

# JOURNAL OF MILK AND FOOD TECHNOLOGY

*Official Publication of the*

**International Association of Milk Sanitarians**  
(Association Organized 1911)

**Designated Official Organ of Other Dairy Products Organizations**

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

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

Published bimonthly beginning with the January number.

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

(For complete Journal Information, see page 178)

---

---

Volume 10

May-June, 1947

Number 3

---

---

## CONTENTS

	<i>Page No.</i>
Editorials	
Public Health Service Disease Outbreak Reports, 1945 .....	125
Biological Technology .....	129
"Regular" Health Department .....	130
Abstracts of the Literature of Food and Sanitary Technology During 1946—Arthur S. Levine .....	131
Studies of Coliform Organisms in Dairy Products—Leon Buchbinder and Edythe C. Alf .....	137
Effect of Stabilizers on Frozen Cream—R. W. Bell .....	149
Measuring Sanitary Practices in Public Eating Establishments—Robert Anderson, C. W. Anderson, and N. O. Gunderson .....	158
Control Practices Used in Supervision of Vitamin D Milk by City and State Milk Sanitarians—K. G. Weckel, <i>Chairman</i> .....	167
Clean Babcock Test Bottles—Clare W. Rink.....	172
New Books and Other Publications.....	175
Information Concerning JOURNAL OF MILK AND FOOD TECHNOLOGY....	178
Affiliates of International Association of Milk Sanitarians.....	179
Officers of Associated Organizations.....	179
Committees, International Association of Milk Sanitarians.....	181
Correspondence .....	182
New Members .....	185
"Doctor Jones" Says— .....	188
Index to Advertisers .....	XIV

# Our Advertisement to Teachers of America!

*Of all*  
**Fluid Milk**  
**Served in**  
**School Lunchrooms...**



**50% to 90%**  
**Is Chocolate Flavored**

\*Survey in 26 States by NATIONAL DAIRY COUNCIL

The sure way to induce the children to include more milk solids with lunch!!

## **Dari-Rich**

TRADE MARK REG. U.S. PAT. OFF.

### **CHOCOLATE FLAVORED DRINK**

*...Is The Nation's Fastest Seller!*

...and our pledge to the Health Officers of America

## **DARI-RICH is DOUBLE CHECKED for PURITY!**

... In the Laboratory

Graduate chemists test every batch of Dari-Rich Syrup to protect quality, purity, and freedom from contamination. The syrup is pasteurized; low bacteria count is maintained; and freedom from B Coli guaranteed.

... In the Dairy

To blend Dari-Rich dairy drink, most dairies use milk containing not less than 2 per cent butter fat. Stale milk cannot be used because excess acid in milk causes sharp separation of milk and syrup mixtures.

CHICAGO 10, ILL., 679 Orleans Street  
 NEW YORK 18, N. Y., 330 W. 42nd Street  
 LOS ANGELES 11, Cal., 4368 District Blvd.

**Bowey's**  
**Inc.**



When writing to advertisers, say you saw it in this Journal

# JOURNAL of MILK and FOOD TECHNOLOGY

---

---

Volume 10

May-June, 1947

Number 3

---

---

## Editorials

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

## Public Health Service Disease Outbreak Reports, 1945

The following table presents an outline-picture of the totals recorded in the reports for 1945, and for the preceding two years insofar as the figures are immediately available to the writer.

	NUMBER OF OUTBREAKS		
	1943	1944	1945
Milk and milk products	30	36	24
Possibly conveyed through milk	*	5	5
Other foods	250	288	272
Possibly conveyed through other foods	*	10	3
Water	*	*	20
Possibly conveyed through water	*	*	6
Undetermined vehicles	*	*	12

\* Figures not immediately available.

It is scarcely necessary to point out that such a tabulation has no statistical value. The recorded outbreaks represent an unknown and, possibly, small proportion of those which probably have occurred. Of the 316 outbreaks recorded (excluding those in which vehicles were not determined) 276 were food poisoning, gastroenteritis or diarrhea. It would appear that in some areas little or no attention is given to such outbreaks. On the other hand, in at least one area from which relatively large numbers of outbreaks have been reported, the health department, as a matter of policy, has begun giving less time and attention to them.

The conclusion there was that, while valuable information had been gained from investigation of gastroenteritis outbreaks in the past, it had reached a point where too much time was being given to them, to the exclusion of other and more important activities. The present general policy in this area is to make detailed investigations of such outbreaks only when they are extensive or otherwise unusual.

The figures lack statistical value because, in short, they are incomplete, not always highly accurate, and are subject to wide, artificial fluctuations. From the standpoint of general information, however, they have definite value.

In the following discussion outbreaks conveyed through undetermined vehicles or "possibly conveyed" through specified vehicles are not considered. Space is limited and there are too many uncertainties.

#### WATER

Outbreaks conveyed through water, being of least interest to milk and food sanitarians, will be touched upon only briefly. There were 20 outbreaks, of which New York State reported 11, the other 9 being divided between 7 states, 1 territory and the District of Columbia. Twelve were of gastroenteritis, 7 of typhoid fever. New York City headed the list with an outbreak of 30 cases of chemical "food poisoning" due to potassium thiocyanate having been put in a water-cooler by persons unknown.

#### MILK AND MILK PRODUCTS

Sixteen states and one territory reported a total of 24 outbreaks. The diseases occurring were diphtheria, 1 outbreak; septic sore throat, 3; typhoid fever, 3; undulant fever, 2; infectious hepatitis, 1; food poisoning or gastroenteritis, 14. Ten outbreaks were traced to raw milk, 6 to pasteurized milk, 6 to cheese, 1 to home-made ice cream and 1 to a dried milk preparation.

Most readers will want to know "forthwith" about the 6 outbreaks traced to pasteurized milk. Five of them were of food poisoning or gastroenteritis. One of these, with 464 cases, was reported from Kansas, the organism noted being *Pseudomonas aeruginosa* (*B. pyocyaneus*, for short). It was attributed to "Improper pasteurization". One of 300 cases which occurred at Phoenix, Ariz., was traced to staphylococcus udder infection and lack of refrigeration for 12 or more hours prior to pasteurization. This illustrates again the fact that pasteurization will not destroy the enterotoxin.

The other three gastroenteritis outbreaks were reported from New York State. In one in a school and another in a summer camp the evidence pointed to contamination after delivery. No satisfactory explanation was found for an outbreak involving 13 children in a grade school. The milk, delivered and served in half-pint bottles, was found to be adequately pasteurized. There were no cases among others using milk from the same batch and (bottle) case.

The sixth outbreak traced to pasteurized milk was one of about 60 cases of septic sore throat which occurred in a summer camp in New York State. The milk apparently was contaminated, after delivery, by a food-handler who was the first case. There were no cases among persons using the same milk elsewhere.

Of particular interest is an outbreak of 14 cases of infectious hepatitis which occurred in Georgia and was believed to have been traced to raw milk. It is the first milkborne outbreak of this disease which has come to the attention of the writer. The circumstantial evidence, very clearly presented, points to the milk as the vehicle.

## FOODS OTHER THAN MILK

Twelve small outbreaks of botulism (including an "outbreak" of one case) head the list. California reported 9; Arizona, Utah and Ohio one each. With the exception of one in which home-cured ham was suspected, all were attributed to home-canned vegetables. Four outbreaks of trichinosis were recorded: 106, 84, 1 and 2 cases, respectively. The larger ones were traced to pork sausage.

Of the 272 cases in this category, 233 were food poisoning, gastroenteritis, or diarrhea. Staphylococci were mentioned in connection with 104, salmonella in 20. The largest recorded outbreak was one of 1637 cases which occurred in an Illinois hospital and was attributed to *Staphylococcus albus* toxin in ham salad which had been inadequately refrigerated. Another of 400 cases reported from Chicago, was charged to creamed macaroni and cheese. It had been kept at room temperature after having been contaminated with staphylococci by food-handlers.

## GENERAL COMMENT

From time to time outbreaks are reported which have resulted from contamination of milk after delivery to the consumers. We have reason to be particularly concerned when this happens in connection with pasteurized milk. We can be reasonably certain that some aggressive opponents of pasteurization will point to the outbreaks as due to pasteurized milk, omitting explanation of the circumstances. This suggests the possible desirability of indicating clearly on the face of the reports that contamination occurred after delivery.

Then there is the old question of terminology: food poisoning, gastroenteritis, and diarrhea. Gastroenteritis is the physical condition resulting from either food poisoning or infection transmitted through food. Couldn't we, possibly, agree on one general classification: "food poisoning or infection"? It would, at least, bring the outbreaks together under one head.

Finally (another old question): should one case of a disease be considered an outbreak? The current report includes 8 such "outbreaks": 1 of botulism, 1 of trichinosis, and 6 of food poisoning or gastroenteritis. An "epidemic" is occurring, according to Webster, when "a large number" of people in a community are affected by a disease at the same time. The term "outbreak" has come to be used more or less synonymously but, as often interpreted, is applicable when the number of persons affected is less than "a large number". Neither term is designed to apply to a single *case*. Epidemiologically, when we are dealing with the common communicable diseases and conditions like gastroenteritis, it usually is difficult, if not impossible, to determine the source with certainty, unless the same source or vehicle is common to several cases.

"Two is a company; three is a crowd". If we say that, to constitute an outbreak, there must be not less than 2 cases, involving more than one household, isn't that drawing the line fine enough?

Again we express our appreciation of the Public Health Service reports. If their limitations are recognized, they are valuable. But is not the time nearly ripe for the Public Health Service to set up some simple and elementary epidemiological standards to which reporting officers and agencies would have to conform in order to have their reports accepted and recorded? It might mean less reports for a time but in records of this character dependability is more important than multiplicity.

P. B. B.

April 1947.

SUMMARY OF MILK-BORNE DISEASE OUTBREAKS REPORTED BY STATE AND LOCAL HEALTH AUTHORITIES  
AS HAVING OCCURRED IN THE UNITED STATES DURING THE YEARS 1923-1945, INCLUSIVE

Year	Typhoid			Paratyphoid			Scarlet Fever & Septic Sore Throat			Diphtheria			Dysentery			Food Poisoning & Gastroenteritis			Undulant Fever			Miscellaneous			Total - all diseases		
	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths
1923	15	423	31	..	..	..	7	406	6	1	0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1924	25	693	48	10	372	16	6	354	0	1	1	23	0	..	110	..	..	..	..	..	..	..	..	..	..	..	..
1925	31	580	43	2	37	4	10	1108	8	1	1	14	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1926	49	1189	83	2	19	1	11	1789	10	2	2	24	0	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1927	24	430	35	2	53	0	4	389	5	2	2	25	0	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1928	25	421	48	..	..	..	11	1449	55	2	2	48	0	1	126	17	2	104	0	0	0	0	0	0	0	0	0
1929	29	541	36	1	38	1	19	1891	14	..	..	..	1	8	2	104	0	0	0	0	0	0	0	0	0	0	0
1930	30	575	41	..	..	..	11	1158	7	..	..	..	64	0	2	6	171	64	..	..	..	..	..	..	..	..	..
1931	21	217	16	1	22	0	9	1059	8	1	22	0	1	65	0	1	13	0	0	0	0	0	0	0	0	0	0
1932	23	254	22	..	..	..	9	356	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1933	25	299	26	1	17	0	10	753	9	2	19	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1934	26	345	27	1	400	0	9	478	8	1	1	9	0	0	..	..	..	..	..	..	..	..	..	..	..	..	..
1935	16	172	14	2	50	0	11	1065	7	..	..	..	1	131	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	15	114	5	1	21	0	18	1553	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1937	15	208	11	..	..	..	14	1384	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1938	18	187	17	..	..	..	12	674	7	1	31	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1939	6	51	1	2	24	0	9	1324	6	..	..	..	2	166	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	14	120	10	..	..	..	5	482	0	..	..	..	2	197	0	0	0	0	0	0	0	0	0	0	0	0	0
1941	12	120	4	..	..	..	3	219	0	1	5	0	3	126	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	5	42	0	1	4	0	6	620	0	1	36	0	1	40	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	6	37	1	0	0	0	3	200	0	1	20	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	7	359	18	1	6	0	2	171	0	0	0	0	2	34	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	3	72	4	0	0	0	3	308	0	1	53	2	1	22	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL 1923-1945	440	7449	514	27	1063	22	202	19190	182	18	324	13	20	1413	20	196	9780	19	34	275	3	18	683	4	955	40177	804

## Biological Technology

**BIOTECHNOLOGY**—what is it? Right now it comprises those features of human physiology, psychology, and hygiene which are pertinent to engineering practice (1). “Implicit in the plan is the recognition that the conditions and trends of modern life involve in increasing degree the following social technological elements: 1. the interdependence of man and machines, 2. the progressive extension of artificial control of human environment, and 3. the expanding role of the engineer in human affairs . . . ; in short, a biotechnology to take its place with the physical technologies which are the bulwark of engineering training.” “The possible ramifications of the biotechnical elements throughout engineering research and practice are almost infinite, but it will suffice here to name some of the engineering fields in which the basic human aspect is of significant importance in design and control; . . . food technology . . . , sanitation.” The idea of the authors (2) of the instant reference” . . . is to broaden the training of the engineer rather than to inaugurate a new engineering sub-profession” and “so produce engineers, well prepared with respect to every technical development, but with additional competence for dealing with man whether on the structural-functional level or the humanistic-social level”.

Another new name has appeared in the engineering firmament. At the recent Boston meeting for the Advancement of Science, a paper was presented to show that the industrial development of the antibiotics, both natural and synthetic, requires a special type of knowledge and technology, not comprised in present curricula of mechanical engineering, chemical engineering, chemistry, or microbiology—biological engineering.

The new work in the sterilization of foods by electronics (3) reveals the broadening scope of food technology that is beginning to reveal itself.

In the field of sanitary engineering (4) (generally comprised under public health engineering) we see some new emphases. Among the several activities listed is the following:

3. Food sanitation, including the production and pasteurization of milk and the manufacture of ice cream and other dairy products; the sanitary production of shellfish, and the production, storage, and distribution of meat, poultry, pastry, bakery goods, fish, and other foods as well as the sanitation of eating and drinking establishments.

This development is in harmony with the ideas we have earlier presented (5), namely, that food technology is a field that includes much sanitary engineering. Our instant interest is the fact that sanitary engineers are emphasizing that food sanitation is a field of their special interest. (See also Correspondence, page , this issue.)

The January-February issue of this Journal (6) carries editorial reference to the statement of Harris of the Food and Drug Administration to the effect that “entomologists, mycologists, chemists, botanists, and bacteriologists will probably take a more active part in regulatory control in the future”. A group of sanitarians have recently begun an organization in this field. Several months ago, a movement was started to form a society of professional biologists, largely to place biology in the industrial sun, so to speak, along with chemistry and engineering.

Where will a student go to get this kind of training? If an institution offers it, what are the possibilities of employment? Who starts such a ball rolling anyhow—industry or the colleges? In our next issue we are publishing pertinent curricula of several of our institutions of higher learning.

Apparently applied biology—biotechnology—is in for extensive development.  
J. H. S.

1. Biotechnology: A New Fundamental in the Training of Engineers. Taylor and Boelter, *Science* 105, 217 (1947).
2. Department of Engineering, University of California, Los Angeles, Cal.
3. Ultrasort Application Time of Penetrating Electrons: A Tool for Sterilization and Preservation of Food in the Raw State. Brasch and Huber. *Science* 105, 112 (1947).
4. Proposed Report on the Educational Qualifications of Public Health Engineers. *Amer. J. Pub. Health* 37, 34 (1947).
4. Food Technology vs. Food Engineering as a Professional Entity. Editorial. *This Journal*, 8, 125 (1945).
5. Food Sanitation. Editorial. *This Journal*, 50, 3 (1947).

---

## "Regular" Health Department

EDITORIAL comment in our last issue referred to one plan of milk control as having been devised by engineers, and the other, by a "regular" health department. Our good friend, J. Lloyd Barron, discusses this reference under Correspondence, page ??, this issue.

By "regular" we meant a health department whose whole procedure has been built up by a medical-minded personnel. Most of the public health milk and food control work originated in and has stemmed from the work of disease control. The object was to prevent food-borne outbreaks. The physician-health officer, supported by medical bacteriologists and later by chemists, and later still by engineers, drew up the regulatory procedure. These practices set pretty well the course of most of the earlier developments in public health food control. They reflect the direct approach of the physician to his patient, a personal relationship in which the judgment of the doctor determines the course of whatever action is needed. This is what we meant by a "regular" health department. We should have defined this term more explicitly.

As the problem of food control became more extensive, and also, as the field of environmental hygiene embraced an increasing variety of control practices requiring a high degree of technological skill (for example, pasteurization of milk by high temperature—short time heat treatment and food processing to conserve nutritional value), the above so-called medical-minded group found that the engineer possessed a special competence to extend the control in directions where the former group could not, or at any rate did not go: preciseness of measurement, effectiveness of mechanical operations, tabulation of control data, coordination of control measures with industrial operations, and other such manifestations of the engineering type of mind. (In some aspects we think that the engineers may have overdone some procedures of control.)

The medical-minded group showed that food-borne disease was controllable, and the engineer-minded group have shown how to do this most effectively.

J. H. S.



## Abstracts of the Literature of Food and Sanitary Technology During 1946

ARTHUR S. LEVINE, PH.D.

*Massachusetts State College, Amherst, Massachusetts*

### PRODUCTS

A simple method for preparation of low ester pectin by use of tomato pectose as the de-esterification catalyst has been developed by Mottern and Hills. (1)

A non-toxic compound said to be 4,100 times as sweet as sucrose has been developed by Verkack. Directions for its preparation and a description of its physical and chemical properties are given. The compound 1-n propoxy -2- amino -4 nitrobenzene leaves no after taste. (2)

The advantages of and directions for using soluble seasonings for making various types of pickles are discussed by Beerend. (3)

Factors in the preparation of maple cream are presented by Hayward. (4)

The growth and chemical characteristics of coriander seeds are discussed by Landes. (5)

Gluten as an optional ingredient is permitted in the amended standards under the Federal Food, Drug, and Cosmetic Act. (6)

According to Hall, Fahs, *et al.* oil-seed, cereal, and legume products were incorporated into various types of candies with good results. (7)

### FATS AND OILS

Lea states that butterfat has about the same storage life in sealed tinplate as in lacquered containers. Very thin films were much less stable on tinplate than on lacquer or glass. (8)

The chemistry of rancidity, including

causative factors and anti-oxidants, is discussed by Child. (9)

Handschumaker presents a comprehensive survey of the chemistry and properties of natural fats and oils, and of refining processes. (10)

The physical effects of shortening on cake batter are discussed by Peterson. (11)

### FROZEN FOODS

A method of concentrating citrus juices by freezing is presented by Stahl and Jordan. (12)

"On the spot" laboratory studies of shrimp-handling methods indicate that shrimp should be prepared and frozen immediately after being caught if high quality is to be retained, according to Fieger and DuBois. (13)

Abstracts of all freezing literature, including patents, to 1946 are compiled and indexed by Weil and Sterne. (14)

Cathcart and Parker assert that high frequency heat can defrost frozen foods in a few minutes with no loss of flavor or quality. (15)

Hutchings and Evers have found that precooked frozen foods provide a rich medium for bacteria and must be cooled and frozen promptly to avoid spoilage. The need for consumer education and producer technical knowledge is stressed. (16)

Cruess and Seagrave-Smith outline the methods used in apple freezing in California and the Northwest. (Flow-sheets included). (17)

A discussion including essential

points of quality control in frozen food production is given by Birdseye. (18)

The greater rapidity with which un-packaged foods can be frozen will probably lead to packaging after freezing in commercial operation according to Nicholas. (19)

Pringle reviews recent developments to improve the quality of frozen products. (20).

