied to biological products (e.g., blood plasma, bacteria, etc.) there is increasing interest in the food drying field, especially for citrus juices and milk. The book is directed particularly to those interested in applications to microbiological, serological, immunological, chemical, pharmaceutical, and related fields, but the presentation is suggestive for application to other fields. Part I, Introduction, Part 2, Basic Principles, pp. 14-68. Chapter 3, Application (including 13 pages on foods) pp. 69-137. Chapter 4, Changes in Product During Desiccation, pp. 138-143, Chapter 5, Equipment Used for Medical Products, pp. 144-217. Chapter 6, Equipment for Foods, pp. 218-228. Appendices list U.S. patents, data, techniques, and bibliography.


This book is a revision and enlargement of the earlier Laboratory Manual, published in 1933, by the International Association of Milk Dealers, the predecessor organization of the present publisher. The scope and format of this edition follows the same general plan of the earlier book except that the physical testing of milk has been given by the present publisher. The scope and format of this edition follows the same general plan of the earlier book except that the physical testing of milk has been brought up to date. Their dependability and practicality are attested by the widely-recognized competence of the revision committee, namely, A. J. Powers, C. J. Austin, A. C. Fay, P. E. LeFevere, F. M. Scales, and E. B. Kellogg, Secretary. The book is valuable not only as comprising all the laboratory tests that a busy dairy plant control laboratory is likely to need, but it would serve well for the rapid screening of many samples that an official food control laboratory may have to handle.


The author states that the book is an outgrowth of a lecture outline for an eight-week course for teaching dairy bacteriology in winter dairy courses. He recommends that this expanded form can be used for the college short-course, in-service course, and also by the farmer, fieldman, inspector, and plant man. The presentation is indeed geared to the needs of the above workers, although the elementary discussion would be more consistently intelligible to these if some of the more technical under such as titration, surface tension, buffers, etc., were explained. The style is easy for general reading. References are appended to each chapter for supplementary information.
ever, look up to American equipment and regard it as a standard of excellence.

Over there, they have instituted economies of time. They are using much sealed equipment and pipe lines that are seldom taken down for cleaning. They just flush with cleaning solutions. This has resulted in poorer quality.

Germany is now back to a normal pre-war three percent butterfat basis for whole milk. It was formerly two percent butterfat. Throughout the European cheese export area conditions are good and clean. In general, quality in ice cream does not exist.

Europe is not as well off as America. Switzerland is the most wealthy. They are producing and creating their own wealth. They are well armed and seem to have national security at minimum cost. In most other countries, the people are not working too hard. The amount of work they did was closely tied in with getting something for nothing. Those countries that received the most help from us were inclined to work the least. Germany is coming back the fastest. They are working harder. The common people in Europe do not have the quality or food we have here. The poorest fed are in England.

Those countries closest to the “Iron Curtain” are the least susceptible to Communism. The farther west one goes the more susceptible they are to Communism; for example, England and the U.S.

The more a government has to do with its people the less they get. Wealth is based on production and only those countries that are working are coming back.

Mr. Weinreich’s talk was followed by questions with off-the-record answers.

Attendance was 108.

At the December meeting, with 128 in attendance, Mr. C. A. Abele addressed the meeting on the subject, “Coliform Organisms in Pasteurized Milk—Their Significance and Measures for Control.” He said that the lead of the U.S.P.H.S. in fixing a limit for the coliform content of Grade A pasteurized milk will be followed by the Chicago Health Department eventually. That action will introduce a new philosophy respecting the use of bacteria counts in milk control in Chicago and its vicinity. Heretofore, the limitation of the bacteria content of milk has been quantitative, i.e., irrespective of family genus, not strain—30,000 per ml, in the case of Grade A pasteurized milk. Now the limitation is to become partially qualitative—not more colonies than 10 per ml. This will be the first instance in which qualitative bacteriology has played a role in the legal aspect of pasteurized milk in that area (except briefly during the war). Consequently thorough reexamination of plant clean-up practices in light of this new emphasis would seem to be in order.

H. P. SMITH
Recording Secretary
LETTER TO EDITOR

November 29, 1949

Dr. J. H. Shradler, 23 East Elm Ave., Wollaston, Mass.

Dear Dr. Shradler:

I have your letter of November 17, 1949, with further reference to your editorial entitled "Sanitarians and Engineers" which appeared in the issue of September-October 1949, and which urged sanitarians to beware of amalgamating with the Engineering Section of APHA.

As I informed you in my previous letter, some of the members of that Section were discouraged by your editorial because it was being interpreted as representing the official views of our Association. They had been planning to give sanitarians a voice in running the Section by dividing the Section into various divisions, including a Food Division, with each division represented on the Section Council.

I took the liberty of informing them that, while many of the members undoubtedly considered it a good editorial on the whole, the statement warning sanitarians against losing their identity by becoming part of the Engineering Section of APHA did not represent the official views of the International. It has never been the policy of our Association to prevent or discourage its members from joining other associations. I do not believe that our members who have joined or may hereafter join APHA will thereby wish to give up their membership in IAMFS. It is not the intention of the Engineering Section to absorb our Association, nor could that be done even if they desired it. APHA can never take the place of IAMFS for those who are concerned with the field of milk and food sanitation, because its program and its Journal can devote only a small fraction of the total time and space to this particular field.