Treatments are described by Wie-gand to prevent discoloration by oxidation in frozen peaches. (21)

Birdseye gives a résumé of the frozen foods industry, its history theory, methods, processing, packaging, storage, transportation, retailing and future. (22)

Diehl discusses a means to establish common quality standards in the frozen food field with special reference to the selection, preparation, and freezing of fruits and vegetables. (23)

#### PROCESSING

Four methods of packing rockfish are given by Harvey and Kempton. (24)

Toepfer *et al.* in this bulletin report the results of a study undertaken to evaluate present home canning process times which hitherto have been arbitrary extension of commercial processes. (25)

McKirahan describes the effect of pH upon the intensity of the thermal processing required to sterilize canned foods. (26)

The public health aspect and nutritional aspect of, and iron and copper discoloration effects on processed foods are reviewed by Chase. (27)

Ford presents a series of three papers dealing with the processing of glass-packed foods. This first article considers proper heat distribution in retort and specifications for installation of vertical retorts. (28)

This is an interesting and rather complete history of the Japanese salmon industry prepared by the Resources Section of the Allied Supreme Command in Tokyo. (29)

Andrews and Epsom give a description of the cooking operation, equipment and control necessary for dehydration of meat in New Zealand. (30)

McConnell, Fellers *et al.* emphasize the vitamin content change of such products as milk powder, dried eggs, dehydrated meat, and dehydrated vegetables under various storage temperatures. (31)

Siegal in this investigation corroborates previous findings in that calcium sulphate when in combination with salt will firm canned tomatoes thus preventing a breakdown of the fruit and losses in drained weight. (32)

A new method is discussed by Moyer and Stotz in which the product is first frozen and then exposed to a high vacuum; it is dried by sublimation. (33)

#### PACKAGING

A conical type of tin can reduces storage space to one-fifth that required for ordinary cylindrical cans. (34)

Laminated cellophane bags are filled with precooked orange juice, frozen in a form at  $-15^{\circ}\text{F}$ . in 20 to 30 minutes, sealed and packed into paperboard cartons. Packages contain 1 lb. and 6 lbs. orange juice. (35)

Alwyn-Schmidt presents an interesting comparison of transportation costs for various types of bottles including cone top and flat top cans. (36)

A formula is presented by Oswin for calculating moisture vapor loss in the kinetics of package life. (37)

A description is given of a machine which tests filled sealed containers for vacuum. The apparatus is fully automatic and an integral part of a high-speed packaging line. (38)

McCoy, Cook *et al.* in the study of frozen food wrapping materials give the results of moisture vapor transmission tests at  $100^{\circ}\text{F}$ . and 90 percent relative humidity. (39)

The properties of regenerated cellulose film for packaging quick frozen foods are discussed by Drew. (40)

The precautions necessary for proper storage and preservation of natural rubber latex are described by McGavack. (41)

Mild poisoning of 300 persons by wine kept in cadmium-plated containers is reported by Monet and Sabon. (42)

Results are reported on experimental packs of food in various types of cans designed to conserve tin by Clark and Brighton. (43)

#### SANITATION

To be effective germicidally Guiteras and Shapiro state that detergents containing cation-active agents must be emulsifying but not saponifying. (44)

David discusses several methods of treating foodstuffs in order to control insect infestation. (45)

An instrument is available in England that will enable an operator of a bottle washing or dish washing machine to know at a glance the condition of the detergent solution and the temperature of various tanks. The British Hydrological Corp. is the sole distributor. (46)

The effect of storage, washing, and warming of new-laid eggs influenced slightly the number of infected eggs but did increase the bacterial count of infected eggs state Johns and Beard. (47)

Parker finds in plant sanitation insect and vermin infestation require constant vigil. Lists of sprays, powders, fumigants, and baits are given with their applications. (48)

Etchells presents suggestions for improved pickle plant sanitary practices. (49)

Various types of air conditioning and their relation to the canning industry are discussed by Sandford. (50)

J. J. Harris describes methods of chlorination in food plants and gives the advantages and limitations of chlorine use. (51)

#### QUALITY CONTROL

Since uniform quality in tomato products calls for control of finishing point Strachan discusses various methods of determining specific gravity of tomato pulp. (52)

According to Dove food acceptance research is a new branch of science which treats of foods and the consumer of foods as a relationship in which the producer or processor and the consumer share an equal interest. (53)

For cakes other than sponge cakes Grover and Hawthorne find there is a correlation between the baking quality and the solubility of dried whole egg samples. (54)

A statistical approach to sample testing of beer that has significance for all groups engaged in sample tasting of food is discussed by Helm. (55)

A digest of eleven papers is given which cover the non-enzymatic browning in dried fruits and vegetables, malt and dairy products, cereals, and sugar mfr. (56)

The indole content of shrimp is a measure of the extent of decomposition, state Duggan and Strasburger. (57)

J. A. Dunn asserts that off-odors in food can be simply and cheaply prevented by proper plant design, ventilation, storage refrigeration, and packaging. (58)

Enzymatic changes, chemical reactions, rancidity changes, retrogradation, and denaturation are among the deterioration reactions which apply to many types of dehydrated and other food products as discussed by Kaufman. (59)

Moncrieff in his comparison of the panel method with the fluorescent method of testing the flavor of dried eggs found reasonable agreement. (60)

Oil separation and stickiness problems in peanut butter were overcome by the addition of sugars and hydrogenated oils according to Woodroof, Thompson, *et al.* (61)

Every phase of shellfish sanitation is covered in detail in this guide to the shellfish industry and regulatory agencies. (62)

Correct procedure is emphasized by Bengtsson and Helm in the principles of taste testing and a summary of rules to be observed by judges is presented. (63)

Helm and Trolle in this article deal with the selection and establishment of a taste panel for reliable taste test results, specifically applied to beer tasting. (64)

Anderson and Whittaker discuss the application of statistical methods to sampling of foods as to what constitutes an adequate sample. (65)

Studies by Miller on the physiology of citrus fruits in storage include the use of carbon dioxide in preventing storage breakdown and of ethylene in coloring fruit. (66)

McGugin discusses the possibility of elimination of oxidizing enzymes in fruit and fruit products. (67)

#### BACTERIOLOGY

*Clostridium botulinum*, types A and B, were found to be distributed widely in five central counties of New York. Toxic cultures were obtained from soils with a pH of 4.25 to 8.0 as reported by Parry. (68)

Tentative methods are presented in detail by Etchells and Jones for examination of the following: Bacteriological examination of brined, salted, and pickled vegetables. (69)

Of the 42 surface-active agents investigated, only the quaternary ammonium and phosphonium compounds had sufficient germicidal properties and stability for a good sterilizing agent as found by Mueller, E. Bennett *et al.* (70)

An outbreak of salmonella food poisoning due to infection of *S. aertrycke* is described by Crowe. (71)

#### CHEMISTRY

An apparatus for determining the quantity and composition of gases in

the vacuum and gas packed food containers is described by Cartwright. (72)

Miller finds that the inversion of cane or beet sugar to levulose and dextrose has no visible sweetening effect. (73)

Woodmansee *et al.* determined that 60 percent soluble solids gels can be produced from powders containing intermediate and low methoxyl pectins. (74)

Jirgensons by treating potato juice with acid found that potato globulin is converted to albumin and an insoluble casein like protein. (75)

DeClerck finds the addition of reductones aids the natural protective agents of beer. (76)

Methods of determination of quaternary ammonium compounds in fruit juices is described in detail by Harris. (77)

Wilson presents two methods for the determination of quaternary ammonium compounds in foods. (78)

Cook and Mehlenbacher present a detailed chemical method in the determination of egg yolk in egg white using the Coleman spectrophotometer. (79)

#### NUTRITION

Results of a survey by the National Research Council are given in detail by Pavcek and the Committee on Food Composition on the proximate composition and vitamin content of a hundred commercial samples of dehydrated foods. (80)

A review is given by Peterson and Pressly with abstracts on the influence of cooking processes on food nutrients. (81)

Sherman's *Chemistry of Food and Nutrition* is an excellent text and reference book for this broad subject. (82)

Patton reports the results of a three year survey on vitamin C changes occurring in tomatoes during home canning and subsequent storage. (83)

## GENERAL

Marshall claims the addition of non-acidulated, starch free, liquid, apple pectin before flash pasteurization will reduce sedimentation to a negligible amount. (84)

Trends of production and consumption of canned fruits, vegetables and juices for the past five years are presented graphically by Bridges. (85)

Microbiology of fermentation to separate coffee beans from their pectinous coating is discussed by Pederson and Breed. (86)

Casselmann discusses factors determining the low level of cheese consumption in Canada. (87)

The bulk of dehydrated foods can be reduced by compression to save shipping and storage space, to facilitate the use of an impervious package and to improve keeping quality report Magoon *et al.* (88)

Sherman reports frozen foods can be defrosted by electronic heat with a minimum of bacterial multiplication. (89)

In the coloration of food products Saenz-Lascano found that mixtures of dyes which could not be separated readily otherwise were separated chromatographically. (90)

Materials suitable for food processing equipment are discussed by Butcher on the basis of recent literature. (91)

The methyl ester of alpha naphthalene acetic acid will stop sprouting of potatoes and other root crops at temps. up to 55° F. for as long as five months asserts Smith. (92)

## REFERENCES

1. Ind. Eng. Chem. 38, 1153-56 (1946).
2. Food Mfrg. (London) 21, 483-485 (1946).
3. West. Canner and Packer 38, 60-61 (1946).
4. Food 16, 19-22 (1946).
5. N. Y. State (Geneva) Agri. Expt. Sta. Bul. 720, 8 pages (1946).
6. Spice Mill 69, 47-48 (1946).
7. Federal Register 11, 7503-7505 (1946).
8. Food Ind. 18, 1008-10, 1172 (1946).
9. J. Soc. Chem. Ind. 65, 136-181 (1946).
10. Food Mfrg. 21, 162-163 (1946).
11. Baker's Digest 20, 1-5 (1946).
12. Baker's Digest 20, 7-9 (1946).
13. Food Freezing 1, 375-377 (1946).
14. Refrig. Eng. 52, 225-228 (1946).
15. Ga. School of Tech., State Eng. Expt. Sta. Special Rept. No. 23, 409 pages (1946).
16. Food Res. 11, 341-344 (1946).
17. Quick Frozen Foods 8, 71 (1946).
18. Fruit Prod. J. 26, 36-37 (1946).
19. Canadian Food Packer 17, 18-20 (1946).
20. Pa. State Hort. Assoc. News 23, 49-56 (1946).
21. Food in Canada 6, 17-19 (1946).
22. Quick Frozen Foods 8, 81-83, 92 (1946).
23. Refrig. Eng. 51, 1-8 (1946).
24. Refrig. Eng. 51, 123 and 51, 223 (1946).
25. Canner 103, 11 (1946).
26. U.S.D.A. Tech. Bul. No. 930, 28 pages (1946).
27. Canadian Food Packer 17, 19-21 (1946).
28. The Crown 35, 17, 26, 27 (1946).
29. Glass Packer 25, 110 (1946).
30. Canner 103, 15-16, 29 (1946).
31. Food Ind. 18, 33-34, 154-155 (1946).
32. Glass Packer 25, 800, 822, 824, 825 (1946).
33. Canning Trade 69, 9-10 (1946).
34. Food Packer 27, 42-44 (1946).
35. Canning Trade 69, 8 (1946).
36. Modern Packaging 19, 136 (1946).
37. American Brewer 79, 27-29 (1946).
38. Modern Packaging 20, 143-146, 172, (1946).
39. Glass Packer 25, 882, 884 (1946).
40. Refrig. Eng. 52, 531-534, 584 (1946).
41. Food Freezing 1, 101 (1946).
42. India Rubber World 115, 362-363, 373 (1946).
43. Presse Med. 49, 677-678 (1946).
44. Canner, 102, 12-13, 29-30 (1946).
45. J. Bact. 52, 635-638 (1946).
46. Food Mfrg. 21, 391-394 (1946).
47. Food (London) 15, 333-334 (1946).
48. Sci. Agric. (Ottawa) 26, 11-15 (1946).
49. Food Ind. 18, 332-336; 510-512, 640-642 (1946).
50. Fruit Prod. J. 26, 45 (1946).
51. Fruit Prod. J. 26, 49-52 (1946).
52. Canner 103 18-20, 48, 50; 14-15, 26 (1946).
53. Food in Canada 6, 22, 23, 25, (1946).
54. Science 103, 187-190 (1946).
55. Food Res. 11, 41-48 (1946).
56. Brewers' Digest 21, 43-46 (1946).
57. Food Ind. 18, 79 (1946).
58. J. Assoc. Offic. Agric. Chem. 29, 177-188 (1946).
59. Food Ind. 18, 188-190, 314-318 (1946)
60. Food Ind. 18, 12-15 (1946).
61. Food Mfrg. 21, 55-58 (1946).

62. Food Ind. 18, 525-526, 634-640 (1946).  
63. Pub. Health Bul. No. 295, 44 pages. U. S. Gov't Ptg. Office, Washington (1946).  
64. Wallerstein Labs. Communications 9, 171-180 (1946).  
65. Wallerstein Labs. Communications 9, 181-194 (1946).  
66. Food Ind. 18, 849-850, 994, 996 (1946).  
67. Botan. Rev. 12, 393-423 (1946).  
68. Quick Frozen Foods 9, 80-81 (1946).  
69. Food Res. 11, 203 (1946).  
70. American J. Pub. Health 36, 1112-1123 (1946).  
71. J. Dairy Science 29, 751-760 (1946).  
72. J. Hyg. 44, 342-345 (1946).  
73. Ind. Eng. Chem. 18, 779-789 (1946).  
74. Food Packer 27, 50-54 (1946).  
75. Food Ind. 18, 356-357 (1946).  
76. J. Polymer Sci. 1, 484-494 (1946).  
77. J. Assoc. Official Agric. Chem. 29, 310-311 (1946).  
78. J. Assoc. Official Agric. Chem. 29, 311-327 (1946).  
79. Ind. Eng. Chem., Anal. Ed. 18, 785-788 (1946).  
80. Ind. Eng. Chem. 38, 853-856 (1946).  
81. N. C. Agr. Expt. Sta., Nutrition Serv. Rept. No. 8, 129 pages (1946).  
82. Chemistry of Food and Nutrition, H. C. Sherman, 7th ed., 675 pages. Illus. Macmillan Co., N. Y. (1946).  
83. Ohio Agric. Expt. Sta., Bimonthly Bul. 31, 44-46 (1946).  
84. Food Packer 27, 49-50 (1946).  
85. Food Packer 27, 48-49 (1946).  
86. Food Res. 11, 99-106 (1946).  
87. Canadian Dairy and Ice Cream J. 25, 46-48, 65 (1946).  
88. Food Ind. 18, 362-364, 472-476 (1946).  
89. Food Ind. 18, 506-509, 628-630 (1946).  
90. Chimic and Ind. 56, 198-203 (1946).  
91. Food 15, 256-257, 327-328 (1946).  
92. Food Packer 27, 61-63 (1946).

Make room reservations now for the thirty-fourth annual meeting.  
Hotel Schroeder, Milwaukee, Wisconsin, October 16-18.

## Studies on Coliform Organisms in Dairy Products

### The Practical Significance of So-Called Heat Resistant Coliform Organisms in the Coliform Testing of Pasteurized Milk.

LEON BUCHBINDER AND EDYTHE C. ALFF

*Bureau of Laboratories, Department of Health, New York City*

THE question of the possible heat resistance of certain strains of coliform organisms\* recovered from pasteurized milk has been under discussion since the beginning of the century. Until near the end of the third decade, interest in the possibility was maintained because the test for coliforms was advocated as an index of proper pasteurization. In 1932 a study by McCrady and Langevin (1) showed that a large outbreak of typhoid fever might well have been caused by contamination of defective milk plant equipment by a typhoid carrier. This study also demonstrated that coliforms were cached and liberated in the same equipment thus contaminating milk after it was pasteurized. The development in the nineteen thirties of the phosphatase test lessened the need for an additional test of proper pasteurization. Thus, the coliform test of pasteurized milk came to be regarded as an index of improper sterilization of post-pasteurization equipment or contamination through defective handling. If coliforms in milk are commonly heat resistant, use of the test as an index of post-pasteurization contamination would lose much of its significance. This is so since the test is predicated on the destruction of practically all coliforms in raw milk in the heating process.

The question of the significance of heat resistant coliforms in milk arose

in this laboratory during a survey of the coliform incidence of pasteurized milk in New York City. This survey, the purpose of which was to establish coliform standards, has been discussed preliminarily elsewhere (2). It is probably fair to state that most competent persons concerned with practical milk control believe that the question of heat resistance of coliforms in milk is of little significance. The purpose of this paper, then, is to attempt to present conclusive objective proof for this feeling by means of a critical re-evaluation of the relevant literature and the presentation of new data.

#### LITERATURE SURVEY

The findings in the literature can be divided roughly into two groups: those which attach significance to the possible heat resistance of coliforms in pasteurized milk and those which do not. Early workers failed to agree on the time and temperature necessary to destroy coliforms in milk completely. A paper by deJong and deGraaff in 1906 (3) gives an account of the findings and opinions held by European workers at that time. It is sufficient to state that some workers concluded that certain time and temperature combinations were adequate to destroy all coliforms in milk and that others came to an opposite conclusion on the basis of their own or other's work. This controversy, similar to the present one, was due to the fact that diverse techniques were used and different interpretations were applied.

\* Hereinafter referred to as "coliforms."

Most of the conclusions in the literature have been based on the outcome of studies which used the so-called laboratory pasteurization test as the principal technic, while several have been derived from studies carried on in milk plants. Two basic methods of laboratory pasteurization have been employed. In the more popular technic, the tube or flask containing a bacteria and substrate mixture is placed in a bath so that its liquid level is exceeded by the water or oil level of the bath. This method is hereafter referred to, for convenience, as the partial submergence technic. The other method is the sealed tube technic: the bacteria and substrate mixture is placed in a tube; the tube is sealed off and then submerged in its entirety in a bath. The latter is the more foolproof technic, since no matter how carefully micro-organisms are introduced into a partially submerged tube, the possibility cannot be ruled out of some of them becoming fixed onto the sides of the tube above the liquid level of the bath. Here they fail to receive a full heat treatment. Their presence on the upper portions of a tube may be caused by macro- or microscopic splashing, by direct contamination from the pipette or inoculating wire, or, as Katzin, Sandholzer, and Strong (1943) (4) point out, by the wetting of the sides of the tube by surface tension. A questionable argument against the use of sealed off tubes, besides the complexity of the technic, is the possibility that the pressure exerted inside the tube upon raising the temperature may augment the action of the heat and thus kill off some organisms (Tanner and Dubois '1925').\* (5)

\* The apparent heat resistance of coliforms in several dairy products has been shown to be affected by such factors as sugar concentration, the presence of locust bean gum, sodium alginate, and other nutritive conditions, by pH, by the age of the cells, by enzyme activity, and by other miscellaneous agents and circumstances involving the physiology of the microorganisms. However, examination of the pertinent literature seems to indicate that these factors are of no importance to the problem of the practical significance of heat resistant coliforms in pasteurized milk.

The work of those who may be regarded as proponents of the hypothesis of heat resistance will be discussed first. DeJong and deGraaff (1906) came to the conclusion from their laboratory experiments that a temperature of 72° C. for 30 minutes was necessary to produce coliform-free milk. This temperature is about 10° C. higher than that used in the present holding method of plant pasteurization. These authors made no effort to conduct strictly quantitative experiments and their technic was not explained in full detail. In the same year Zelenski (6), using the partial submergence technic, found it necessary to heat milk at 60° C. for as long as 78 minutes to kill all coliforms. Convinced of the inherent resistance of coliforms to heat, Gage and Stoughton (1906) (7), who used a similar technic, attempted to obtain a resistant strain by selection. They claimed that their results indicated that a race in which the individual organisms tended to be more resistant had been established. Examination of their data has led the present authors to doubt the validity of their conclusion. Shippen (1915) (8) likewise found that various strains of coliforms survived heating at 60-68° C. for 15-30 minutes. He concluded that the presence of coliforms could not be used as an index of proper pasteurization because of the resistance of some strains to higher temperatures than that used for pasteurizing milk. It should be noted that while Shippen used the generally satisfactory sealed tube technic, he made no effort to determine the total number of organisms inoculated into each tube. His method of scraping all the available growth from a slant into the liquid to be pasteurized, does not duplicate the natural mode of distribution of coliforms in milk.

The work of Ayers and Johnson (1915) (9) has been most frequently quoted by proponents of the hypothesis of heat resistance of coliforms. These authors used the partial submergence



technic and large numbers of organisms, as many as five and six million per ml. They found that 7 percent (12 of 174) of the cultures used survived 62.8° C. for 30 minutes. Examination of their data reveals survival of some strains in an irregular manner upon repeated tests. Thus variations in the heat resistance of individual strains or perhaps inadequacies of the technic used are indicated. Adams and Ward (1925) (10) incubated 39 samples of pasteurized milk and were able to recover coliform organisms from 38 of them. They concluded that the coliform count was of questionable value as an indication of effective pasteurization. Swenarten (1927) (11) also accepted the possibility of heat resistant coliforms. He came to the conclusion, nevertheless, as the result of a milk plant study, that the test could be used as an indicator of plant performance. Beavens (1930) (12) found that 32 percent of 100 samples of pasteurized milk taken directly from a pasteurization vat showed the presence of coliforms. He reasoned from this that the coliform test could not be used as a true measure of proper pasteurization. Long, Hammer, and Hedrick (1944) (13) were unable to find coliforms in 83 samples of pasteurized milk. They succeeded, on the other hand, in isolating such organisms from 143 of 220 samples of butter obtained from 77 different plants. Further studies were carried out on these isolated strains by the sealed tube technic to determine their survival at 61.5° C. for 20, 30, 40, and 50 minutes. Some survival after 30 minutes was obtained in each of ten trials when the initial number of bacteria per ml. ranged from 5 million to 15 million. No survivors were obtained, however, when tests of two of the cultures were repeated with smaller initial numbers, 58,000 and 130,000 respectively.

The findings of the following authors have been cited as upholding the view that heat resistance is of no practical

significance. Thus Finkelstein (1919) (14) observed that pasteurization at 62.8° C. for 30 minutes destroyed practically all coliforms and that lower temperatures failed to accomplish this. Tanner and DuBois (1925) (5) pasteurized milk in the laboratory both by the sealed tube technic and by the partially submerged tube technic. They found that as many as 2,000,000 organisms per ml. were destroyed in as few as 7 minutes. Likewise, sealed tubes with an unreported number of coliforms were heated at 60° C. for 15 minutes and yielded no survivors. These authors also noted that when partially submerged tubes with similar inoculums were used, survivors were rarely found and then only in very small numbers. In the following year Jenkins (15) found that laboratory pasteurization with the partial submergence method eliminated all coliforms in original number up to 100,000 per milliliter. She also studied milk plant line samples from eight runs and found that four of eight samples had coliforms after the holding period. Samples of the original raw milk pasteurized in the laboratory were all found to be negative for coliforms. Jenkins concluded from her comparative studies that the presence of these organisms in milk indicated post-pasteurization contamination. Ten years later Stark and Patterson (1936) (16) tested 505 strains of coliforms for heat resistance by means of laboratory pasteurization. The average inoculum used was about 100 million organisms. They found that after 30 minutes at 61.5° C., 99.2 percent of the strains were destroyed and that the remainder were destroyed at 62.8° C. In the light of these findings they concluded that the presence of coliforms in pasteurized milk was due to recontamination in the majority of instances.

In the same year Vernon and Walker (17) came to the conclusion that from the point of view of plant operation the occurrence of heat re-

sistant strains was so infrequent as to be negligible. They found that all of 576 cultures isolated from tank milk or water failed to resist pasteurization and likewise that 440 samples of tank milk yielded no coliform survivors. On the other hand, they were unable to isolate 33 coliform cultures resistant to laboratory pasteurization from 1000 positive McConkey tubes inoculated with samples taken from various parts of a pasteurizing plant. The method of laboratory pasteurization used is not indicated. Craige (1946) (18) studied, by means of the partially submerged tube technic, the possible relationship of the number of coliforms in raw milk to survival after pasteurization. He used numbers which were frequently far greater than one would expect to find in normal raw milk and was able to isolate survivors readily. Craige concluded, however, that such findings did not satisfactorily prove that his strains were inherently heat resistant but suggested that any strain might survive if its original concentration is great enough.

Most, if not all, of the work reviewed has been concerned with the possible interference of the property of heat resistance with a practical test, formerly one for proper pasteurization, and presently one for post-pasteurization contamination. The fact that with a few exceptions most of the data in these papers were derived from laboratory experiments only weighs heavily against their acceptance as completely applicable to the practical milk plant problem. Apart from this criticism, when those papers which describe the laboratory technics used are judged on the adequacy of their methods, several flaws are apparent. It seems likely that survivors often result because of technical inadequacy. Another possible error lies in the frequent use of millions of organisms per milliliter in laboratory tests, when such numbers far exceed those normally present in raw milk.

#### EXPERIMENTAL

The studies which follow attempt to assess the practical significance of heat resistant coliforms by seeking answers to the following questions: (1) How frequently do coliforms appear in milk obtained directly from the plant holder? (2) What is the distribution of the numbers of coliforms in raw milk in the several seasons of the year? This investigation was made because the possible survival of coliforms after plant pasteurization would most likely be determined by the initial concentration of these organisms in raw milk. Such a study would also furnish a basis for evaluation of coliform concentrations used in laboratory pasteurization tests. (3) How reliable is the partial submergence test for laboratory pasteurization of coliforms and how does it compare with the sealed tube technic.

##### (1) *The frequency of coliforms in milk immediately after pasteurization.*

A study was carried out in a large milk plant in an attempt to determine how frequently coliforms survive heating at 61.5° C. for 30 minutes and thus escape into the post-pasteurization part of the equipment.

*Procedure.* Large volumes of milk, 800-1000 milliliters, were taken as samples in order to determine precisely the presence of coliforms in milk immediately after the holding period. Since it would be impractical to plate out such large volumes in sodium desoxycholate agar, the medium of choice, another technic was adopted. This consisted of incubating the entire sample and subsequently determining the presence of coliforms in a 1 milliliter portion.

Preliminary experiments were made to determine the minimum number of coliforms which could be recovered after inoculation and incubation of pasteurized milk. Quarts of milk were obtained from a relatively coliform-free source, inoculated with small numbers of organisms under aseptic precautions, and incubated overnight. One

ml. of the incubated sample was then tested for the presence of coliforms. then examined for the presence of coliform colonies. Occasionally the presence of a large number of very fine colonies made coliform determination

The findings are summarized in Table 1. It is noted that coliforms

TABLE 1

DETECTION AFTER INCUBATION OF SMALL NUMBERS OF COLIFORM ORGANISMS INOCULATED INTO QUART VOLUMES OF MILK

No. of Organisms inoculated	Total	SAMPLES		No. of organisms recovered per ml.
		Positive	Negative	
0	24	3	21	5, 7 & 66
3 to 4	26	6	20	13, 25, 120, 150, 295 & 600
5 to 12	27	22	5	205 to 2,435
195	8	8	0	160 to 475

The low number of coliforms per milliliter isolated after overnight incubation (last column) may be either an expression of micro-biological competition in pasteurized milk or else the result of an inhibitory property of the milk itself. This interference may perhaps explain the failure of coliforms to grow out in each inoculated bottle.

Parenthetically, these data may also throw some light on another practical aspect of coliform control of pasteurized milk. There is a school of thought which believes that the coliform testing of pasteurized milk is unreliable if the sample is not taken at the plant or if it is kept longer than one day in a refrigerator. What might be regarded as contrary evidence is found in Table 1. As indicated, when as many as 195 coliforms are placed in a quart of milk which is then held, not in a refrigerator but at a most favorable incubation temperature (35° C.) for 18 hours, the growth of coliforms is limited.

grew out in about two-thirds of the trials after inoculation with as few as five to twelve organisms. It was concluded from these experiments that the proposed technic was satisfactory.

*Plant tests.* Relatively large volumes of milk were taken in one liter Florence flasks, with aseptic precautions, from a spigot in a sanitary line off the holder. A smaller number of samples was obtained by a similar technic from other points in the equipment. Individual samples ranged from 800 to 1,000 ml. in volume. Regularly bottled quarts of milk were used as samples from the filler bowl. The great majority of samples were taken before cooling and the flasks immediately immersed and rotated in an ice and water mixture until cool. They were incubated overnight and on the following day 1 ml. of each sample was plated out in sodium desoxycholate agar. The plates were incubated overnight and

difficult. In such cases a sterile loop was used to make several cuts through the agar of the suspected plate. The loop was then streaked on an E. M. B. plate and the presence of typical colonies determined after overnight incubation.

The findings of the plant study are presented in Table 2. All except one of some 468 individual process samples totaling 430 liters were negative for coliforms by the technic used. On the other hand, quarts of the final product taken on 5 of the 11 days during which these tests were run yielded coliforms in 46 percent (43 of 93) of the samples. It should also be noted that although the coliforms in the raw milk used in these trials ranged in number from 10 to 560,000 per ml. these numbers appeared to bear no relationship to the findings before or after bottling. The opinion may thus be advanced that in this plant no

TABLE 2

ISOLATION OF COLIFORMS FROM LARGE VOLUMES OF PASTEURIZED MILK  
BEFORE AND AFTER BOTTLING

Date	No. of coliforms per ml. in raw milk	BEFORE BOTTLING			AFTER BOTTLING		
		Total	Flasks (Liter)		Total	Quarts	
			Pos.	Neg.		Pos.	Neg.
4-10	18,000	24	0	24	—	—	—
4-20	12,000	48	1	47	—	—	—
4-26	500	47	0	47	—	—	—
5-3	1,000	47	0	47	—	—	—
5-9	10	47	0	47	—	—	—
5-16	225,000	47	0	47	12	0	12
5-22	40,000	45	0	45	18	5	13
5-29	1,500	48	0	48	—	—	—
6-20	15,000	22	0	22	18	12	6
7-24	560,000	48	0	48	12	8	4
8-1	not done	45	0	45	18	13	0
TOTALS		468*	1	467	78	43	35

The Before Bottling samples in the first nine tests were all taken from a sanitary line directly from the holder. Those in the tenth test were taken either after the pump or after the regenerator but before the cooler, while those in the eleventh test were taken from the following locations: (1) after the pump, (2) after the cooler, (3) from a surge tank, (4) before the second surge tank, (5) from the second surge tank.

\* The total volume in all the flasks was 430 liters.

evidence was adduced that the presence of coliforms in the final product is caused by heat resistant coliforms in the antecedent raw milk.

(2) *Survey of coliforms in raw milk.*

A survey of the number of coliforms

per ml. in raw milk was carried out for a one year period. Raw samples were selected at random from those brought to the laboratory for routine tests. The findings are summarized by months in four numerical categories in Table 3. It is seen that only about 15

TABLE 3

## COLIFORMS PER MILLILITER IN RAW MILK BY MONTHS

1944	No. of samples	0-99	Organisms per ml. Per Cent		10,000 & over
			100-999	1,000-9,999	
October*	177	10.7	40.6	39.2	9.0
November	93	18.3	40.9	39.8	1.0
December	79	24.1	40.4	34.2	1.4
1945					
January	59	11.9	57.6	25.4	5.0
February	39	7.8	46.1	35.9	10.3
March	41	12.2	51.2	31.7	4.9
April	50	4.0	26.0	58.0	12.0
May	60	8.3	28.3	45.0	18.3
June	93	10.8	24.7	40.8	23.7
July	126	3.2	9.5	51.6	35.7
August	100	8.0	18.0	54.0	20.0
September	160	9.4	16.3	56.9	17.5
Total No. of samples	1,077	114	324	479	160
Percent	100.0	10.6	30.1	44.5	14.8

\* These samples were taken in the years 1944 and 1945.

percent of the samples had 10,000 or more coliforms per ml. and it should be noted that of these only about 2 percent had 100,000 or more. The highest single count of the 1,000 samples taken was 400,000 per milliliter. This relatively low percentage of high counts was found despite the fact that more samples were taken in the summer months when, as is seen in the table, a marked seasonal rise in coliform count takes place. It is thus obvious that the numbers of coliforms usually present in raw milk in New York City is much less than those which very often have been used in laboratory studies on heat resistance. Since the survival of coliforms following pasteurization is in part determined by the initial number, the practical significance of laboratory experiments using numbers much greater than those found in the survey may well be questioned.

(3) *Laboratory pasteurization experiments with raw milk containing natural coliforms and with sterile or certified pasteurized milk in which coliforms have been seeded.*

The purpose of these experiments was twofold. One was to explain the discordant findings of others on the basis of the technics used. The other was to carry out laboratory pasteurization by a relatively adequate technic on coliforms whose number per unit volume fell in the same range as those normally found in raw milk.

*Technic.* Three different technics of laboratory pasteurization were used.

*A. Partial Submergence Technic with Double-End Rubber-Stoppered Tubes.* Glass tubes, 5 in. x  $\frac{1}{2}$  in., open and flame polished at both ends are used. A tube is filled by inserting it almost half way into a vial of raw milk. A rubber stopper is then fitted on the upper end. The tube containing approximately four mls. of milk is withdrawn from the vial and a second rubber stopper quickly fitted into the bot-

tom. A small amount of liquid is allowed to run out before the bottom stopper is firmly fixed into place. This helps create a partial vacuum to further secure the stoppers. The technic was developed to lessen the chance of the upper portions of the tube becoming contaminated with milk. When definite numbers of organisms are used, they are sometimes introduced into the tube with a pipette. Care is taken to prevent the pipette from coming into contact with the sides of the tube. There are occasions, however, when accidental touching of the sides of the tube occurs.

Tubes after filling, are partially submerged in a water bath at 61.5° C. with the liquid level of the bath at least  $\frac{1}{2}$  in. above that of the tubes. They require approximately five minutes to reach this temperature, and are held for 30 minutes. The rack of tubes is then removed and immediately plunged into ice water for 5 minutes. The temperature of the milk usually is lowered to 3 to 5 degrees C. at the end of this period. The number of organisms present before and after pasteurization is determined by one of several methods.

*B. Partial Submergence Technic with Ordinary Cotton-Stoppered Test Tubes.* This technic is a variation of (A). Ordinary cotton-stoppered test tubes 6 in. x  $\frac{5}{8}$  in. are used. The organisms in 5 ml. volumes are pipetted into these tubes by ordinary sterile technic and then treated as in (A).

*C. Complete Submergence with Sealed-Off Tubes.* The tubes used are 4 $\frac{1}{2}$  in. x  $\frac{3}{8}$  in. with a globular base  $\frac{3}{4}$  in. in diameter. The neck of the tube is constricted about one inch from the opening and the organisms in a volume of 3 ml. of milk are placed in the tube with a capillary pipette. The tube is then sealed off with a blast burner. Tubes are completely submerged in an upright position in the water-bath. Thereafter the technic is practically the same as in (A). After the tubes are iced, the necks of the

tubes are filed, wrapped in alcohol-dampened cotton and opened.

#### TESTS

Initially, tests were made on raw milk brought to the laboratory for routine examination. They were carried out to determine, first, whether coliforms could be recovered after laboratory pasteurization of raw milk, and secondly, whether there was any relation between the initial numbers and the presence of survivors. The partial submergence technic (A) was employed and determination of the number of coliforms in the milk before and after heating was made by means of poured sodium desoxycholate agar plates.\*

Four hundred and eighty-two samples of raw milk were tested. It was found that 7.5 percent (36) of the heated samples yielded coliforms. The coliform counts of raw milk which yielded survivors varied from 340 to 580,000 per milliliter. The coliforms in milk which yielded no survivors were in a similar numerical range, 0 to 620,000. There did not seem to be any correlation between the initial number and the presence of survivors.

The heat resistance of some 18 pure culture isolations of survivors from nine samples was next determined by the same technic. Appropriate dilutions of lactose broth cultures were made in sterile skim milk. Two milliliters of these dilutions were pipetted into tubes to which 3 ml. of sterile skim milk had already been added. Four decimal dilutions were used in each of a total of 21 tests. The number of organisms per milliliter used ranged from 40-520 to 40,000-520,-

000. After pasteurization 1 ml. portions were plated out in T. G. M. agar.\*

Survivors were found in very small numbers, in 55 percent (46 of 84 tubes). It is of interest that the number of positive tubes found in each of the several dilutions did not differ significantly. Differences would be expected if coliforms died according to a natural death rate without the interventions of any extraneous factors.

The experiment was repeated to more closely simulate laboratory pasteurization of whole milk. Certified pasteurized milk was used because of its very low bacterial count. One milliliter portions of the heat treated samples were uniformly streaked out with a bent glass rod in 0.1 ml. fractions on each of ten E. M. B. agar plates. The E. M. B. agar was used to avoid any confusion of coliform with possible non-coliform survivors. Another variation was that the tip of the inoculating pipette was wiped with a sterile pad prior to insertion. Furthermore, four additional intermediate time intervals were used in each test. They were 0 (time to reach 61.5° G.), 5, 10, 15, and 30 minutes. Four strains were so tested. Three dilutions were used for each strain, the numbers ranging from 6 thousand to 17 thousand in the highest dilution and from 60 million to 170 million in the lowest.

Survivors were again found and as in the previous experiments the positive tubes were variably distributed. Thus six of twelve sets showed coliforms and the positive tubes in five of the six were not orderly arranged. Here, also, as in the raw milk routinely pasteurized, there was no correlation between the initial and surviving numbers of coliforms. This finding agrees with that of Tanner and Windsor (1929) (18). The most that can be said is that there was a slight tendency

\* The composition of this medium prepared in our laboratory is as follows:

Distilled water	1000 ml.
Peptone	10 gm.
Lactose	10 "
Sodium Chloride	5 "
Dipotassium phosphate	2 "
Sodium Desoxycholate	1 "
Agar	16 "
1% Neutral Red	3 ml.

\* *Standard Methods for The Examination of Dairy Products*, Eighth Edition, 1941, p. 22.

for tubes with the greatest initial numbers to be positive more frequently. No orderly sequence of survival was noted at the different time intervals of heating. Finally, when the data were arranged according to strains a complete lack of consistency of findings was indicated on repeated test.

The general inadequacy of the partial submergence test being so clearly demonstrated, the sealed tube complete submergence technic was investigated as an alternate method. Twenty-four hour cultures of the same strains which had previously "resisted" pasteurization were diluted 1/10 in pasteurized certified milk. Three milliliters of this dilution in milk were then added to the bulb tube and the procedure indicated in technic (C) followed. A total of 36 tests were run on ten strains. All strains were heated for 30 minutes and in addition 25 tests were run at intermediate time intervals of 0, 5, 10, and 15 minutes. The number of organisms used ranged from 3 million to 396 million per milliliter with a mean of about 60 million.

The results differed markedly from those of the preceding tests since in no instance did any coliforms survive 30 minute heating. It should be pointed out that among these strains were some which had shown repeated "resistance" by the partial submergence technic. Likewise, survivors were completely absent despite the fact that the numbers of coliforms used in these tests far exceeded those normally found in milk before pasteurization. It was observed in the intermediate time interval tests that no survivors were present at ten minutes or thereafter. Three tests did yield survivors at 5 minutes and eight at 0 minute, (i.e. upon reaching 61.5° C.)

When the above work had been completed, a report by Craige (19) appeared in which coliform survivors were demonstrated by a partial submergence technic with an ordinary cotton-stoppered tube. Craige used

serial dilutions of pure cultures with initial tubes containing very great numbers of coliforms, ranging from millions to trillions. The use of such large numbers indicates, of course, that this part of his work has no direct relation to the problem of heat resistance of coliforms in raw milk. Craige, however, reported the fairly consistent survival of organisms in tubes with initial numbers in the thousands or less, the raw milk range. It was decided, therefore, to check the adequacy of Craige's technic with simultaneous tests of the two technics previously discussed.

Craige's method was followed with some slight modifications. Coliform cultures were grown on infusion broth overnight. One-tenth milliliter of a culture was then spread on each of two nutrient agar slants and incubated for two days at 37° C. Two milliliters of sterile broth were next added to each slant and the growth emulsified. Three milliliters of this emulsion were added to 27 ml. of sterile skim milk to make the 10<sup>-1</sup> dilution used in the tests. The number of organisms present was determined by pouring nutrient agar plates in duplicate from 10<sup>-7</sup> and 10<sup>-8</sup> sterile water dilutions made from this dilution. The plates were incubated overnight at 35° C. Those with 30 to 300 colonies were averaged to estimate the number of organisms present. The contents of two slants were used to prepare duplicate tubes for each of the three technics, the partial submergence method with test tubes and with double open-end tubes and the complete submergence method. These three sets, each with a temperature control tube, were submerged in a water bath at 61.5° C. When all three temperature controls had reached 61.5° C., the corresponding tubes were timed for 30 minutes and then removed to an iced water bath for 5 minutes. The mouth of each tube was wiped with alcohol, flamed, and the contents poured into large lactose broth fer-

mentation tubes. The tubes were incubated for three days at 35° C.

A total of ten strains was tested,

physical technic may be imperfect, or the numbers of organisms used may be unreasonably great.

TABLE 4

## A COMPARISON OF SEVERAL TECHNICIS OF LABORATORY PASTEURIZATION

## TECHNIC \*

Strain	Initial no. of organisms per ml.	Totally Submerged		Partially Submerged
		Sealed tubes	Open-end double-stoppered tubes	Test tubes
A	328,500,000	--	--	++
B	1,440,000,000	--	+-	++
C	1,360,000,000	--	+-	++
D	1,960,000,000	--	++	++
E	500,000,000	--	--	++
F	650,000,000	--	+-	+-
G	1,420,000,000	++	++	++
H	610,000,000	--	--	++
	6,100,000	--	--	+-
	61,000	--	--	--
	610	--	--	--
I	750,000,000	--	+-	++
	7,500,000	--	+-	++
	75,000	--	+-	--
	750	--	--	--
J	580,000,000	--	++	++
	5,800,000	--	+-	+-
	58,000	--	--	--
	580	--	--	--
Total survivors		2	13	23

\* All tests were carried out in duplicate.

seven at the  $10^{-1}$  dilution only, and three at the  $10^{-1}$ ,  $10^{-3}$ ,  $10^{-5}$ ,  $10^{-7}$  dilutions. The results of our findings are summarized in Table 4.

It will be noted from the table that the yield of positive tubes varied widely with the three technics. Thus, the sealed totally submerged tubes yielded only 2 positives of 38, the open-end double-stoppered partially submerged tubes yielded 13 positives of 38, and the ordinary cotton stoppered test tubes, Craige's technic, yielded 23 positives of 38. It must be judged from the findings that reliable results cannot be obtained with either of the partial submergence technics used. It may be concluded, therefore, that when survivors are found as a result of laboratory pasteurization of pure cultures of coliforms, either or both of two faults may be present. The

## SUMMARY AND DISCUSSION

The main question raised in this study is: Have heat resistant coliforms any practical significance in the coliform test of pasteurized milk? It seems clear on the basis of all the findings which are summarized below that the answer is an unequivocal, "No".

The alleged heat resistance of coliforms is discussed in reports which cover a long span of years. The information available in the literature was first analyzed. The following conclusions were drawn: (1) That reports frequently are fragmentary and do not attack the problem as one with several facets. (2) That a number of studies suffer from the defect that they were carried out in the laboratory only and not in a milk plant itself. Crucial testing of the hypothesis of practical heat resistance should be



carried out at a pasteurizing plant on "natural" coliform-containing raw milk.

(3) That many of the reports on laboratory studies are unsatisfactory because the technic of partial submergence used is prone to error, or because the number of micro-organisms used in individual tests are either not given or, where given in tests purporting to show heat resistance, are obviously much greater than would normally be found in raw milk.

Our own investigation, which followed this analysis, frankly attempted to bolster the hypothesis that heat resistant coliforms are of no practical importance in the coliform testing of pasteurized milk. Three distinct lines of investigation were followed.

The first was an attempt to determine the frequency with which coliforms are present in milk just leaving the holder in a pasteurizing plant. The technic used was capable of detecting, in the majority of instances, the presence of as few as five coliforms per liter of milk. Repeated tests made over a period of several months revealed that coliforms very rarely escape destruction in the holder. Thus coliforms were detected in only one of some 400 liters of milk sampled. This despite the fact that by the same technic the final bottled quarts of milk were found, on the several occasions tested, to yield about 50 percent positives. Although plant study seems to be the most pertinent line of investigation, it would probably be unwise to draw a final negative conclusion to the question of heat resistance from this work at one plant only. When, however, this finding is integrated with those that followed it is the most reasonable decision to be made.

The second line of endeavor was a coliform survey of raw milk in New York City for a period of one calendar year. The purpose was to determine the usual as well as the maximum numbers of coliforms which are present in raw milk during the several seasons.

It was found that on the whole in only about 2 percent of the samples did the number of coliforms exceed 100,000 per milliliter and that in a great majority of instances they were far below this figure. These results place in question the significance of those laboratory reports which claim to demonstrate heat resistance, in which excessive numbers of coliforms are used.

The third line of investigation consisted of laboratory studies. It was found that when raw milk was pasteurized by a commonly used so-called partial submergence technic that 7.5 percent of 482 samples tested yielded coliforms. It was noted, however, that the presence of survivors was haphazard and was unrelated to the initial numbers present in raw milk. The same technic was used to test 18 pure cultures of some of these survivors in a total of 21 trials. The cultures were each tested in four decimal dilutions falling within the range of coliforms previously found to be present in natural raw milk. Similar findings were obtained; 46 (55 percent) of 84 tubes were positive. Again the survivors seemed to be distributed by chance among the several dilutions. This was noteworthy and caused grave doubt about the technic since with pure cultures survival usually follows a logarithmic law. These doubts were further compounded when further tests were made using four cultures with three dilutions for each and five different periods of heating ranging up till 30 minutes for each dilution. Similar irregularities in survival were found. The irregularities were unrelated to the time of heating as well as to the dilution. Convinced of the unsatisfactory nature of the partial submergence technic, the complete submergence sealed tube technic was next investigated. Ten of the same strains were studied in some 36 tests with initial numbers this time greater than would be expected in normal raw milk.

The numbers ranged from 3 millions to 396 million per milliliter. It was found that in none of the tests were any coliforms recovered after 30 minutes. When shorter time intervals were used, however, 8 of 25 cultures survived after 0 minute (i.e. upon reaching 61.7° C.), 3 of 25 survived after 5 minutes, but none did so after 10, or 15 minutes. These findings indicate that coliforms die in a regular fashion and usually do not survive the time and temperature of laboratory pasteurization when an adequate technic is used.

Finally, recently reported findings with a partial submergence technic using cotton-stoppered tubes were checked. It was found that this technic is even less efficient than the unreliable partial submergence technic which we had investigated.

#### CONCLUSION

Evidence was obtained as the result of a pasteurizing plant investigation and laboratory studies that so-called heat resistant coliform organisms are of absolutely no practical significance in the coliform test of pasteurized milk.

#### ACKNOWLEDGMENT

The study in the milk plant was carried out in cooperation with the Milk Division of the Bureau of Food and Drugs of this Department, particularly Mr. Samuel Greene, Mr. Joseph Goldstein, and Mr. Alfred Meyers.