I also pointed out that the official views of the Association concerning this matter are reflected in the action taken by our Executive Board in September 1949, when the Board authorized Mr. Harold B. Robinson, Chairman of our Committee on Professional Status of Sanitarians, to express, to the Policy Advisory Committee of the Engineering Section of APHA, its approval of the proposal to establish divisions within the Engineering Section, with each Division represented on the Section Council. Unfortunately, through an oversight on my part for which I apologize, you were not informed of this action when the editorial in question was written.

I trust that you will reconsider the statement in your letter that the action of the Executive Board commits our members "to a project of becoming affiliated with another organization." It commits us to nothing more than approval of a proposal to reorganize the APHA Engineering Section.

Sincerely yours,

A. W. Fuchs
Past President

P.S.: I should appreciate your publishing the above letter in the January-February issue if possible.

New Milk Canning Process

Experimentally, fresh milk has been canned by a new process. Sampled months later, it still had a flavor indistinguishable from bottled milk fresh from a dairy farm.

On farms large enough to have their own canneries, the milk would be drawn from cows under vacuum by milking machines. It would flow through stainless steel tubes to a homogenizer. Thence it would be pumped into a new flash-type pasteurizer consisting of two cylinder steam jackets with a spiraled core of stainless steel. Here it would be pasteurized at the unusually high temperature of 190 degrees. From the pasteurizer, the milk would flow to the canning machine.

Originators of the new process are Dr. Roy Graves, formerly with the Department of Agriculture; and dairy farmer-implement dealer Jack Stambaugh. Experimental work has been done on the latter's farm near Valparaiso, Ind.

GEORGE C. SUPPLEE, 1889-1949

Dr. George C. Supplee, noted food and pharmaceutical chemist, and former president of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, 1925, died of a heart attack at his home in Bainbridge, November 7, 1949.

Dr. Supplee was widely known for his chemical research work. He is credited with developing the first commercially practical method of irradiating milk.

He developed methods for the commercial isolation of riboflavin from waste milk products. For this work he received the Billings award from the American Medical Association in 1936.

In 1937 he received from the American Chemical Society the Borden award for research in the chemistry of milk. He has authored more than 100 scientific papers on his research work.

Dr. Supplee received his bachelor of science degree at Cornell University in 1913. He served on the Cornell faculty with special assignments for the United States Department of Agriculture in Pennsylvania, New York, California, Michigan, and Minnesota. He received his Ph.D. degree from Cornell in 1919 after specialization in physiological and food chemistry and in bacteriology.

He was employed in 1918 to organize and manage the research and control laboratory for the Dry Milk Company, an affiliate of the Casein Company of America. He continued as director of research until 1919 when this company was absorbed by the Borden Company. From 1929 to 1935 Dr. Supplee was directing head of numerous phases of technical and developmental research relating to milk products and derivatives under the Borden Company. From 1935 to 1944 he was director of the biological and chemical laboratories of the company.

In 1944 he organized the G. C. Supplee Research Corporation, with offices in Bainbridge, to render consulting services to the food and pharmaceutical industries. He was head of this corporation at the time of his death.
INDUSTRIAL NOTES

Changes at National Dairy Research Laboratories
Oakdale, Long Island, N.Y.

Left: Dr. H. A. Tremler recently appointed Director of Engineering Research and Development

Right: Dr. Randall Whitaker recently appointed Director of the Dairy Technology Department


Oregon Dairying Short Course

The Thirty-Ninth Annual Dairy Manufacturing Short Course Convention will be held at Oregon State College, Corvallis, on February 27, 28, and March 1, 1950. Professor C. A. Iverson, Head of the Department of Dairy Industry, Iowa State College, will head the list of many prominent speakers. Professor G. H. Wilster will report on his observations in Sweden and Denmark and will show 200 colored slides of dairy plants, farms, and places of interest. As usual a dairy products contest will be held in connection with the meeting.

Wisconsin Fieldmen's Conference

The annual Wisconsin Dairy Fieldmen's Conference will be held on the Agricultural Campus of the University of Wisconsin, Madison, in temporary lecture room T-16 on February 1 and 2, 1950. The general themes of the Conference will be "Effects of Minimum Standards on Field Work" and "Programs for the Interstate Shipment of Milk and Dairy Products." A panel discussion will be held on problems connected with field work. For further information, write to Professor H. C. Jackson, Professor of Dairy Industry, University of Wisconsin, Madison, Wis.

NEW MEMBERS

ACTIVE

Richard M. Barber, 1918 Loomis, Winfield, Kansas
Hugh Belcher, Crane & Fillmore, Topeka, Kansas
Joseph A. Bradley, Comanche County Health Dept., Lawton, Okla.
Clifton J. Byrd, 851 A St., N.W., Ardmore, Okla.
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Cecil C. Graves, 572 E. Park Street, Olathe, Kansas
Larry Green, Lawrence-Douglas County Health, Kansas
F. L. Hart, Hiawatha, Kansas, Milk Inspector
Wynn Hull, Box 21, Junction City, Kansas
Robert G. Hunter, P. H. Laboratories, National Reserve Building, Topeka, Kansas
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