#### BIBLIOGRAPHY

1. McCrady, H. M., and Langevin, E. M. The Coli-Aerogenes Determination in Pasteurization Control. *J. Dairy Sci.*, 15, 321-329 (1932).
2. Buchbinder, L., and Fertig, J. W. Preliminary Report on Coliform Studies of Pasteurized Milk and Milk Products. *19th Annual Report of N.Y.S. Assoc. of Milk Sanitarians*, p. 103, 1945.
3. De Jong, D. A., and deGraaff, W. C. De coli-controle der gepasteurizeerde melk. *Nederl. Weekblad v. Zuivel. en Veeteelt*, 12, 37-38 (1906).
4. Katzin, L. E., Sandholzer, L. A., and Strong, M. E. Application of the Decimal Time Reduction Principle to a Study in the Resistance of Coliform Bacteria to Pasteurization. *J. Bact.*, 45, 265 (1943).
5. Tanner, F. W., and Du Bois, G. C. Some Notes on the Effect of Heat on Members of the Colon-typhoid Group in Milk. *J. Dairy Sci.*, 8, 47-53 (1925).
6. Zelenski. Zur Frage de Pasteurisation der Sanglingsmilch. *Jahrb. f. Kinderheilk.*, 63, 288-307 (1906).
7. Gage, S. de M., and Stoughton, G. VanE. A Study of the Laws Governing the Resistance of Bacillus Coli to Heat. *Technol. Quart.*, 19, 41 (1906).
8. Shippen, L. P. Significance of *Bacillus coli* in Pasteurized Milk. *J. Am. Med. Assoc.*, 64, 1289-1291 (1915).
9. Ayers, S. H., and Johnson, W. T. Ability of Colon Bacilli to Survive Pasteurization. *J. Agric. Res.*, 3, 401 (1914-15).
10. Adams, F. O., and Ward, A. R. Tests of Certified and Pasteurized Milk for B. coli-like Colonies on Endo Medium. *Rep. Internat'l. Assoc. Dairy and Milk Insp.*, 249-251, (1924).
11. Swenarton, J. C. Can B. Coli be Used as an Index of the Proper Pasteurization of Milk? *J. Bact.*, 13, 419 (1927).
12. Beavens, E. A. Escherichia-aerobacter Group as an Index to Proper Pasteurization. *J. Dairy Sci.*, 13, 94 (1930).
13. Long, H. F., Hedrick, T. I., and Hammer, B. W. Heat Resistant Coliform Organisms with Particular Reference to Butter. *J. Milk Tech.*, 7, 20-25 (1944).
14. Finkelstein, R. Occurrence of the Colon-aerogenes Group of Organisms in Raw and in Pasteurized Milk, and its Significance. *J. Dairy Sci.*, 2, 460-481 (1919).
15. Jenkins, H. Experiments on the Pasteurization of Milk, with Reference to the Efficiency of Commercial Pasteurization. *J. Hyg.*, 25, 273-284, (1926).
16. Stark, C. N., and Patterson, M. C. The Heat Resistance of Colon Organisms in Milk. *J. Dairy Sci.*, 19, 495 (1936).
17. Vernon, T. R., and Walker, L. J. Coli Contamination in Pasteurized Milk. *Soc. Agric. Bact., Report Ann. Conf.* (1936).
18. Tanner, F. W., and Windsor, M. F. The Ability of *Escherichia Coli* and *Serratia Marcescens* to Survive 62.8° C. for Thirty Minutes in Milk. *J. Dairy Sci.*, 12, 202-210, (1929).
19. Craigie, J. E. Significance of Concentration of Coliform Organisms in Raw Milk Upon Survival of Pasteurization. *J. Milk Tech.*, 9, 191-196, (1946).

## Effect of Stabilizers on Frozen Cream

R. W. BELL

*Division of Dairy Research Laboratories, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture*

CREAM that has been frozen, stored, and thawed is not as stable in its physical properties as was the cream before it was frozen. Freezing and storage tend to weaken the emulsion, especially when conditions prior to freezing favor clumping of the fat globules. Cream is affected less by the disruptive forces of freezing, storage, and thawing if the milk from which it is derived contains relatively small fat globules and the milk and cream are kept warm so that these globules are maintained in a dispersed state until freezing time (1).

When advantage is taken of the properties of the fresh milk and these properties are conserved throughout the preparation, freezing, and storage of the cream, the freshly thawed product is a free flowing liquid which does not have the high viscosity and apparent richness of cool whipping cream. During refrigeration at 5° to 10° C. it becomes a homogeneous semisolid of smooth, cream-sauce consistency. Thawed storage cream that is prepared from cream in which the fat globules clumped before the cream froze is coarse-textured and soon forms a cream plug.

This investigation was conducted to determine whether the use of a stabilizer would make it possible to obtain thawed cream which would more nearly resemble bottled whipping cream. Two different stabilizers have been investigated. These stabilizers are emargol and fruit pectin.

Emargol is a trade name for a mixture of mono- and diglycerides and sulfoacetates thereof (2,3,4). Accord-

ing to its inventors, emargol possesses at least two groups, one having a hydrophile function and the other having a lipophile function in the molecule and they are balanced in the molecule. They further state that by lipophile groups they mean those which have an attraction or affinity for oleaginous media, or which taken alone would dissolve or have a tendency to dissolve in oleaginous substances. By hydrophile groups they mean groups having an affinity for water or tending to dissolve in water.

Pectic substances are complex carbohydrate derivatives. Pectin is water soluble, a colloid and a polymer, and is similar in properties to many of the other polysaccharides (6). It is widely used in jelly making and for many other purposes.

The following is quoted from Hills and Speiser (5).

"The molecule of the natural high polymer, pectin, is composed principally of anhydrogalacturonic acid residues, partially methyl esterified and linked together to form a long chain. Nongalacturonide materials, galactan and araban, may constitute one-third or more of the weight of the pectin. As has been shown by Schneider and Bock (*Ber.*, 1938, 71B, 1353), the characteristic properties of pectin—gelation, film formation, and high viscosity in dilute solution—derive from the polygalacturonide chain; the nongalacturonide constituents or 'ballast materials' act mainly as diluents."

### EXPERIMENTAL METHODS

In this work a 50 percent emargol-50 percent water paste was used. The

supply was stored in a dark room that was maintained at 7° C. This emargol paste was mixed with a small volume of fresh cream and the mixture homogenized in a household type of hand homogenizer before being added to the raw cream.

Only one lot or sample of fruit pectin was used in the following experiments. The pectin was dispersed in water before it was added to the raw cream.

The cream was prepared, frozen, thawed, and examined as described by Bell and Sanders (1). Unless otherwise specified it contained 40 percent fat. All cream was pasteurized by heating to 80° C. and cooling promptly to not lower than 30° C.

About 150 ml., or one-third of a pint of cream in a small can was the experimental unit and the storage periods were from less than 2 days to several months.

The warm canned cream was frozen in ethyl alcohol at -15° and -29° C. Solid carbon dioxide was added to the alcohol to maintain it at these temperatures and to agitate it during freezing of the cream. Under these conditions a sample became solid in 50 minutes and 25 minutes, respectively. The cans were stored in air at -15° and -29° C.

The emulsion stability of each sample was obtained by weighing 9 grams of the frozen cream into a funnel placed in a cream test bottle, washing the cream into the bottle with lukewarm water, and proceeding as described by Bell and Sanders (1).

Viscosity measurements were made at 30° C. with a MacMichael viscosimeter.

#### EXPERIMENTAL RESULTS

*Addition of 0.5 percent of a 50-percent emargol paste to cream from warmed milk containing 3.7 percent fat.* The freshly drawn milk was warmed to 42° C. and delivered to the Bureau's research laboratories in Washington, D. C., where it was separated while

still warm, and portions of the cream were standardized with the skim milk to 40-, 30-, and 20-percent fat content.

Each cream was divided into two parts. To one part was added 0.5-percent emargol as described and the cream pasteurized; the other part was pasteurized and used as the control and the samples were frozen and stored. The second day thawed samples were examined and thereafter at intervals of two to five weeks (Fig. 1).

On the initial inspection, samples which had been held at -15° C. thawed at room temperature within three hours into homogeneous liquids, except the control sample which contained 40 percent fat. However, this control became a smooth cream when stirred.

On the second inspection of samples which had been stored at -15° C., those which contained emargol became fluid sooner and were more homogeneous than the controls. The 40- and 30-percent creams were rough when first stirred.

After 24 hours at 6° C. the samples which contained no emargol and which had been stored at -15° C. had separated into a semisolid upper layer and a milky lower layer.

In general, those samples which contained 0.5 percent emargol thawed into better creams. The 40-percent creams were not as stable in body as the 30- and 20-percent creams.

Progressive deterioration in the samples stored at -15° C. is indicated in figure 1. Figure 1 also shows the decisive superiority of -29° C. as a freezing and storage temperature.

At all times during the 14 weeks period the samples stored at -29° C. thawed readily into fluid creams of apparently good quality. However, unlike fresh cream, on standing at 5° to 10° C. they became homogeneous semisolids.

Although the emargol did not materially increase the viscosity of the thawed creams at 30° C., it helped to prevent weakening of the emulsion,

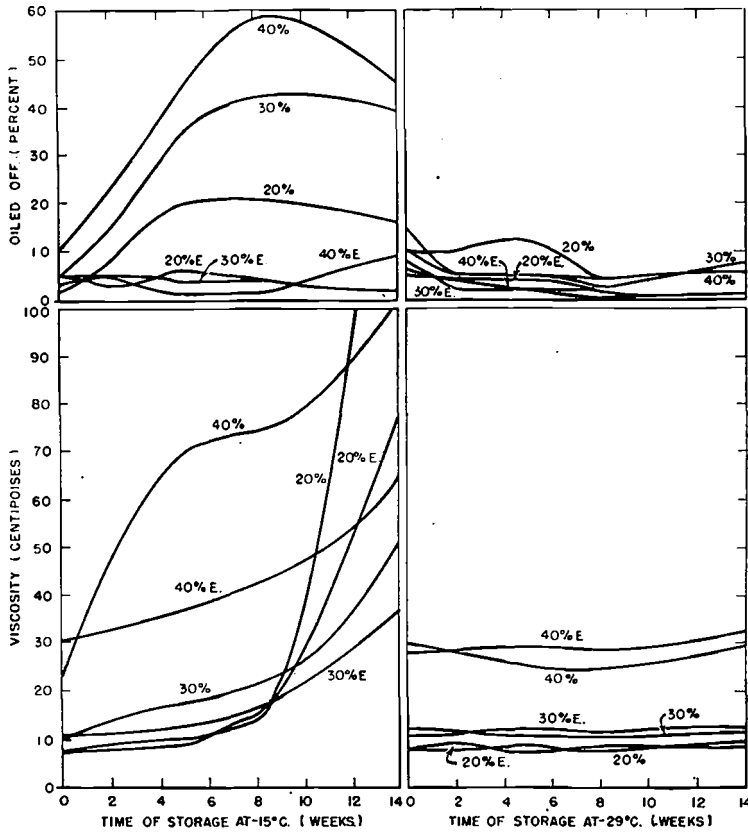


Figure 1. Effect of emargol (E curves) on the viscosity and oiling off values of thawed 40-, 30-, and 20-percent pasteurized cream from warmed milk of 3.7 percent fat content. 0.5 percent emargol by weight was added to each of the 3 raw creams after homogenizing it in a small volume of cream of comparable fat content.

especially of those samples which were stored at  $-15^{\circ}\text{C}$ ., and it caused the creams to be smoother and more uniform in consistency.

*Addition of emargol paste (50 percent emargol) to cream from warmed milk containing 3.3 percent fat.* Emargol, in the amounts shown on the curves in figure 2, was added to 40-percent raw cream by first dispersing it with a hand homogenizer in 400 ml. of cream. The creams were then pasteurized, canned while warm, and frozen in the usual manner.

On the initial inspection of samples

frozen and stored at  $-15^{\circ}\text{C}$ ., the body of the thawed control cream resembled that of good cultured buttermilk and the consistency of the others improved with the increase in proportion of emargol. After several days at  $10^{\circ}\text{C}$ ., the samples which contained emargol were superior to the control. The cream layer which formed in the latter was rougher and firmer than the cream layers in the former. However, all samples were fairly acceptable in appearance after they had been stirred with a spoon. Of these 5 samples, the one which contained 0.5 percent emargol was the best.

## STABILIZERS IN FROZEN CREAM

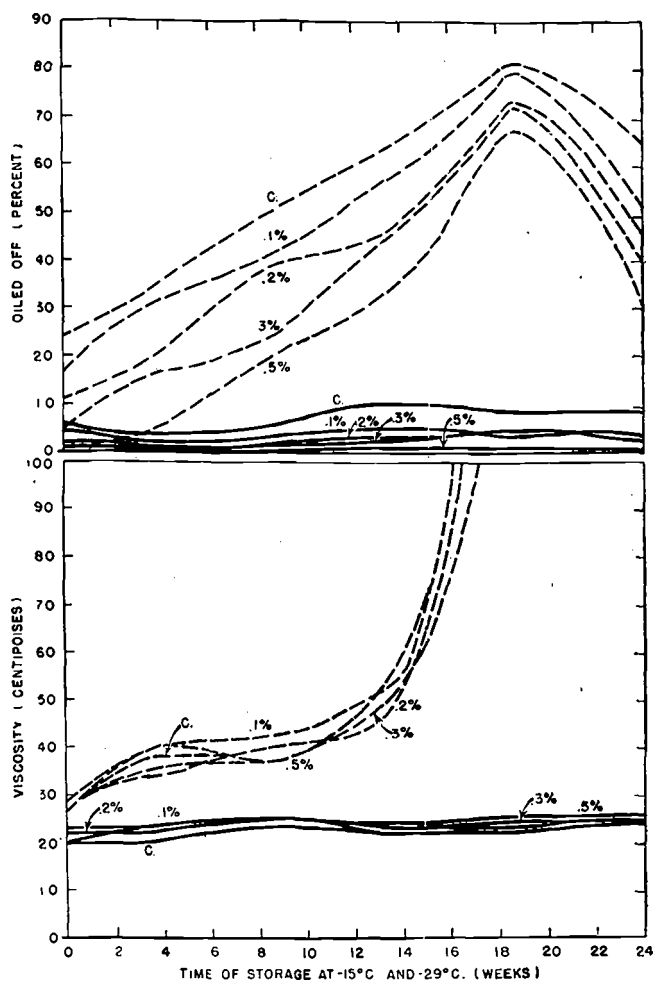


Figure 2. Effect of emargol on the viscosity and oiling off values of thawed 40-percent pasteurized cream from warmed milk of 3.3 percent fat content. "C" refers to the controls; .1%, .2%, .3% and .5% to the amount of emargol added by weight to each raw cream after homogenizing it in a small volume of the cream. Solid lines represent creams quick frozen and stored at  $-29^{\circ}\text{C}$ .; broken lines refer to creams quick frozen and stored at  $-15^{\circ}\text{C}$ .

Deterioration in the physical characteristics of these thawed samples with lengthening of the storage period is shown in figure 2. Although emargol had only minor influence on viscosity, it increased the stability of the emulsion. It partially neutralized the weakening effect of freezing and storage at this temperature.

Samples that had been quickly frozen

and then stored at  $-29^{\circ}\text{C}$ . for 2 days thawed at the same rate into creams which drained cleanly off the side of a glass beaker. After 16 hours at  $10^{\circ}\text{C}$ ., the samples resembled homogeneous cream sauce. This was true of all samples frozen and stored at  $-29^{\circ}\text{C}$ . and examined over the period shown in figure 2. Little was gained by adding emargol. The low fat milk,

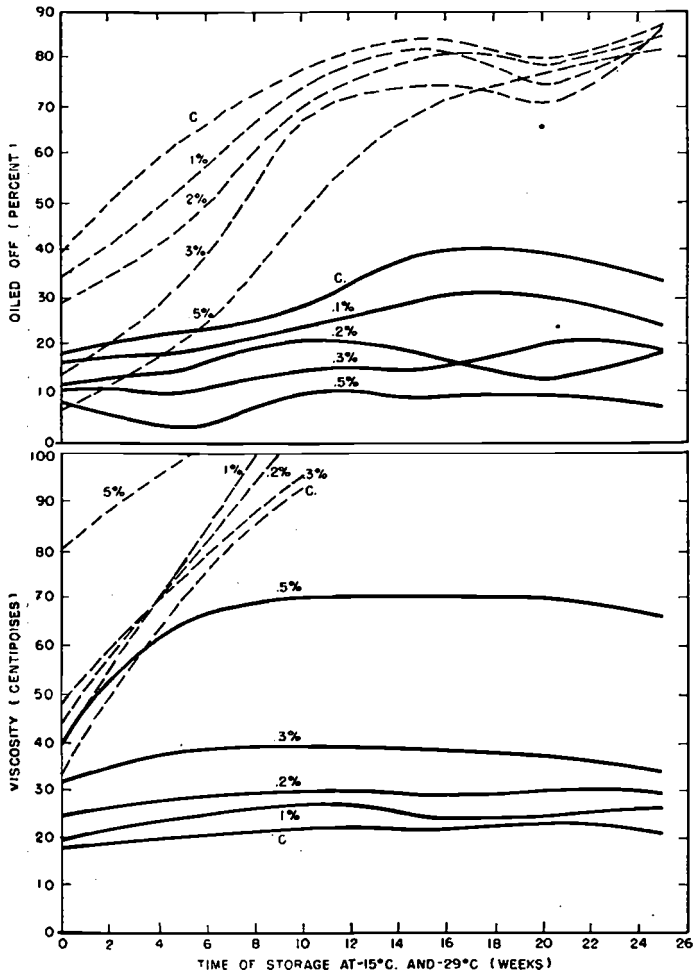
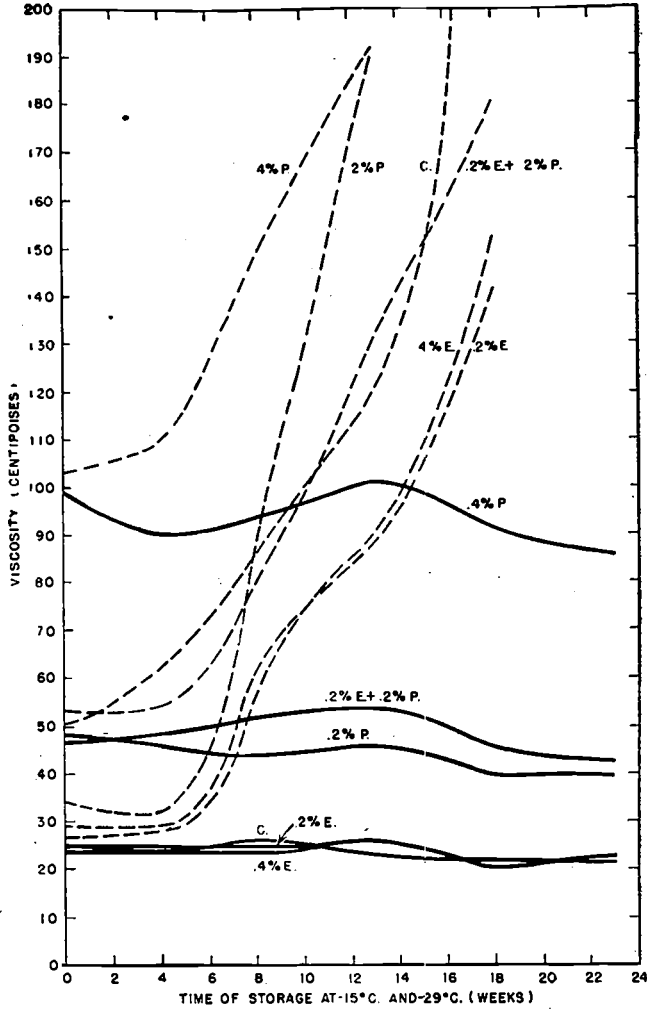


Figure 3. Effect of pectin on the viscosity and oiling off values of thawed 40-percent cream from cooled milk of 3.7 percent fat content. "C" refers to the controls; .1%, .2%, .3% and .5% to the amount of pectin added by weight to the raw cream. Solid lines represent creams quick frozen and stored at  $-29^{\circ}$  C.; broken lines refer to creams quick frozen and stored at  $-15^{\circ}$  C.

the method of preparation, the rapid rate of freezing and the low storage temperature sufficed to yield cream of apparently good physical properties. Furthermore, the controls had a better flavor. The emargol contributed a slightly foreign flavor in proportion to the amount added. The flavor was scarcely noticeable in samples which contained 0.1 percent emargol but it

was usually detectable in those that contained 0.5 percent.

*Addition of fruit pectin to cream from cooled milk containing 3.7 percent fat.* The pectin was dispersed in water and added to the raw cream in the concentrations recorded on the curves in figure 3. A proportionate volume of water was added to the control so that each cream contained 40 percent fat.



Figures 4 and 4a. Effect of emargol (E curves), pectin (P curves) and equal parts of emargol and pectin (E + P curves) on the viscosity and oiling off values of thawed 40-percent cream from warmed milk of 3.5 percent fat content. The "C" curves refer to the controls. Solid lines represent creams quick-frozen and stored at  $-29^{\circ}$  C.; broken lines refer to creams quick-frozen and stored at  $-15^{\circ}$  C.

The creams were then pasteurized, canned, and frozen as usual at  $-15^{\circ}$  and  $-29^{\circ}$  C.

On the initial inspection of the two sets of thawed samples, it was observed that the consistency of the cream improved with each additional increment of pectin. The specimens that were stored at  $-29^{\circ}$  C. were, as had been

expected, markedly superior to those that were held at  $-15^{\circ}$  C. However, they were not as homogeneous as the comparable samples of figure 2. This is attributed to the fact that this cream was made from cooled milk containing 3.7 percent fat rather than from warmed 3.3-percent milk, which had smaller, unclumped fat globules.



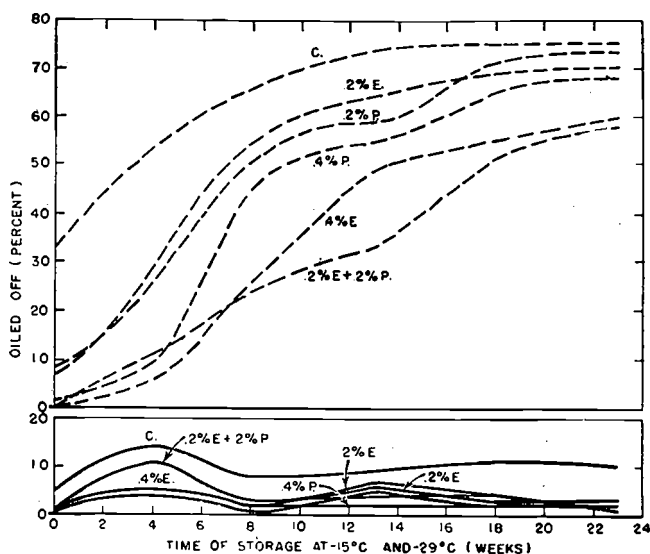


Figure 4a

Comparison between emargol and pectin as stabilizing agents in frozen cream prepared from warmed milk containing 3.5 percent fat. To portions of the warm, raw 40-percent cream was added 0.2 percent emargol, 0.4 percent emargol, 0.2 percent pectin, 0.4 percent pectin, and 0.2 percent of each in the manner already explained. Then each cream was flash pasteurized, cooled to not less than 30° C., canned and frozen in alcohol at -15° and -29° C.

The viscosities and emulsion stabilities of these samples over a period of nearly 5 months are plotted in figures 4 and 4a.

The samples which contained pectin, being more viscous than the others, did not warm up as fast. Under the same conditions of warming, the pectin creams had a temperature of about 25° C. when the other creams had already reached 30° C.

The curves in figure 4 show that the emargol had practically no influence on the viscosity of the thawed creams. Although emargol seems to have lowered the viscosity of the thawed samples that had been maintained at -15° C., this difference is believed to have

been due to the greater general deterioration of the control. In fact, all samples stored at -15° C. were of inferior quality after the first month of storage.

Measured by the homogeneity and thinness of the film after a portion of each had drained off a clean glass, the -15° C. creams were rated in the following order: 0.2 percent pectin plus 0.2 percent emargol, 0.4 percent pectin, 0.2 percent pectin, 0.4 percent emargol, 0.2 percent emargol, and control. On the basis of their emulsion stability, the sequence was 0.2 percent pectin plus 0.2 percent emargol, 0.4 percent emargol, 0.4 percent pectin, 0.2 percent pectin, 0.2 percent emargol, and control. The curves show how nearly similar some of these values were.

The influence of the pectin on the thawed creams was apparent in their greater viscosity, smoother texture, and lesser tendency to form cream plugs.

All samples that had been stored at -29° C. were in good physical condition. Those that contained pectin, although more viscous than the others, were not gels. At room temperature they flowed readily and were of superior texture.

As will be seen in the figures, the pectin had approximately the same emulsion stabilizing power as the emargol. This was due partly to the greater viscosity of these creams as they cooled in the freezing baths. Since the viscosity of these creams increased during this period to two or more times that of the controls, conditions were less favorable to fat clumping.

#### DISCUSSION

Although only one sample of emargol and one of pectin were used in these experiments, sufficient evidence has been obtained to demonstrate the possibility of using a stabilizer to advantage in the preparation of frozen cream. In the selection of such a stabilizer, preference would be given to a product which helped to preserve not only the emulsion but also the body against the disruptive forces of freezing, storage, and thawing. The ideal agent would not detract from the natural flavor or wholesomeness of the cream. It would contribute to the apparent richness of the freshly thawed product and to its body and physical stability while it was being preserved in an unfrozen state in a refrigerator.

Other pectins and other emulsion stabilizing agents consisting principally of the sodium sulfoacetate derivatives of mono- and diglycerides of fat-forming fatty acids may be more effective than were those used in these experiments.

Most of the samples did not have an objectionable flavor. The older they were the less fresh they tasted. When several months of age, they had a tendency to be flat. Flavor would appear to be a factor which can be largely controlled by using strict sanitary measures and processing the milk as soon as possible after it is produced (7).

Although homogenization divides the fat globules in cream, it decreases

the resistance of cream to the disruptive forces of freezing, storage, and thawing. A firm, coarse-textured cream plug forms in the thawed product, the cream beneath it becomes a milky fluid, and the body is no longer acceptable. This weakening of the physical stability of the system due to homogenization is demonstrable also in a decreased heat stability.

Interest in frozen cream will increase with improved and more extensive facilities for quick freezing and low temperature storage of food. There would be obvious advantages in preparing and freezing cream on a dairy farm, since, with the necessary facilities, pasteurized cream from the warm, low-fat fresh milk could be converted by prompt and rapid freezing into a state in which it could be preserved effectively. High sanitary standards would have to be practiced, copper avoided, and the principles described in this and earlier papers applied.

#### SUMMARY AND CONCLUSIONS

The addition of small amounts of the edible stabilizers, emargol and pectin, to raw cream helped to conserve the physical stability of the pasteurized cream during low temperature storage.

Emargol decreased the tendency of the thawed creams to oil off, without changing the viscosity. It shortened the thawing period and improved the consistency of the cream.

Pectin had a comparable effect as an emulsion stabilizer. It improved the consistency, and in addition increased the viscosity of the thawed cream and lessened its tendency to form a cream plug.

The differences between the control samples and those which contained a stabilizer were more pronounced when the freezing and storage temperature was  $-15^{\circ}\text{C}$ . than when it was  $-29^{\circ}\text{C}$ .

Although emargol and pectin aided materially in stabilizing the cream

against the disruptive forces of freezing, storage, and thawing, they were not as important factors as the size of the fat globules, the avoidance of clumping, the rate of freezing and especially the storage temperature.

## REFERENCES

1. Bell, R. W., and Sanders, C. F. Factors which Contribute to the Physical Stability of frozen Cream. *J. Dairy Sci.*, 19, 213-220 (1946).
2. Epstein, Albert K. Emulsion. U. S. Patent No. 2,223,558. Dec. 3, 1940.
3. Epstein, Albert K. and Harris, Benjamin R. Margarine Emulsion and Product to be Used Therein. U. S. Patent Re. 21,683. Reissued Jan. 7, 1941.
4. Harris, Benjamin R. Lipophilic-Hydrophilic Derivatives of Thio Compounds. U. S. Patent No. 2,201,535. May 21, 1940.
5. Hills, Claude H., and Speiser, Rudolph. Characterization of Pectin. *Science* 103, 166-167 (1946).
6. Rooker, Wm. A. Fruit Pectin, Its Commercial Manufacture and Uses. *The Avi Publishing Co., Inc.*, New York, N. Y. (1928).
7. White, Wm. Unpublished data of this Bureau.

## Measuring Sanitary Practices in Public Eating Establishments

ROBERT ANDERSON

C. W. ANDERSON, B.S.

N. O. GUNDERSON, M.D.

*Department of Health, Rockford, Illinois*

### INTRODUCTORY STATEMENT

IN the light of our present knowledge of food sanitation, it is well to ask why our known sanitary control measures have not been more universally applied to public eating establishments.

One of the reasons perhaps is that a goodly number of restaurant operators are not cognizant of the saving and good will that can be created through: (1) the proper application of cold and heat that keeps food fresh and palatable until served to patrons, (2) the adequate cleaning, washing, and sanitizing of utensils, glassware, and equipment with improved detergents, wetting agents, and germicides that prevent food spoilage and possible spread of disease producing bacteria, and (3) the use of a "Seeing Is Believing Swab Test" that shows how well these sanitary practices are carried on in their places of business.

It is now possible for food sanitarians to offer easily interpreted business improvement as well as public health protective reasons why restaurant owners can afford to cooperate with corrective measures advanced by health departments for eradicating potential disease hazards, so ably discussed in the article "Disease a la Carte" in the December, 1946 issue of the *Woman's Home Companion*.

### WORK TABLES

Heretofore, the word ptomaine and the typhoid germ have occupied the

limelight of expectancy in food poisoning, but now with the recovery, isolation, and identification of other organisms such as the staphylococcus and Salmonella groups, it is possible to ascertain more accurately the probable cause. Other bacterial types such as proteus, paracolon, and streptococci are also potential sources.

After using kitchen tables for the preparation of chicken, turkey, pork, livers, hearts, sweetbreads, etc., it would seem to be good policy to sanitize these tables before being used again in the preparation of foods consumed without cooking, if organisms present on raw meat are not to contaminate these foods.

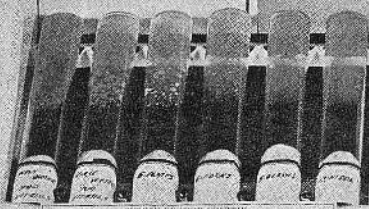
### EXCLUDING CERTAIN EMPLOYEES

To keep staphylococcus food poisoning at a minimum, it is consistent with good public policy to exclude from employment any worker afflicted with boils, sore fingers, or other infections, as well as those with streptococcal sore throats, colds, and flu that may spread to patrons and employees.

Health Department laboratory technicians are able to locate spreaders of infectious disease with great accuracy through improved laboratory procedures. Likewise, the legal responsibility involved when reasonable precautions are not observed in public eating establishments can lead to patron or employee reimbursement for (1) lost time, and (2) doctor and hospital

**“SEEING IS BELIEVING”**

**SANITIZING AGENT  
NOT USED**



IN DEPT. OF FOOD CONTROL  
Department of Public Health  
City of Rochester

**SANITIZED WITH  
QUATERNARY AMMONIUM  
SOLUTION-200 P.P.M.**



IN DEPT. OF FOOD CONTROL  
Department of Public Health  
City of Rochester

**HOW TO USE TEST KITS**

- 1-KITS ARE TAKEN TO RESTAURANTS
- 2-UTENSILS ARE SWABBED
- 3-TUBES ARE INOCULATED
- 4-KITS LEFT AT RESTAURANT FOR OPERATOR TO **SEE AND BELIEVE**

bills, as well as inconvenience and embarrassment to proprietors.

**PROTECTIVE STORAGE OF FRESH FOODS**

When fresh foods reach public eating establishments, owners must meet the problem of protecting these foods from: (1) spoilage, and (2) contamination with disease producing bacteria which may cause a direct financial loss and a loss of customers as well.

For this reason, a well arranged room or rooms are needed for the proper storage of food. The following precautions should be observed: (1)

all products need to be elevated above the floor and away from walls, (2) adequate floor drainage is essential, (3) condensation needs to be prevented through adequate ventilation, (4) proper temperature is paramount, and (5) in and out inventory check sheets are useful in case of large stocks.

Reference is made to the hotel incident in Chicago during the World's Fair which resulted in numerous cases of illness and some deaths, to appreciate the importance of protective storage of foods awaiting to be served the public.

#### REGARDING PESTS

Beside the esthetic aspect involved, there is an inherent health hazard lurking in foods contaminated with excrement and disease producing organisms from rats, mice, cockroaches, and weevils. The most effective means of eradicating these nuisances which constitute a financial loss and customer disfavor, is for owners and operators to enter into a monthly contract with a reputable qualified exterminating company utilizing the newer products and methods available. This method is gaining favor as revealed by the increasing number of establishments now under monthly contract. This is a specialized field and should be treated as such. Health Departments have the responsibility to see that this work is adequately and efficiently carried on.

#### REFRIGERATION

It is well established that bacterial growth is dependent upon (1) proper temperature, (2) sufficient food, and (3) adequate moisture. Likewise, bacterial disease in man is dependent upon the (1) kind, (2) number, and (3) virulence of the organisms present, as well as (4) the resistance of persons coming in contact with these bacteria. Refrigeration controls the temperature factor of this 3-way bacterial survival requirement with the result that any bacteria that may be on or in food are unable to multiply. This means a direct saving through less food loss by spoilage.

For this reason, perishable foods, especially soft pies, custards, etc., in the warmer months of the year, need to be refrigerated, so as to curb the growth of disease producing bacteria, especially certain types of staphylococci which produce gastroenterotoxins during their growth. Such toxins are not destroyed by heat even though the bacteria are killed.

#### SUBMERGED INLETS

At this point, it is necessary to mention that back-siphonage of contami-

nated material into a water supply system by means of submerged inlets is possible under certain circumstances, with epidemic possibilities. This is well known to health department sanitary engineers. For this reason, operators can well afford to seek the aid of the city health department in determining whether any of these connections exist on the equipment or apparatus in their place of business.

To illustrate the point at hand, reference is made to the spread of undulant fever among workers in a laboratory in the middle-west a few years ago. This outbreak was apparently due to a hose connection from a faucet left submerged in a wash tank with improperly sterilized dishes that contained the organism of this disease. Back siphonage occurred resulting in several cases of undulant fever among students.

#### STEAM TABLES

The practice of leaving cooked, fried or broiled foods at room temperature until served to customers, also needs serious consideration in terms of loss through food spoilage. When food is heated sufficiently, storing at room temperature for limited periods usually has no deleterious effects. Consider the number of banquets, large dinners, church suppers, and picnics followed by stomach and intestinal disturbances, which upon investigation have often been found to be due to the storing of previously heated food for too long a period at room temperature.

Realizing that pasteurization temperature (143° to 145°F.) destroys disease producing bacteria, it is good practice to keep heated foods for serving on steam tables maintained at a temperature of 150°F.

Public health records contain many cases where food poisoning has resulted from keeping foods on steam tables at incubation rather than pasteurization temperatures.

### INTENSIVE ASEPSIS

The sanitary care of utensils and equipment used in the preparation and serving of food is not a difficult matter for both small and large establishments. Attention to certain specific details is a necessary precaution.

For this reason "intensive asepsis" is recognized as being applicable to public eating establishments. This consists of directing especial daily attention to the utensils, equipment, and people actually coming in contact with food so contamination can be averted regardless of the type of environment in each case.

With intensive asepsis, the so-called greasy spoon and gold coast eating establishments are comparable insofar as serving wholesome food is concerned. In other words, a lumber camp breakfast, dinner, or supper, can be made just as safe as those served in a restaurant with the latest equipment and skilled help.

### PRE-SCRAPING OR PRE-FLUSHING UTENSILS

It should be remembered and strongly emphasized that the use of detergents, wetting agents and germicides is predicated on the premise that utensils and equipment will be pre-scraped or pre-flushed with sufficient force to remove any excess food that may be present.

Without this, the wash water soon becomes nothing more than "bacteriological soup". Is this the origin of the coined phrase "Disease a la Carte" that received such wide publicity not so long ago? If bacterial growth is dependent upon (1) proper food, (2) adequate temperature, and (3) sufficient moisture, is it not well to control the food factor of this 3 link-chain by pre-scraping or forceful pre-flushing all utensils before washing?

### REGARDING SOAP

With the advent of improved detergents, wetting agents, and germicides,

we perhaps have to revise some of our thinking on the use of soap as a cleaning agent in public eating places. All soaps form insoluble curds with hard water resulting in (1) wash and rinse tank sludge rings, (2) accumulations on and near faucets, (3) bottom and side wall wash tank grease accumulations, (4) sticky utensils and equipment, and most important of all soaps weaken the sanitizing effect of many germicidal agents.

For these reasons, detergents, wetting agents, and germicides when adjusted to the kind of water used and job to be done, apparently obviate the use of soap in public eating establishments. With the "Seeing is Believing" swab test, interested persons can make comparative tests to verify this contention.

In using detergents in wash tanks, however, it is best not to use a type of detergent that saponifies the grease or oil that may be washed off the utensils into the wash tank since this material may inactivate the sanitizing agent in the rinse tank, during the rinsing process.

### 170° RINSE WATER

While the larger establishments are able to maintain 170° water for sanitizing purposes, other restaurants, which constitute well over 90 percent of all public eating establishments find it difficult continuously to maintain rinse water at this temperature, even with gas burners under the rinse tanks. This can be demonstrated by making a survey and actually testing the hot rinse water with a thermometer.

Because of the expense, softened water likewise is difficult to obtain in the smaller establishments. Hard water often results in lime and rust deposits on dishwashing racks, tanks, and utensils, much to the disgust of the help and restaurant owner. Another objection to 170° rinse water is the excessive condensation that settles and forms on the ceiling, walls, and fixtures of

## MEASURING SANITARY PRACTICES

Public Eating and Beverage Establishments  
Efficiency Check Sheet  
By The "Seeing Is Believing" Method

Bureau of Food Control  
Department of Public Health  
City of Rockford, Illinois

Name of Place Blank Restaurant, 1000 Doe Street

Date March 10, 1947

Food Sanitarian R. G. Anderson

No.	Equipment Item	Lab. No.	Growth			Interpretation		
			None	Moder- ate	Heavy	Excellent	Satis- factory	Needs Immediate Attention
B E F O R E								
1	Wash Water 120°F. With Detergent				X			X
2	Rinse Water 120°F. Wetting Agent Only				X			X
3	5 - Cups				X			X
4	5 - Plates			X			X	
5	5 - Glasses				X			X
6	5 - Forks				X			X
A F T E R								
1	Wash Water 120°F. With Detergent				X			X
2	Rinse Water 120°F. Cationic Agent Added		X			X		
3	5 - Cups		X			X		
4	5 - Plates		X			X		
5	5 - Glasses		X			X		
6	5 - Forks		X			X		

Remarks:

1. Manager Well Pleased With Appearance of Utensils.
2. Likes Test Because "Seeing Is Believing".
3. Results Are Encouraging.



<u>Type</u> <u>Counter &amp; Booths</u>	Inspection Report Eating and Drinking Establishments Bureau of Food Control Rockford Department of Public Health Food Sanitarian <u>R.G. Anderson</u>	Person interviewed <u>John Blank</u> Manager
<u>License No</u> <u>2797</u>		
<u>Date</u> <u>March 10, 1947</u>		
<hr/>		
<u>Name</u> <u>Blank Restaurant</u>	<u>Address</u> <u>1000 Doe Street</u>	
Dear Sir: By making the changes indicated below, your place of business can be considered as meeting acceptable sanitary requirements.		
<p>(1) <b>FLOORS:</b> Defective construction ( ). Not smooth (X). need repair ( ). not clean ( ), being cleaned during hours <u>Kitchen &amp; Dining Room</u></p> <p>(2) <b>WALLS AND CEILING:</b> Defective in _____, not clean in _____ need paint in _____, Kitchen, not light color ( ).</p> <p>(3) <b>DOORS &amp; WINDOWS:</b> Ineffective screening ( ), need washing ( ), screen doors not self-closing ( ).</p> <p>(4) <b>LIGHTING:</b> Inadequate in _____</p> <p>(5) <b>VENTILATION:</b> Not reasonably free of odors or condensation in _____</p> <p>(6) <b>TOILET FACILITIES:</b> Not adequate ( ), need repair ( ), not clean ( ), excessive flies ( ), poorly lighted ( ), poor ventilation ( ), doors not self-closing ( ), enter directly into kitchen ( ), no handwashing sign ( ).</p> <p>(7) <b>WATER SUPPLY:</b> No hot &amp; cold running water ( ), not safe ( ).</p> <p>(8) <b>LAVATORY FACILITIES:</b> Inadequate (X), no individual towels (paper or roll type) (X), not clean ( ). (X) No Soap</p> <p>(9) <b>UTENSILS AND EQUIPMENT:</b> Corroded ( ), open seams ( ), chipped or cracked dishes ( ), work tables not clean ( ), not sanitized with germicide.</p> <p>(10a) <b>CLEANING:</b> Not sanitized with germicide, shelves ( ), meat blocks ( ), tables ( ), counters ( ), hoods not cleaned ( ).</p> <p>(10b) <b>BACTERICIDAL CARE OF UTENSILS:</b> No 170°F. water (X), ineffective detergent ( ), no germicide in rinse tank (X), towels not clean ( ), Handwashed</p> <p>(11) <b>STORAGE AND HANDLING OF UTENSILS:</b> Not stored above floor ( ), not protected from flies, splash, dust, etc. ( ) not inverted or covered ( ) dispensing spoons and dippers, not sanitized ( ), not kept in running water ( ).</p> <p>(12) <b>DISPOSAL OF WASTES:</b> Not connected with public sewer ( ), cross connection ( ), possibility of back-siphonage into washing machine, sinks ( ).</p>	<p>submerged inlet in sinks ( ), garbage not stored in tight covered metal containers ( ), receptacles not washed frequently ( ), receptacles for rubbish not provided ( ).</p> <p>(13) <b>REFRIGERATION:</b> Temperature not below 45°F. ( ) not clean and sanitary ( ), drip does not empty into open trapped drain or pan ( ), needs repair ( ), food placed directly on ice ( ), cream filled pastries and custards not refrigerated ( )</p> <p>(14) <b>WHOLESALENESS OF FOOD AND DRINK:</b> Not clean, wholesome ( ), spoiled ( ), cream filled pastries not promptly cooled after baking ( ), milk not aerated in individual bottles ( ), frozen desserts not from approved sources ( ).</p> <p>(15) <b>FOOD STORAGE AND DISPLAY:</b> Food contaminated, overhead seepage ( ), on floors ( ), open displays ( ), domestic animals (X), no monthly contract for pest control ( ), poisonous rodenticides and insecticides used ( ).</p> <p>(16) <b>CLEANLINESS OF EMPLOYEES:</b> Hands not clean ( ), outer garments not clean ( ), street clothes ( ), waitress without hair net or head covering ( ), chef wears no head covering (X), food handlers with open sores, boils, or infectious diseases not excluded ( ), tobacco used where food is prepared ( ), spitting ( ).</p> <p>(17) <b>MISCELLANEOUS:</b> Premises not neat and clean ( ), living or sleeping rooms ( ), clothing hung in kitchen ( ), no container for soiled linens, coats, aprons, etc. ( ).</p> <p>(18) <b>STEAM TABLES:</b> Not adequate ( ), need repair ( ), not drained and cleaned daily ( ), temp: not 265° ( ).</p> <p>(19) <b>FOUNTAIN:</b> Drain clogged ( ), scum and odor beneath syrup containers ( ), inadequate sink facilities ( ).</p> <p>(20) <b>STOVES:</b> Not elevated ( ), not 2 ft. from walls ( ), not clean ( ), no ventilating system ( ).</p> <p>(21) <b>BASEMENT:</b> poor ventilation ( ), improperly drained ( ), defective flooring ( ), not satisfactory place for food ( ), food not elevated from floor ( ).</p>	
<p>General Monthly Pest Control Contract</p> <p>REMARKS:</p> <ol style="list-style-type: none"> <li>1. Repair Floors in Dining Room &amp; Kitchen.</li> <li>2. Provide Soap &amp; Paper Towels in Lavatory.</li> <li>3. Need Cationic Germicide in Rinse Tank Water.     Note Seeing Is Believing Swab Test Report.</li> <li>4. Exclude Domestic Animals From Restaurant.</li> <li>5. Have Waitresses Wear Head Bands.</li> <li>6. See Swab Test Report Also.</li> </ol>		

the kitchen, especially during the colder months of the year. Lastly, the heating of highly mineralized water has a tendency to deposit lime on the inside of water supply piping, with resulting plumbing repair bills.

This no doubt, is the reason why the proper sanitization of utensils, glassware, and equipment with hot water at 170°F. in most restaurants is a very difficult problem. It may affect the flavor of food and in some cases may spread disease among patrons because bacteria especially of the pathogenic type are not completely destroyed but on the other hand may be given a warm stimulating bath.

#### CATIONIC AGENTS

Perhaps one of the greatest advancements in the field of food sanitation has been the introduction of new agents (quaternary ammonium compounds) for sanitizing purposes, although other sanitizing agents still have a definite place.

Authorities reporting on these compounds following carefully conducted experiments are apparently agreed that with a well cleaned surface (usually with a detergent adjusted to the water used) these cationic agents when combined with a wetting agent are particularly adapted for germicidal uses in public eating establishments.

As many as 700 to 800 utensils can be sanitized in one tank of rinse water, containing a sanitizing and wetting agent in a concentration of 200 ppm.

#### DRYING UTENSILS

Whether to air or towel dry utensils and glassware following sanitization with (1) steam, (2) hot water, or (3) sanitizing agents is apparently dependent upon the chemical content of the water used in dishwashing. Utensils, no doubt, can be air dried without lime spotting, directly from an efficiently operated steam or 170°F. water dishwashing machine, or from sanitizing rinse tanks providing a wet-

ting agent and sanitizing agent are added to the rinse tank water.

When hard water, containing calcium, sodium, magnesium, etc. is used, utensils may be towel dried without lime spotting, when the rinse tank is treated with a cationic and wetting agent. In fact, the amount of residual quaternary ammonium compound remaining on the utensils, apparently aids in keeping the towels in a sanitary condition.

#### THE "SEEING IS BELIEVING" SWAB TEST

Food sanitarians and restaurant owners have needed a visual means for measuring or judging the effectiveness of cleaning, washing and sanitizing eating utensils, glassware, and even equipment, that could be used right on the job for the visual education of restaurant owners, managers, and especially for those who actually wash the dishes.

It is possible to estimate the strength of sanitizing agents used, but a visual means of measuring the effectiveness of sanitizing methods on the job instead of in the laboratory has been lacking.

Though used on dairy equipment now for about four years at Rockford, Illinois, the "Seeing is Believing" swab test for measuring the sanitization of utensils and glassware in public eating establishments and on dairy farms as suggested by Dr. M. C. Jamieson, Manitoba University, Winnipeg, Canada, has encouraging possibilities.

#### HOW THE SWAB TEST IS USED

In brief, the method consists of swabbing a given number of plates, cups, glasses, forks, knives, or spoons and even equipment and work table surfaces with sterile cotton swabs, previously dampened in sterile water. The cotton swabs are then gently rolled over the surface of agar slants contained in oval test tubes, which are left in the kitchen of the public eating

establishment to incubate at room temperature and observation by restaurant personnel to note any growth of bacteria that may take place on the agar media in 24, 48, or 72 hours.

It is of interest that restaurant workers watch with keen interest the bacterial growth that can be seen on the test tubes without a microscope. This simple and easily performed test has marked educational value in teaching personnel how to sanitize utensils, glassware and equipment properly. More active cooperation and intelligent understanding can almost always be obtained through the use of this visual and forceful demonstration. The skeptics have no arguments to offer. Swabs can also be dipped in the wash and rinse water to note their sanitary condition.

For details of the field kit used in making these Seeing is Believing swab tests, reference is made to a pamphlet entitled "A Handbook On Testing Dishwashing Practices In Restaurants by the Seeing is Believing Swab Test Method", obtainable from the City Health Department, Rockford, Illinois.

JUDGING RESULTS

No bacterial counts are made of the test tubes, after incubation at room temperature. Each tube, however, is classified according to the amount of bacterial growth that does or does not take place on the agar slant in the oval test tubes. (1) *no growth*, or a few colonies means excellent sanitization, (2) *moderate growth*, which is acceptable but can be further improved, and (3) *heavy growth*, which means the sanitizing methods need immediate attention. The results are self-evident to operators when they look at the tubes, on the following, second or third day. This visual or "Seeing is Believing" swab test method of measuring utensil sanitization apparently is most effective because operators *believe what they can see*. Below is the simple

classification used instead of the standard bacterial counts:

<i>Amount of Bacterial Growth</i>	<i>Interpretation</i>
None or few	Excellent Sanitization
Moderate	Sanitization Can Be Improved
Heavy	Needs Immediate Attention

FIELD COMMENTS

It may be of interest to cite some of the comments of managers and operators to this on-the-job—seeing-is-believing swab test method of measuring dishwashing practices:

"I like it because it vividly shows how well utensils are being washed in my establishment."

"This visual test is something we have wanted for a long time. I never could understand bacterial counts."

"My help believes in the test because it is something they can see for themselves."

"Watching the bacteria grow on the test tube media convinces the most skeptical dishwasher."

OTHER SEEING IS BELIEVING  
TABULATION SHEETS

Owners and operators of restaurants anxiously await health department sanitary reports on their place of business since they are not complicated and are easily understandable.

Bacteriological reports of sanitization practices in terms of numerical estimates are difficult of interpretation as food sanitarians well know. Operators may ask "what is the difference between a glassware bacterial count of 90 and 110?" Since the counts represent only approximations, it seems unrealistic to unreservedly place a stamp of approval upon the count of 90 and unequivocally condemn a count of 110 as being wholly unsatisfactory.

Health Department environmental scoring cards, are in general difficult of interpretation by owners of public eating establishments. Such report forms are sometimes too technical for the average grass root owner of a restaurant to understand. It would be

advantageous to simplify them as much as possible without impairing their usefulness.

#### SUMMARY

1. One of the reasons why our known sanitary control measures have not been more universally applied to public eating establishments is that a goodly number of restaurateurs are not cognizant of the saving and public good will that can be created through eradicating those conditions which: (1) may spoil or affect the flavor of food, and (2) in some cases may spread disease among patrons, so ably discussed in the December, 1946 issue of the *Woman's Home Companion* under the title of *Disease a la Carte*.

2. Some of the important factors that protect the reputation and patronage of the restaurateurs are (a) pest control, (b) adequate refrigeration, (c) thorough cooking, (d) efficient use of steam tables, and (e) proper cleansing and sanitization of

utensils, glassware and equipment with improved methods now available.

3. The use of improved detergents, wetting and germicidal agents (especially the cationic type) when adjusted to the type of water used and problem to be solved, aid materially in maintaining sanitary practices in public eating establishments, and also is an important factor in curbing the spread of infectious diseases.

4. A description is given of a visual educational method of measuring or judging the effectiveness of restaurant dishwashing and sanitization practices by means of a "Seeing Is Believing" Swab Test. This method has the definite advantages of (a) simplicity, (b) low cost, (c) practical application *right on the job* and (d) high educational value.

The method also appeals to the restaurant owner, manager, and help because they believe in what they can see. We recommend for serious consideration a Chinese proverb which sagely advises: "One picture is better than a thousand words".

Make room reservations now for the thirty-fourth annual meeting.  
Hotel Schroeder, Milwaukee, Wisconsin, October 16-18.

## Control Practices Used in Supervision of Vitamin D Milk by City and State Milk Sanitarians\*

REPORT OF COMMITTEE ON APPLIED LABORATORY METHODS

K. G. WECKEL, CHAIRMAN

*University of Wisconsin, Madison, Wisconsin*

VITAMIN D fortified milk has become a product of major significance in the list of products distributed by fluid milk distributors in a large number of American cities. In many major markets vitamin D fortified milk constitutes from 30 to 60 per cent of the total fluid milk sales. The significant role of vitamin D fortified milk as a product may be attributed to four important factors: (1) the recognition by consumers of the need for vitamin D; (2) the nutritional convenience by which the factor can be made available in milk; (3) the nutritional propriety of its presence in milk; (4) the opportunity for sales emphasis by milk distributors.

The conditions involved in the production of vitamin D milk should be of interest to milk sanitarians for several reasons. Its production involves some sort of manipulation or treatment of the milk. It is a responsibility of sanitarians to assure consumers the nutritional value of milk products since its use largely is predicted as a food. Vitamin D milks are distributed as specialty products on which consumers must have come to place reliance for a special feature.

There is no simple, convenient, and economical way to appraise the vitamin D content of milk. It must be determined by biological assay methods. The bioassay is costly, from twenty-

five to fifty dollars per sample. Frequent assays are desirable to assure attainment of the desired potency level in the milk. Too frequent assays assess an unreasonable cost upon milk processors and consumers, and may even prevent availability of the product to the consumer. The latter may be particularly true in smaller communities.

Three general methods have been developed for the vitamin D fortification of milk namely, by metabolism, by irradiation, and by direct addition of the D to the milk. Of these methods the addition of a concentrate of vitamin D is the most widely used. Vitamin D concentrates are of two general types. One consists of the vitamin dissolved in butterfat emulsified in fluid milk solids, then canned and sterilized. The other consists of the vitamin dissolved in a vegetable oil and this mixed with a special oil-in-water dispersing agent.

There are several general problems sanitarians should recognize in the supervision of the processes wherein vitamin D milk is produced. The first has to do with the acceptability of the substances which comprise the vitamin D concentrate. Since much supervisory effort is extended in appraisal of the milk which is to be processed in a dairy, it is reasonable to assume that any vitamin D materials or concentrates added to the milk should be derived from sources of equal quality, and processed and handled under con-

\* Presented at the Thirty-third Annual Meeting of the International Association of Milk Sanitarians, October 24-26, 1941, Atlantic City, New Jersey.

ditions of equal standards prescribed for the milk itself. It is reasonable to assume the procedure of addition of the concentrate be acceptable—to assure uniformity of dispersion in the milk, and under conditions commensurate with sanitary practise. The addition of concentrates to milk involves the human element. Understanding on the part of participants of the process is important.

There are many ways in which vitamin D milk may be supervised. There are changes being made in the condi-

tions by which the milk is produced. The product is being produced in increasing quantities.

In the light of these observations, it appeared proper to review the regulations now in force in a number of cities and states. The results of the survey are herewith presented.

The procedures in use in 88 cities and 26 states from which survey replies were obtained are presented in this report. The figures presented percentage-wise were determined on the basis of the specific questions answered.

1. Vitamin D. potency (minimum U. S. P. units) required per qt.

	Cities		States	
	Total	Percent	Total	Percent
400 units .....	43	70.5	4	16
135 units .....	2	3.3	3	12
no requirement .....	16	26.2	16	64
prohibited .....			2	8
2. Are bioassays of the milk required?				
Yes .....	48	75	9	60
No .....	16	25	6	40
3. How many bioassays are required each year of the milk produced by a dairy?				
None .....	2	4.8	3	25.0
One .....	1	2.4	1	8.3
Two .....	10	24.4	3	25.0
Three .....	15	36.6	1	8.3
Four .....	12	29.2	2	16.6
Six .....	0	0.0	0	0.0
Twelve .....	1	2.4	1	8.3
By request .....			1	8.3
4. How is the sample procured for bioassay?				
Samples taken by sanitarian without prior knowledge of the dairy .....	49	84.5	9	69.2
Sample submitted voluntarily by dairy to an approved laboratory .....	5	8.6	2	15.4
Sample submitted by the dairy directly to an approved laboratory at request of sanitarian .....	2	3.45	1	7.7
Other procedures of submitting samples ..	2	3.45	1	7.7
5. How frequently are milk samples procured for bioassay? Intervals of:				
One month .....	2	4.0	1	9
Two months .....	0	0.0	0	0
Three months .....	18	35.3	1	9
Four months .....	10	19.8	3	27
Six months .....	7	13.7	3	27
Twelve months .....	1	2.0	2	18
No procedure .....	13	25.8	1	9

	Cities		States	
	Total	Percent	Total	Percent
6. Are the samples of milk procured for bioassay always obtained at approximately regular intervals?				
Yes .....	15	30.8	2	18
No .....	34	69.2	9	82
7. Are the samples of milk obtained from a given dairy at irregular intervals procured at the discretion of the sanitarian?				
Yes .....	38	81	8	72
No .....	9	19	3	28
8. To which one of the following types of laboratories is the sample submitted for vitamin D bioassay?				
Approved commercial laboratory ....	15	25	8	61.5
State operated laboratory .....	7	11.8	2	15.4
University operated laboratory .....	28	46.6	3	23.1
City operated laboratory .....		0.0		
No specification on laboratory .....	10	16.6		
9. Must the results of bioassay of the vitamin concentrate used to fortify milk be submitted to the city, or state, prior to its use?				
Yes .....	18	34	3	23.1
No .....	35	66	10	76.9
10. Must any of the following records of identification of the concentrate used by the dairy be kept on file by the dairy?				
(a) Name of product				
Yes .....	31	60	8	66.6
No .....	22	40	4	33.3
(b) Code identification of product				
Yes .....	15	37.5	4	40.0
No .....	25	62.5	6	60.0
(c) Date of use of product				
Yes .....	18	40	3	33.3
No .....	28	60	6	66.6
(d) Quantity of concentrate used				
Yes .....	25	53.2	6	60.0
No .....	22	46.8	4	40.0
(e) Quantity of milk fortified				
Yes .....	23	56.0	6	54.5
No .....	18	44.0	5	45.5
(f) Monthly invoice of concentrate purchased .....			1	
(g) Monthly report of volume of milk ..			1	
(h) Monthly report by dairy .....	1		1	
11. Is it legally mandatory that the vitamin concentrate be added to the milk prior to its pasteurization?				
Yes .....	43	74	10	71.4
No .....	15	26	4	28.6
12. Is the addition of vitamin concentrate to milk after it is pasteurized permitted?				
Yes .....	2	3.8	3	23.0
No .....	51	96.2	10	77.0
13. Is it mandatory that the vitamin concentrate be added to the milk only in the presence of an official?				
Yes .....	0	0	0	0
No .....	62	100	13	100
14. Must the concentrate used by dairies to fortify the milk have the prior approval of the supervising milk sanitarian?				
Yes .....	40	65.7	5	38.5
No .....	21	34.3	8	61.5

## CONTROL OF VITAMIN D MILK

	Cities		States	
	Total	Percent	Total	Percent
15. Is it required that the premises where the vitamin concentrates are produced be inspected and approved before the concentrate may be added?				
Yes .....	5	8.4	2	15.4
No .....	55	91.6	11	84.6
16. Must the concentrate have the prior approval of an authoritative medical, public health, sanitarian or laboratory organization?				
Yes .....	31	51.0	3	25.0
No .....	28	49.0	9	75.0
17. What procedure is followed when the bioassay report of a given sample shows the vitamin D content is below the required potency?				
(a) Require an additional extra bioassay be made upon another sample of milk.				
Yes .....	36	80		
No .....	10	20		
(b) Is a repeat bioassay required immediately?				
Yes .....	33	84.6	7	87.5
No .....	6	15.4	1	12.5
(c) Must the cost of the additional bioassay be borne by the dairy?				
Yes .....	39	88.6	9	100
No .....	5	11.4	0	
18. Which of the following bottle cap of bottle labelling requirements are mandatory?				
Vitamin D units per quart				
Yes .....	46	82.1	12	92.3
No .....	10	17.9	1	7.7
Brand name of concentrate used				
Yes .....	12	26	2	20.0
No .....	34	74	8	80.0
Name of type of Vitamin D (e. g. irradiated ergosterol)				
Yes .....	23	49	7	63.6
No .....	24	51	4	36.4
19. Are the results of the bioassays of milk obtained officially by the State acceptable to the city?				
Yes .....	33	64.7		
No .....	18	35.3		
20. Are the results of the bioassays obtained officially by the city acceptable to the State?				
Yes .....			9	82.0
No .....			2	18.0

21. Of 88 cities included in the survey, in only 62 is vitamin D milk produced and distributed. In these, the milk was produced and distributed by 367 different companies. Of these 367, 51 or 13.89 per cent produced milk at least once during the preceeding year below the required standard of potency. Sanitarians in the 62 cities acquired and submitted for bioassay during the preceeding year 1476 samples of milk. Of the 1476 samples, 71 or 4.81 per cent were found to have less than the required vitamin D potency. Of the 1476 samples acquired by city sanitarians for bioassay purposes, 140 were obtained in communities where only two or less bioassays are required annually. Of

the 140, only 1 or 0.71 per cent of the samples were found to have less than the desired potency. The remaining 1336 of the 1476 samples were acquired in cities where three or more bioassays of the vitamin D milk are required annually. Seventy of the 1336 or 5.24 per cent of the samples were found to be sub-standard in potency. One hundred one or 27.6 per cent of the 367 dairies distributing vitamin D milk were located in cities where two or less samples were submitted annually for bioassay. Eleven or 21.57 per cent of the 51 dairies that produced milk low in potency during the preceeding year were located in cities where



only two or less bioassays are required annually.

Eleven of 26 states have no regulations governing production of distribution of vitamin D milk. In five of the 26 states, vitamin D milk is neither produced nor distributed. A total of 351 dairies distributed the product in 10 states. Of these, 60 or 17.1 per cent produced milk at least once during the preceding year below the required level of potency. The sanitarians in these states acquired and submitted 957 samples for bioassay. Of these, 43 or 4.48 per cent had less than the desired level of potency. A total of 662 of the 957 samples were procured by sanitarians in states where two or less assays of the milk produced by a dairy are required annually. Thirty-four or 3.55 per cent of the 662 samples were below the desired potency. A total of 295 of the 957 samples were procured for test purposes in states where three or more bioassays are required annually. Of the 295 samples, 9 or 0.94 per cent were reported below the desired level of potency. Of the 60 dairies that distributed milk having a potency less than desired at least once during the preceding year, 52 or 86.6 per cent were located in states where an assay is required only two or less times a year. The number of dairies distributing milk in states where only two or less assays are required a year was reported as 249, which is 71 per cent of the total number of dairies reported in the 10 states.

#### SUMMARY

It is evident that there is considerably divided opinion among sanitarians, at least as exemplified by the prevailing practices, in what is considered the desirable means of assuring that the desired potency is present in all vitamin D milk produced. On the average, one out of every seven dairies producing the milk may be suspected of pro-

ducing a product below the desired potency. Obviously, some dairies are more violating of the standard than others. About one of every twenty samples acquired by city sanitarians for bioassay purposes was found to be sub-standard. It is not clear as to the effectiveness of frequency of sampling by sanitarians on maintaining the desired potency in milk. Fewer low potency samples were found, percentage-wise, where bioassay sampling was less frequent. On the other hand, more frequent sampling brought to light, percentage-wise, more frequent inadequate fortification of the milk. Fortunately, inadequate fortification does not do the harm that could be done potentially by inadequate pasteurization. Nonetheless, consumers in many instances pay a premium for vitamin fortified milk and ultimately must depend upon assurance for labelled potency upon a supervisory sanitarian. In the light of the above survey, it would be proper for many sanitarians to re-assay their procedure of supervision of vitamin D milk produced in their areas.

The members of the Committee on Applied Laboratory Methods wish to thank those sanitarians who kindly cooperated by participating in the survey on this subject, and R. H. Larsen who assisted in the tabulations herein reported.

K. G. WECKEL, *Chairman*  
M. R. FISHER  
V. C. STEBNITZ

## Clean Babcock Test Bottles

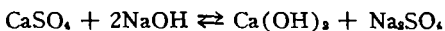
CLARE W. RINK

*Diamond Alkali Company, Pittsburgh, Pennsylvania*

KEEPING Babcock test bottles in a bright, clean condition has always presented a difficult cleaning problem. Some operators use sand, others use lead shot. In some cases the chemical cleaning solution (sulfuric acid and dichromate) has been used successfully. The best advice to most operators has been to rinse the bottles immediately after use, wash the bottles with a washing powder, and use the special brushes.

Recently a dozen test bottles were submitted to the writer which defied cleaning by acids, brushing, or any of the known procedures. Examination of the film on the bottles showed it to be calcium sulfate with fat and protein inclusions. The calcium sulfate had been formed by the reaction of the calcium from casein and from water hardness with the sulfate from the sulfuric acid used in the Babcock test.

Calcium sulfate is only slightly soluble in dilute mineral acid solutions and does not respond very well to acid treatment. However, calcium sulfate will react with alkalis, according to the following equation:



With dilute solutions (1-10 percent) of caustic soda, only the surface of the scale is affected. The reaction will stop as soon as the scale has become coated with calcium hydroxide. It is then

necessary to treat the coated scale with acid in order to dissolve the hydroxide. Repeated alternate treatments are necessary until all the scale has been dissolved.

With a concentrated solution (30 percent) of caustic soda, the mass action of the hydroxyl ions forces the reaction to completion. Only the one treatment is necessary.

The procedure as finally developed involves the exposure of the inside of the Babcock test bottle to a 30 percent caustic soda solution at boiling temperature in a water bath for 30 minutes. The film that has not already fallen from the sides can be released by merely shaking the bottle as the caustic solution is being emptied.

Sometimes a very light haze of calcium hydroxide remains in the bottle. This haze can generally be removed by a treatment with dilute hydrochloric acid or full strength vinegar.

### CLEANING PROCEDURE

*Making 30 Percent Caustic Solution:* Dissolve one pound of caustic soda, lye, or high caustic content bottling alkali in one quart of water. The caustic should be placed in a crock or pyrex beaker sitting in a cold water bath. Add the quart of water and stir with a glass rod. Avoid contact with skin—treat the caustic solution with same caution you handle sulphuric acid. Let solution cool.

*Cleaning bottles:* Fill the Babcock test bottles to be cleaned with this 30 percent caustic solution to the base of the neck.

Set the bottles in a water bath and heat the bath to boiling. Boil for 30 minutes, then turn off the heat, and let the bottles sit in the bath for another 30 minutes.

Dump the caustic solution from the bottles, shaking well as the bottles empty; no brushing is necessary.

Rinse with water.

#### NOTES

Milk test bottles are easily filled, then the 30 percent caustic solution is poured into the neck from a 150 c.c. pyrex beaker or from a graduate having a small pouring spout. The usual acid measures can be used but the size of the measure slows the operation.

The 30 percent caustic solution can be re-used for about three treatments. The concentration of sodium sulphate, however, reduces the speed of the reaction.

The film in bottles contains fat and protein with calcium sulphate acting as a binder. The presence of these organic materials probably simplifies the cleaning problem and explains why the film is usually completely removed leaving no deposit of calcium hydroxide.

A 30 percent caustic solution has no etching effect on glass as does a solution of 10 percent caustic. The 30 percent solution has been kept in Babcock test bottles for as long as two months with no etching of the surface.

The procedure was developed from an article by Wasco and Alquist, *Industrial and Engineering Chemistry*, April, 1946.

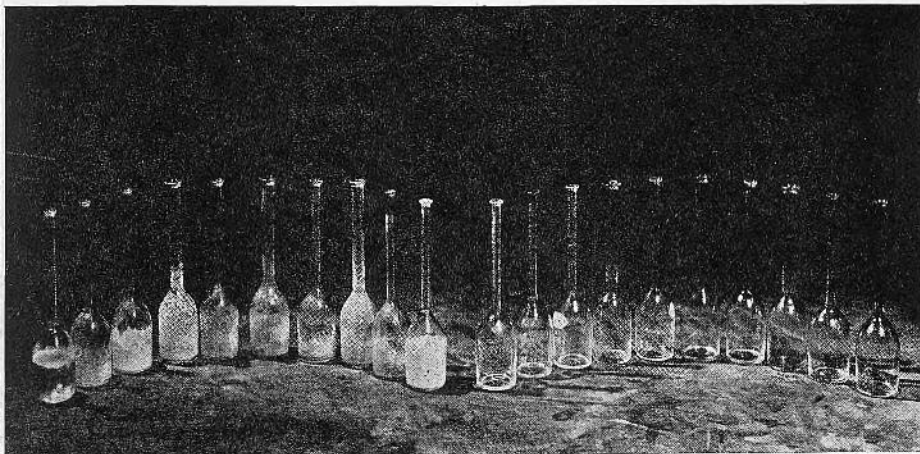


PLATE 1

The cleaned bottles on the right were equally as heavily soiled as the group on the left.

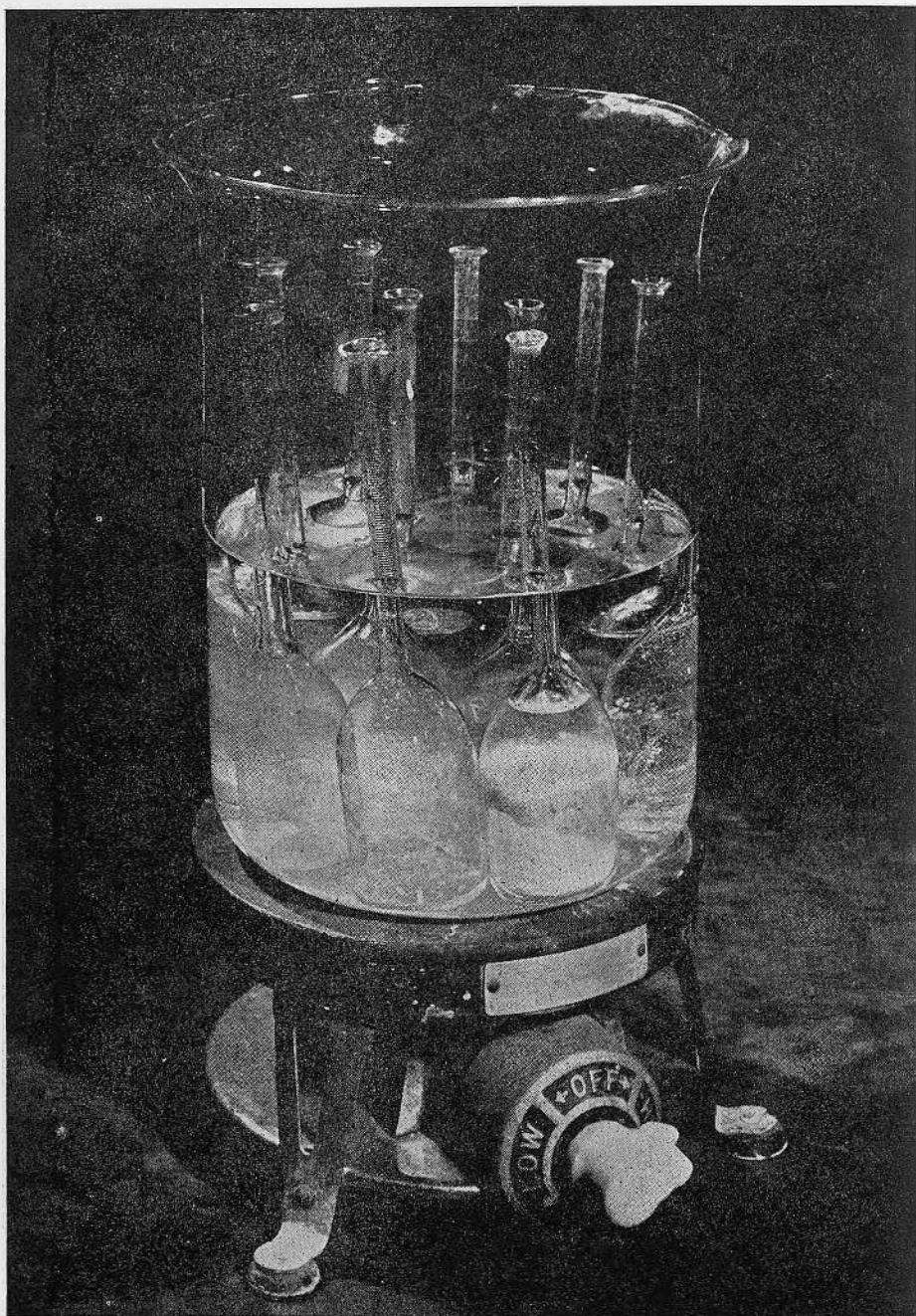


PLATE 2

Fill the soiled test bottles with a 30 percent caustic solution to the base of the neck.  
Set in a water bath and boil for 30 minutes.

## New Books and Other Publications

**The Butter Industry**, by Otto F. Hunziker. Third edition. Published by the author, 103 Seventh Ave., La Grange, Ill. 779 pages of text. 136 figures. 82 tables. Price \$6.50. 1940.

The author with his characteristic thoroughness and industry has produced a book which is excellently arranged for use as a text, as a reference source for investigators, and as a handbook for the industry. It covers the butter industry from its historical beginnings all the way through organization, production, control, marketing, and food value. The text is full of content without being ponderous, and is presented in well-organized sections which facilitate location of given topics. Every food control official needs this book in view of the increasing importance of butter control in the public health picture.

**The Ice Cream Industry**, by G. D. Turnbow, P. H. Tracy, and L. A. Raffetto. Second edition. Published by John Wiley and Sons, Inc., New York. 654 pages. 111 tables. 108 figures. \$6.00. 1947.

In producing this new edition, the authors bring up to date historical development of the ice cream industry. They have added new material on mix standardization, selection of milk products, sweetening agents, stabilizing agents, mix processing, operation of continuous freezer, engineering, hardening, flavor, and defects. Of especial interest to sanitarians are the new chapters on sanitary control of ice cream equipment and plants. A particularly valuable chapter deals with the physical and chemical properties of mixes, covering 64 pages and 154 references. Engineering in the ice cream plant covers 54 pages. Altogether there are 491 references, many of which are as late as 1944. This book

is useful for control official, student, and operator.

**Chemical Specialties, A Symposium**, compiled by H. Bennett. Published by the Chemical Publishing Co., Brooklyn 2, N. Y. 826 pages. \$12.50. 1946.

This book is written for those who intend to prepare their own chemical specialties and to build up a chemical specialty business. Many formulae are given for the manufacture of cosmetics, foods, pharmaceuticals, drugs, polishes, cleaners, lubricants, insecticides, rodent poisons, adhesives, and inks. The information is not too technical for the average business man, and yet will be useful to furnish ideas for the chemist. The chapter headings are: Compounding Chemistry, Classes of Chemicals, Chemicals Classified by Use, Raw Materials, Processing Procedure and Equipment, Formulary, Marketing, General Business Principles, Records and Forms, Technical Help, Laws and Regulations, and Appendix (of hazardous chemicals, first aid, abbreviations, names, tables, and where to buy).

**German for the Scientist**, by P. F. Wiener. Published by the Chemical Publishing Co., Brooklyn 2, N. Y. 238 pages. \$3.50. 1946.

Here is a brief book that streamlines the grammar into four chapters, totaling 27 pages, followed by an appendix of 15 pages of useful tables of declensions and conjugations of regular and irregular verbs, then prepositions, German abbreviations, and sample examinations. Then comes 85 pages of chemistry and physics passages, followed by the respective English translation. The procedure differs somewhat from conventional patterns. For example, the order of declension is nominative, accusative, genitive, and

dative. No second person verbs are given. The declensions may be considered as being rather "skimpy". However, the arrangement is simple, clear, and practical. The tables arrange the forms well, and the reading passages are good. All in all, the book follows a good plan for learning to read scientific German quickly.

**The Spice Handbook—Spices, Aromatic Seeds, and Herbs**, by J. W. Parry. Published by the Chemical Publishing Co., Inc., Brooklyn, N. Y. 240 pages. Illustrated. 1945. \$6.50.

Information of interest and value to manufacturers, importers, and salesmen is presented in a practical manner, such as macroscopic and microscopic appearance, botanical grouping, nativity, description, properties, uses, adulteration, processing, packing, essential oil with properties, and government standards. Spice formulae are given for sixteen different food products.

In the Appendix there are standard contracts, table of distances between ports, differences in standard time, glossary, and foreign weights. This is a useful book for food manufacturers.

**Bovine Mastitis, A Symposium**, edited by R. B. Little and W. N. Plastridge. Published by McGraw-Hill Book Co., Inc., New York. 546 pages. Illustrated. 1946. \$7.00.

This subject is developed in the form of a symposium because of the wide differences of opinion held by workers in this field. Chapter headings are: I. Anatomy of the Udder; II. Physiology of Milk Secretion; III. Pathology of Mastitis; IV. Diagnosis of Mastitis; V. Bacteriology of Mastitis; VI. Serological Classification of the Mastitis Streptococci; VII. Environmental and Hereditary Factors; VIII. Transmission; IX. Mastitis in Heifers; X. Eradication of Chronic Mastitis; XI.

Vaccination in the Control of Bovine Mastitis; XII. Treatment of Bovine Mastitis; XIII. Public Health Significance of Bovine Mastitis; XIV. Relation of Bovine Mastitis to Quality of Dairy Products; XV. Stable Hygiene in the Control of Mastitis for the Production of Clean Milk; XVI. Recommendations for State Control Programs; XVII. Mastitis in Goats; and Appendix (containing additional tests and mediums that are not covered in Chapters IV, V, and VI).

The authors give an over-all picture of the disease and of advances in its study. It contains over eight hundred references to the literature, including many as late as 1944, and some 1945. The text shows the signs of diversity of authorship but the coverage is authoritative and extensive.

**Secretion of Milk**, by Dwight Espe. 3rd edition. Published by The Collegiate Press, Inc., Ames, Iowa. 314 pages. 61 figures. 38 tables. 1946. \$3.25.

The author states that the principal objective of this text is to focus information in anatomy, physiology, and nutrition on problems dealing with the normal functioning of the mammary gland. He has endeavored to keep the subject at a level between the needs of the practical dairyman and the research student. The work is a compilation of data from the literature of 1294 references, many of which are as late as 1944, several 1945. The chapters: I. Phylogenetic Development of the Mammary Gland; II. Anatomy of the Udder; III. Nervous Control; IV. Theory of Milk Secretion; V. Factors Affecting the Amount and Composition of Milk; VI. Miscellaneous Factors Related to Milk Secretion; VII. Hormonal Control; VIII and IX. Effect of Feed on the Amount and Composition of Milk.

**Concise Chemical and Technical Dictionary**, edited by H. Bennett.

Published by Chemical Publishing Co., Inc., Brooklyn, N. Y. 1120 pages. 6x9. 1947. \$10.00.

This book contains 50,000 definitions of terms used in chemical, bacteriological, pharmaceutical, biological, medical, electrical, metallurgical, mineralogical, and plastic fields. Trade names, abbreviations, and scientific names are all listed in alphabetical order. Chemical names often carry their synonyms, together with semi-structural formulas, molecular weights, physical properties, and use. The definitions are concise and clear. Useful tables are appended, including a uniquely useful one on Greek symbols which includes many of the different uses to which a given letter applies. It is a valuable reference book for technical and professional people at large as well as for specialists.

**Disinfection and Sterilization**, by

E. C. McCulloch. 2nd ed., published by Lea and Febiger, Philadelphia. 68 engravings. 472 pages. 1946. \$6.50.

"An important study in formal education, it (this book—Ed.) has also real significance for those outside of institutional circles who are interested in orienting themselves on any old or new questions in the field of bacterial control whether they arise in private or public relations. To those who are thinking along such lines this work

will appeal." (from Foreword by Henry B. Ward).

The book is intended for use by bacteriologists, sanitarians, and members of the medical profession as a reference book, and by teachers and students of bacteriology, medicine, and public health "who are interested in the natural laws governing the growth and death of microorganisms as well as the practical problems of disinfection and sterilization".

The scope is broad: development of our knowledge of disinfection and sterilization; natural agencies which control microbial populations; germicidal properties of the body; bactericidal properties of radiant energy, heat, cold, desiccation, electricity, and other physical agents; disinfectant rating; dynamics of disinfection, acids, alkalies, metals, dyes, phenols and related compounds, halogens, miscellaneous disinfectants; water purification; sewage treatment; air disinfection; and selection of a disinfectant. The book shows that the author is writing with a background of experience in milk and food sanitation. Each chapter carries an average of about fifty references to the literature totaling over a thousand, some of which are as late as 1943, many 1942. The style is interesting, the format pleasing, and the presentation clear. It is useful for the sanitarian, the teacher, the student, the medical man, and the plant operator.

# JOURNAL OF MILK AND FOOD TECHNOLOGY

*Official Publication of the*

**International Association of Milk Sanitarians**

(Association Organized 1911)

*Editors*

W. B. PALMER, *Managing Editor*  
Orange, N. J.

J. H. SHRADER, *Editor*  
Wollaston, Mass.

*Associate Editors*

C. A. ABELE Chicago, Ill.	P. B. BROOKS Altamont, N. Y.	SARAH V. DUGAN Louisville, Ky.	F. W. FABIAN East Lansing, Mich.
C. R. FELLERS Amherst, Mass.	A. W. FUCHS Washington, D. C.	J. G. HARDENBERGH Chicago, Ill.	M. D. HOWLETT Los Angeles, Cal.
C. K. JOHNS Ottawa, Canada	J. A. KEENAN Chicago, Ill.	ERNEST KELLY Washington, D. C.	P. F. KRUEGER Chicago, Ill.
M. E. PARKER Chicago, Ill.	G. W. PUTNAM Chicago, Ill.	F. M. SCALES NEW YORK, N. Y.	H. R. THORNTON Edmonton, Alberta, Can.

The JOURNAL OF MILK AND FOOD TECHNOLOGY is issued bimonthly beginning with the January number. Each volume comprises six numbers. It is published by the International Association of Milk Sanitarians, and is printed by The William Boyd Printing Co., Inc., Albany, N. Y., U. S. A.

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

All correspondence concerning advertising, reprints, subscriptions and all other business matters should be addressed to the Boyd Printing Company, 374 Broadway, Albany 7, N. Y., or to the Managing Editor, W. B. Palmer, 29 North Day Street, Orange, N. J.

*Manuscripts:* All correspondence regarding manu-

scripts, editorials, news items, announcements, and other reading material should be addressed to the Editor, J. H. SHRADER, 23 EAST ELM AVE., WOLLASTON, MASS.

*Membership and Dues:* Active membership in the Association is \$3.00 per year, and Associate membership is \$2.00 per year, including respectively all issues of the JOURNAL OF MILK AND FOOD TECHNOLOGY. All correspondence concerning membership in the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS, including applications for membership, remittances for dues, failure to receive copies of the JOURNAL OF MILK AND FOOD TECHNOLOGY, and other such matters should be addressed to the Secretary of the Association, J. H. SHRADER, 23 EAST ELM AVE., WOLLASTON, MASS.

---

INTERNATIONAL ASSOCIATION OF MILK SANITARIANS

*President*, R. G. Ross.....Tulsa, Oklahoma  
*First Vice-President*, W. D. Tiedeman.....Albany, New York  
*Second Vice-President*, A. W. Fuchs.....Washington, D. C.  
*Third Vice-President*, M. E. Fisher.....St. Louis, Missouri  
*Secretary-Treasurer*.....J. H. Shrader, 23 E. Elm Ave., Wollaston, Massachusetts



## Affiliates of INTERNATIONAL ASSOCIATION OF MILK SANITARIANS

### ASSOCIATED ILLINOIS MILK SANITARIANS

*President*, Frank J. Capouch.....Chicago  
*Vice-President*, Howard McGuire.....Springfield  
*Secretary-Treasurer*, P. E. Riley, Illinois Department of Public Health, Chicago  
*Executive Board Members*:  
 L. S. Blaisdell.....Chicago  
 Raymond K. Esmond.....Chemung  
*Auditors*:  
 Paul N. Hanger.....Springfield  
 L. H. Weiner.....Chicago

### FLORIDA ASSOCIATION OF MILK SANITARIANS

*President*, Alex G. Shaw.....Tallahassee  
*Vice-President*, J. F. Koger.....Miami  
*Secretary-Treasurer*, L. R. Arrington..Gainesville  
*Executive Committee Members*,  
 L. A. Scribner.....Orlando  
 P. D. Shirley.....Tampa  
 W. H. Brown.....Jacksonville

### IOWA ASSOCIATION OF MILK SANITARIANS

*President*, W. F. Schlenker.....Des Moines  
*Vice-President*, C. A. Hooven.....Marshalltown  
*Secretary-Treasurer*, Milton E. Held, State Health Dept., Des Moines.

### MICHIGAN ASSOCIATION OF DAIRY AND MILK INSPECTORS

*President*, Charles E. Gotta.....Lansing, Mich.  
*1st Vice-President*, H. R. Mohr.....Adrian, Mich.  
*2nd Vice-President*, H. Dunsmore, Battle Creek, Mich.  
*Secretary-Treasurer*, G. J. Turney, Lansing Department of Health, Lansing, Mich.

### NEW YORK ASSOCIATION OF MILK SANITARIANS

*President*, Samuel Abraham.....Slate Hill, N. Y.  
*Vice-President*, E. S. St. J. Baldwin, New York, N. Y.  
*Secretary-Treasurer*, W. D. Tiedeman, New York State Department of Health, Albany, N. Y.

### OKLAHOMA ASSOCIATION OF MILK SANITARIANS

*President*, Fred Peters.....Ponca City  
*1st Vice-President*, James Poolson.....Okmulgee  
*2nd Vice-President*, Earl Reid.....Wewoka  
*3rd Vice-President*, Dr. Wm. Bishop.....Bartlesville  
*Secretary-Treasurer*, W. B. Lanphere, c/o Carter County Health Department, Ardmore

### WISCONSIN MILK SANITARIANS' ASSOCIATION

*President*, K. G. Weckel.....Madison  
*Vice-President*, V. P. Melhuish.....Oconomowoc  
*Secretary-Treasurer*, L. Wayne Brown, State Department of Agriculture, Madison  
*Directors*: August C. Hillstad, Elmer C. Kleffen  
*Auditors*: Peter P. Peterson, Ward M. Totman

## Associations Which Have Designated the JOURNAL OF MILK AND FOOD TECHNOLOGY As Their Official Organ

### CALIFORNIA ASSOCIATION OF DAIRY AND MILK INSPECTORS

*President*, Gaylord K. Cooke.....Berkeley  
*Vice-President*, H. E. Ball.....Lodi  
*Secretary-Treasurer*, Hugh G. Hart, Yolo County Health Dept., Woodland

### CHICAGO DAIRY TECHNOLOGY SOCIETY

*President*, C. A. Abele.....Chicago  
*Vice-President*, F. W. Rayl.....Chicago  
*Secretary*, P. H. Tracy, University of Illinois, Urbana  
*Treasurer*, G. C. Hussander.....Chicago  
*Sergeant-at-Arms*, John Dusansky.....Chicago

### CONNECTICUT ASSOCIATION OF DAIRY AND MILK INSPECTORS

*President*, E. O. Anderson, University of Connecticut, Storrs.  
*First Vice-President*, Bruce C. Grant..New Britain  
*Second Vice-President*, E. St. J. Baldwin, New London.  
*Third Vice-President*, Alfred W. Fish....Hartford  
*Secretary-Treasurer*, H. C. Goslee, State Office Building, Hartford, Conn.

### INDIANAPOLIS DAIRY TECHNOLOGY CLUB

*President*, James Irwin.....Indianapolis  
*Vice-President*, Martin Koldyke.....Indianapolis  
*Secretary*, Dr. B. E. Horrall, Purdue University, West Lafayette  
*Assistant Secretary*, W. K. Moseley, 3862 East Washington Street, Indianapolis  
*Treasurer*, Tom Wright.....Frankfort

### KANSAS ASSOCIATION OF MILK SANITARIANS

*President*, Mrs. Doris Van Gundy...Wellington  
*Vice-President*, Ivan Van Nortwick.....Topeka  
*Secretary-Treasurer*, Howard M. Weindel, Kansas State Board of Health, Topeka  
*Directors*: J. R. Mingle, Deputy State Dairy Commissioner, Oakley; Dr. C. F. Kubin, City Milk Sanitarian, McPherson

### MASSACHUSETTS MILK INSPECTORS' ASSOCIATION

*President*, Robert C. Ferriello.....Attleboro  
*Vice-President*, Timothy M. Miller....Springfield  
*Secretary-Treasurer*, Robert E. Bemis...Cambridge  
*Executive Committee*, John J. Cortin.....Quincy  
 Edward E. Williams.....West Springfield  
 Henry L. Richard.....Ware

## METROPOLITAN DAIRY TECHNOLOGY SOCIETY

*President*, S. H. Harrison.....New York, N. Y.  
*Vice-President*, Richard S. Doughty, Hoboken, N. J.  
*Secretary-Treasurer*, F. C. Button, New Brunswick,  
 N. J.  
*Sergeant-at-Arms*, D. X. Clarin..New York, N. Y.

MISSOURI ASSOCIATION OF MILK AND FOOD  
SANITARIANS

*President*, E. C. Loren.....Columbia  
*Vice-President*, Dr. I. H. Baird.....St. Joseph  
*Secretary-Treasurer*, Glenn M. Young.....  
 State Board of Health, Jefferson City  
*Acting Secretary-Treasurer*, Charles E. Carl....  
 State Board of Health, Jefferson City

PACIFIC NORTHWEST ASSOCIATION OF DAIRY AND  
MILK INSPECTORS

*President*, A. W. Metzger.....Salem, Ore.  
*Vice-President*, E. W. Soper.....Arlington, Wash.  
*2nd Vice-President*, R. D. Bovey.....Boise, Idaho  
*Secretary-Treasurer*, Frank W. Kehrl, Portland,  
 Ore.

## PHILADELPHIA DAIRY TECHNOLOGY SOCIETY

*President*, Dr. H. Kenneth Wilson.....  
 Sylvan Seal Dairies, Phila.  
*First Vice-President*, Thomas Waddell.....  
 Philadelphia Milk Exchange, Phila.  
*Second Vice-President*, William M. Taylor.....  
 Cherry-Burrell Corp., Phila.  
*Secretary-Treasurer*, Wesley S. Holmes.....  
 Philadelphia Dairy Council, Phila.  
*Assistant Secretary*, Miss Jane Collins.....  
 Supplee-Wills-Jones Milk Co., Phila.

## TEXAS ASSOCIATION OF MILK SANITARIANS

*President*, Taylor Hicks.....San Antonio, Texas  
*1st Vice-President*, F. C. Armstrong, Fort Worth,  
 Texas.  
*2nd Vice-President*, R. N. Hancock, McAllen,  
 Texas.  
*Secretary-Treasurer*, G. G. Hunter, Lubbock, Texas.

## VIRGINIA ASSOCIATION OF MILK SANITARIANS

*President*, J. W. Robertson.....Lynchburg  
*Vice-President*, C. B. Neblett.....Richmond  
*Secretary-Treasurer*, H. P. Jolly, Health Depart-  
 ment, Norfolk.

## WEST VIRGINIA ASSOCIATION OF MILK SANITARIANS

*Chairman*, Donald K. Summers, Charleston 1,  
 W. Va.  
*Secretary-Treasurer*, J. B. Baker, Department of  
 Health, Charleston, W. Va.

## Florida Milk Sanitarians Meet at Gainesville

The Florida Association of Milk Sanitarians met at the Dairy Products Laboratory on the University of Florida campus April 7, 8 and 9 for their third annual meeting and conference. Eighty people registered for the meeting including, in addition to Association members, forty interested producers and milk plant operators. During the conference thirteen applications for membership in the Association were received bringing the total membership to forty-seven, the largest since organization of the Florida Association.

The varied program of topics presented and discussed was of current

interest to the different groups present. Representatives of the State Board of Health discussed phases of their work as related to functions of Milk Sanitarians. Dr. George Hopson of the DeLaval Separator Company discussed and demonstrated new techniques in modern milking methods. Mr. L. E. Bober of Babson Brothers, Inc., discussed cleaning of dairy equipment in relation to production of quality milk. Other lectures and group discussions completed a full three day program.

L. R. ARRINGTON  
 Secretary-Treasurer

## COMMITTEES

### INTERNATIONAL ASSOCIATION OF MILK SANITARIANS

#### APPLIED LABORATORY METHODS:

K. G. WECKEL, Chairman, University of Wisconsin, Madison 6, Wisconsin.  
 Franklin C. Clark, State Dept. of P. H., Montgomery, Alabama.  
 L. V. Rowles, Topeka City-St. Lawrence County Health Dept., Topeka, Kansas.  
 Milton R. Fisher, Dept. of P. H., St. Louis, Missouri.

#### DAIRY FARM METHODS:

MERLE P. BAKER, Chairman, Iowa State College, Ames, Iowa.  
 J. F. Blacklock, Health Dept., Hamilton, Ontario.  
 C. P. Bletch, Maryland and Virginia Milk Prod. Assoc., Washington, D. C.  
 L. E. Bober, Babson Bros., Chicago, Ill.  
 L. Wayne Brown, Wisconsin Dept. of Agriculture, Madison, Wis.  
 R. L. Griffith, City Health Dept., Oakland 12, California.  
 R. M. C. Harris, City Health Bureau, Richmond, Virginia.  
 George H. Hopson, DeLaval Separator Co., New York City, N. Y.  
 M. M. Miller, U. S. Public Health Service, Dist. 8, Denver, Colorado.  
 E. H. Parfitt, Evaporated Milk Assoc., Chicago, Ill.

#### COMMUNICABLE DISEASES AFFECTING MAN:

W. P. S. HALL, Chairman, Department of Health, Toledo, Ohio.  
 R. F. Cowley, National Technical Milk Commission, Havana, Cuba.  
 R. G. Flood, San Francisco Medical Milk Commission, San Francisco, Calif.  
 J. G. Hardenbergh, American Veterinary Med. Assoc., Chicago 5, Illinois.  
 I. A. Merchant, Iowa State College, Ames, Iowa.  
 A. R. B. Richmond, Department of Health, Toronto, Ontario.

#### FROZEN DESSERTS SANITATION:

F. W. FABIAN, Chairman, Michigan State College, East Lansing, Mich.  
 W. C. Cameron, Dept. of Agriculture, Ottawa, Canada.  
 O. A. Ghiggoile, State Dept. of Agriculture, Sacramento, California.  
 Ralph E. Irwin, Irwin's Dairy Inc., Camp Hill, Penn'a.  
 Andred J. Krog, Health Officer, Plainfield, New Jersey.  
 John M. Scott, State Dept. of Agriculture, Gainesville, Florida.

#### COMMITTEE ON ORDINANCES & REGULATIONS:

W. D. TIEDEMAN, chairman, New York State Health Dept., Albany, New York.  
 C. A. Abele, Board of Health, Chicago, Ill.  
 C. J. Babcock, U. S. Department of Agriculture, Washington, D. C.  
 H. L. De Lozier, City Health Department, Louisville, Ky.  
 Herbert J. Dunsmore, Battle Creek Health Dept., Battle Creek, Michigan.  
 A. W. Fuchs, U. S. Public Health Service, Washington, D. C.  
 O. A. Ghiggoile, State Dept. of Agriculture, Sacramento, California.

#### COMMITTEE ON RESOLUTIONS:

ALL EX-PRESIDENTS OF ASSOCIATION IN ATTENDANCE AT THE CONVENTION.

#### SANITARY PROCEDURE:

C. A. ABELE, Chairman, Board of Health, Chicago, Illinois.  
 E. B. Buchanan, Cleveland Health Dept., Cleveland, Ohio.  
 Paul Corash, New York City Dept. of Health, New York City, N. Y.  
 C. B. Dalzell, Cherry-Burrell Corp., Little Falls, New York.  
 Milton R. Fisher, Division of Health, Dept. of Public Safety, St. Louis, Mo.  
 A. W. Fuchs, U. S. Public Health Service, Washington, D. C.  
 Ralph E. Irwin, Irwins Dairy Inc., Camp Hill, Penn'a.  
 I. M. Marty, City Health Department, Baltimore, Md.  
 Sol Pincus, New York City Dept. of Health, New York City, N. Y.  
 George W. Putnam, Creamery Package Mfg. Co., Chicago, Illinois.  
 W. D. Tiedeman, New York State Health Department, Albany, New York.  
 Harold Wainess, State Board of Health, Portland, Oregon.  
 C. W. Weber, New York State Dept. of Health, Albany, New York.

## Correspondence

January 15, 1947

Mr. J. H. Shrader, Editor  
Journal of Milk Technology  
23 East Elm Avenue  
Wollaston, Massachusetts

Dear Sir:

The "‘Doctor Jones’ Says—" article in your November-December issue in my opinion was a very unfortunate presentation of a very important phase of food sanitation. For such an article to appear in print in any recognized publication would be bad but definitely doubly so when published in the *Journal of Milk Technology*.

It has taken many years to educate the public in general, and more especially the public which offers food for sale, that there is a definite connection between disease and dirt, or, if you please, filth and sanitation and health.

It does not take a great stretch of the imagination to realize that health requirements in food dispensing places are closely allied to cleanliness. The health card is merely a written symbol of recognition of the above facts and manifests an awareness on the part of food dispensers that the consuming public is entitled to protection for their money.

If some correction needs to be made in the manner in which health cards are obtained, then let us make some adjustments, but don't let us begin to break down a good educational program. Clean eating places and clean, healthy people operating them is such a pleasant thought!

Very truly yours,

H. H. ROTHE,

State Dairy Supervisor.

### My Statement on What "Doctor Jones Should Not Have Said"\*

If a layman, who understands little of disease and communicability of disease, is so impressed by being required to submit to physical examination as to make him cognizant of the fact that good health and cleanliness are essential in serving the public in any manner, then the program is justified both from the standpoint of prevention of disease and as an educational program as well.

If the examinations are not properly made and the cost too high, then correction and not elimination should be made.

I challenge the statement, "The question is whether they (the public) recognize how little actual protection the consuming public is getting in return for its expenditure for *routine* medical examinations." If you or I could be saved just one spell of sickness by the program in question, I am sure we

would admit that the program is worth the cost. And who is to prove that we have not already been saved such a spell of sickness?

To admit that health authorities have been wrong about this would have a psychological effect very detrimental to the work and one that would be hard to overcome.

For the many intelligent food handlers that we have this program is not so important, but it is for the ignorant and those who just do not give a damn. By eliminating the bad ones we make more room for the good ones, and in that way their inconvenience is compensated for.

My principal objection to the original "Doctor Jones Says" article is the casual treatment of a serious subject matter. Dr. Brooks' reply to my letter on the other hand is in a different tone and contains remedial references and educational suggestions. However, in Dr. Rice's plan, as out-

\* Submitted by Mr. Rothe at request of Editor.

lined by Dr. Brooks, a physical examination is still resorted to "in any individual case where there was reason to suspect the existence of a potentially dangerous condition". This plan implies action after a diseased condition has manifested itself in some manner and perhaps after some spreading; then "investigations would be made which would be thorough and searching enough to insure dependable results".

I should like to ask Dr. Brooks how the above mentioned "potentially dangerous condition" can be uncovered

without a *routine* examination so as to make possible a more thorough treatment.

In conclusion I will frankly admit that many health cards are issued in a haphazard manner with very little physical examination. These of course have very little value. On the other hand a proper examination would be of value to the applicant as well as to the general public.

H. H. ROTHE, D.V.M.,  
State Dairy Supervisor.

March 6, 1947

#### Reply to Mr. Rothe's Letter\*

The subject of the "Doctor Jones" dissertation to which Mr. Rothe objects was the requirement of *routine medical examinations* of food-handlers in public eating places. The crux of the matter was in the one sentence: "We've learned from experience that these routine examinations not only cost a lot of money but they don't accomplish what they're supposed to."

The truth of that statement was well substantiated by the results of the investigation which led Dr. John L. Rice, when he was Health Commissioner of New York City, to rescind such a requirement which had been in effect there for many years. It was found that the aggregate cost of the routine examinations had been out of all proportion to the very meager results in the way of discovery, for example, of typhoid carriers. At the same time it was recognized, on the basis of laboratory experience, that the "negative" laboratory reports following such routine examinations gave practically no assurance of freedom from the carrier condition.

New York City substituted a pro-

gram of education of food handlers and their employers as to the potential dangers and the precautions necessary to avoid them. This was with the understanding that, in any individual case in which there was reason to suspect the existence of a potentially dangerous condition, investigations would be made which would be thorough and searching enough to insure dependable results. The New York State Department of Health heartily endorsed Dr. Rice's action.

The "health card", Mr. Rothe says, is a "written symbol" which "manifests an awareness on the part of the food dispensers that the consuming public is entitled to protection for their money". The question is whether they recognize how little actual protection the consuming public is getting in return for its expenditures for *routine medical examinations*.

It has taken many years to educate the public, Mr. Rothe says, and we should not "begin to break down a good educational program". I quite agree. We should not overlook the fact, however, that education is progressive and continuous, not static.

\* Submitted by Dr. Brooks at request of Editor.

Discarding outmoded ideas and amending others to conform to new developments, discoveries, and understandings is a part of the process. A "good educational program" is one which is based on truth and is flexible enough to conform to changing conditions and ideas. Such a program will not be broken down easily.

Whether what "Doctor Jones" said in the dissertation in question was "unfortunate" or timely might be considered to depend, it would seem, on whether or not what he said was true and scientifically sound. If he made untrue or misleading statements he should be called to account.

P. B. B.

---

### EFFECT OF COCOA ON CALCIUM UTILIZATION

Cocoa added to milk or ice cream in normal quantities apparently has little effect on the utilization of calcium by the adult human body.

This was the conclusion reached from a series of experiments at the University of Illinois by Dr. H. H. Mitchell and Dr. Janice M. Smith. The data derived from these experiments, which were carried out both on human beings and on rats, revealed no deleterious effects on calcium metabolism among the human subjects.

The research was initiated by the National Dairy Council after previous animal experiments at Massachusetts State College had led research workers at that institution to believe that cocoa added to milk might interfere with the utilization of milk calcium by children.

The Massachusetts research by Mueller and Cooney was carried out on rats, but was interpreted generally as having an application to child nutrition. The Illinois research was undertaken to check this interpretation since chocolate is one of the public's favorite flavors and is used in flavoring dairy products, especially milk and ice cream.

Nutritionists quickly observed, however, that the Massachusetts experiments were conducted with cocoa in the ratio of 3.3 parts milk to 1 part cocoa, whereas in chocolate milk ordinarily the ratio is 13 parts milk to 1 part cocoa.

Seven young women, ranging in age from 18 years to 22 years, volunteered for the Illinois tests which extended over 51 experimental periods for four days each.

A medium priced American process brand of breakfast cocoa of the quality normally used in making dairy syrups for the manufacture of chocolate milk and chocolate ice cream was chosen for the tests. (The cocoa

used by the Massachusetts investigators was a low-grade, low cost brand.)

The cocoa was added to the diets in amounts ranging from approximately two teaspoons to as much as 12 teaspoons daily. It was incorporated in milk alone, in ice cream, in cookies, in candy and in syrup.

In addition, the Illinois group repeated on rats the experiment conducted at Massachusetts State College, but extended it to include good grades of cocoa, one of the cocoas being the brand used in the human tests.

It has long been known that rats are incapable of utilizing calcium oxalate. Calcium oxalate is an extremely insoluble salt formed when oxalate acid in food unites with calcium. There is some evidence that this calcium salt may be utilized by human beings, however.

Other experiments, notably those with spinach—a food which contains enough oxalic acid to combine with all the calcium in the vegetable itself—have proved that rats cannot utilize the calcium oxalate from this source. A number of experiments have indicated that human beings may be able to utilize the calcium in spinach to a considerable extent.

An interesting finding in the human experiment was that the human body can tolerate up to about 1 ounce (35 grams) of cocoa daily, approximately 12 teaspoons. In order to consume this amount of cocoa by eating chocolate ice cream, it would be necessary to eat 1½ quarts per day. To consume this amount of cocoa in chocolate milk it would be necessary to drink 3½ quarts daily, whereas the average daily cocoa consumption in the United States is equivalent to that contained in only 1 pint of chocolate milk.

## New Members

### ACTIVE

- Collins, Lt. Col. Wm. F., Veterinary Corps, U.S. Army, School of Veterinary Medicine, University of Pennsylvania, Philadelphia, Pennsylvania.
- Dunsmore, Herbert J., Calhoun Co. Health Dept., Battle Creek, Michigan.
- Fellers, Carl R., Mass. State College, Amherst, Massachusetts.
- Fergusson, Arthur B., Asst. Health Officer, Health Department, Rocky Mount, North Carolina.
- Haynes, Edwin R., Bacteriologist, Bacterio-Chem Laboratories, 36 Janes Street, London, Ontario, Canada.
- Hiscock, Prof. Ira V., Yale University School of Medicine, New Haven, Conn.
- Matthews, Dr. W. W., Sanitary Officer, County Health Dept., Sebring, Florida.
- Moffat, Dr. A. E., Department of Public Health, (Director of Laboratories) Room 312, City Hall, Toronto 1, Ontario, Canada.
- Morgan, V. C., Jackson County Health Dept., Medford, Oregon.
- Olmsted, Philip, Saginaw Health Department, Saginaw, Michigan.
- Robinson, Harold B., U.S. Public Health Service, 15 Pine Street, New York 5, N. Y.
- Skiver, F. M., Michigan Dept. of Agriculture, State Building, Lansing, Michigan.
- Taylor, Darold W., Sanitarian, U.S. Public Health Service, 4326 Old Brook Rd., Apt. 21, Richmond 22, Va.
- Utes, Harry H., Sr. Dist. Sanitarian, 510 Court Street, The Dalles, Ore.

### ASSOCIATE

- Akin, R. Paul, The Borden Co., Evans Mills, New York.
- Allen, Robert O., (Dr.) Crowley's Milk Co., 8 Davis Street, Binghamton, New York.
- Anderson, J. A., Dairy Sanitarian, Johnson & Johnson, 4949 W. 65th Street, Chicago, 38, Illinois.
- Bailey, E. L., Dairymen's League Co-Op Assoc., Inc., South Street, Edmeston, New York.
- Baker, Dr. D. T., Dairymen's League Co-Op Assoc., Inc., 731 Main Street, Poughkeepsie, New York.
- Baker, Irving, Iowa & Lafayette County Co-op, 612 Wisconsin Street, Mineral Point, Wisconsin.
- Barber, W. J., N. Y. City Dept. of Health, 7½ Champion Street, W. Carthage, New York.
- Barden, Leon E., The Borden Company, Antwerp, New York.
- Barkman, Vernon L., Chautauqua Malted Milk, Inc., 69 E. Chautauqua Street, Mayville, New York.
- Bauman, Robert W., Technical Control & Chemist, Sanna Dairies, Inc., Menomonie, Wisconsin.
- Beardsley, Samuel, Lisle Producers' Co-Op, Whitney Point, New York.
- Begeman, L. H., Health Department, Room 207, City Hall, Lansing, Michigan.
- Blizzard, Ernest Z., 100 West St., (Aldovin Dairy) Tunkhannock, Pennsylvania.
- Bowles, Harold, Dairymen's League Co-Op Assoc., Inc., Crown Point, New York.
- Boxell, Kenneth C., Plant Manager, 219 Waldron Street, West Lafayette, Indiana.
- Brown, Onslow L., Sheffield Farms Co., Inc., Vergennes, Vermont.
- Burns, Clarence, Oakite Products, Inc., 50 Mississippi Street, Buffalo, New York.
- Cameron, J. Robert, Washtenaw County Health Dept., Ann Arbor, Michigan.
- Clearo, John F., Reids Union Dairy, Oneida, New York.
- Coddington, C. E., Newark Milk & Cream Co., 17 Allen Street, Deposit, New York.
- Coleman, Paul E., Quality Control & Sanitation, Otto Milk Company, R.D. 3 Bellevue, Pittsburgh 2, Pennsylvania.
- Comyns, Arnold T., Cowles Detergent Company, 253 Davidson Street, Buffalo, New York.
- Connors, Edward W., Cattaraugus Co. Dept. of Health, 3 Rockwell Avenue, Ellicottville, New York.
- Cromley, Roy H., State Dairy Inspector, 226 Hancock Avenue, Detroit, Michigan.
- Davis, John Gilbert, Express Dairy Company, 133 Euston Road, London, N.W. 1, England.
- Davis, Walter C., Geneva Dept. of Health, 83 Oak Street, Geneva, New York.
- Day, Harry L., Dairymen's League Co-Op Assoc. Inc., West Street, Fort Plain, New York.
- Decker, George H., Dairymen's League Co-Op Assoc., Inc., 33 Liberty Street, Liberty, New York.
- DiLoreto, Gilbert R., Calhoun County Health Dept., Battle Creek, Michigan.
- Dolan, J. E., 424 State Office Bldg., Denver 2, Colorado.
- Engels, L. W., Grand Traverse County Health Dept., Traverse City, Michigan.

- Evans, Stanley A., Evans Dairy, 204 Webster Avenue, Syracuse, New York.
- Feagles, J. H., Jr., Dairymen's League Co-Op Assoc. Inc., Liberty, New York.
- Feiler, Vernon L., Elmwood Cooperative Creamery Assoc., Elmwood, Wisconsin.
- Fitchett, Alson M., Fitchett Bros., Inc., Creek Road, Poughkeepsie, New York.
- Flack, D. S., Dairymen's League Co-Op Assoc. Inc., 11 W. 42nd Street, New York 18, N. Y.
- Frick, D. B., Pharmacist, Box 994, Sequim, Washington.
- Gardner, Douglas R., Sheffield Farms Company, Inc., Hobart, New York.
- Gary, Harold J., Queensboro Farm Products, Inc., 11 Miner Street, Canton, New York.
- Gray, Alton L., The Pfaudler Co., 89 East Avenue, Rochester, New York.
- Grunge, Walter H., N. Y. City Dept. of Health, 17 Second Street, Malone, New York.
- Guthrie, Richard S., (Dr.) DeLaval Separator Co., DeKalb, Illinois.
- Haag, Joseph A., 1527 Brookline Blvd., Pittsburgh 26, Pennsylvania.
- Halsted, W., Dairymen's League Co-Op Assoc., Inc., 353 N. 7th Street, Newark, New Jersey.
- Hanson, George V., President, Dairy Fresh Creamery Inc., 71 West Island Avenue, Minneapolis 1, Minnesota.
- Harris, Dr. T. W., Hinman Milking Machine Company, 451 Elizabeth Street, Oneida, New York.
- Hawkins, Orville J., Quality Control Committee, 2276 Como Avenue, St. Paul 8, Minnesota.
- Hollenbeck, Frank, Dairymen's League Co-Op Assoc., Inc., Fort Plain, New York.
- Hurlbutt, Leo, Sheffield Farms Co., Inc., New Berlin, New York.
- Jewett, George, Queens Farm Dairy, Martville, New York.
- Kassube, Kenneth F., Quality Control Officer, Kraft Foods Co., Melrose, Minnesota.
- Klueter, Harry, 1 West Main Street, Madison 3, Wisconsin.
- Kulahosky, Bernard J., Dairymen's League Co-Op Assoc., Inc., Callicoon, New York.
- Leach, Bradford S., Owner, Dairy Laboratory Service, 20 Sudbury Road., Concord, Massachusetts.
- Levi, Irving, Plant Manager, Queens Farms Dairy, 341 Beach 40 Street, Far Rockaway, New York.
- Lynch, Dr. R. J., Mansfield, Pennsylvania.
- Lyons, Nelson S., Jr., General Ice Cream Co., North Bangor, New York.
- Mallett, Cliff, Edmonton Rural Health District, Qu'Appelle Bldg., Edmonton, Alberta.
- Manchester, F. W., Dairymen's League Co-Op Assoc., Inc., Leonardsville, New York.
- McBride, David A., Jr., Sheffield Farms Co., Inc., Walton, New York.
- McMichael, H. S., Director of Laboratories, Meadow Gold Dairies, Inc., 126 Denniston Avenue, Pittsburgh 6, Pennsylvania.
- McPeak, Thomas L., 7505 Bradbury Avenue, Ft. Wayne 6, Indiana.
- Mosher, Donald J., Dairymen's League Co-Op Assoc., Inc., 9 W. State Street, Lowville, New York.
- Moss, Kenneth W., Department of Health, 432-78th Street, Niagara Falls, New York.
- Moynihan, Dr. Walter A., Food Control & Sanitation Director, Brant County Health Unit, Brantford, Ontario.
- Nadler, Earl D., Nadler Bros. Dairy, 6 Collins Street, Amsterdam, New York.
- Northrup, Dewey M., Dairymen's League Co-Op Assoc., Inc., Andover, New York.
- Obourn, J. O., Dept. of Health, 15 Houghton Circle, Corning, New York.
- Oggel, Henry F., Kalamazoo, Michigan.
- Ollivett, Edith, Dairymen's League Co-Op Assoc., Inc., 731 Main Street, Poughkeepsie, New York.
- Orris, Charles M., Jr., Lancaster Milk Company, 210 Peyton Rd., York, Pennsylvania.
- Pickard, Ralph C., Calhoun County Health Dept., Marshall, Michigan.
- Pouliot, Paul, Field Technician, 2624 Decarie Blvd., Montreal 28, Canada.
- Richardson, Treva M., Sanitarian, Pixley & Ehlers, 77 W. Jackson Blvd., Chicago 1, Illinois.
- Roe, Robert C., Milk Plant Specialties Corp., 125 Westminster Road, Rochester, New York.
- Roehr, Roy E., 500 N. Court Street, Sparta, Wisconsin.
- Rogers, John C., Sheffield Farms Co., Inc., 35 N. Broad Street, Norwich, New York.
- Rohe, Clarence, Universal Milking Machine Co., 125 S. Franklin Street, Syracuse, New York.
- Rollema, Peter R., Dairymen's League Co-Op Assoc., Inc., Windham, New York.
- Rollin, R. E., Seneca Dairy, 4001 S. Salina Street, Syracuse, New York.
- Ryan, Joseph, Schoharie County Co-Op, 18 Elm Street, Cobleskill, New York.
- Scheib, Bernard J., N. Y. State Dept. Agriculture & Markets, State Office Building, Buffalo, New York.
- Smith, Mason J., Dickinson County Health Unit, Iron Mountain, Michigan.
- Stark, Harleigh, Dairymen's League Co-Op Assoc., Inc., N. Main Street, Flemington, New Jersey.



- Teal, Emerson, 155 W. Washington Street, Romeo, Michigan.
- Ten Eyck, R. N., United Dairy Machine Corp., 1090 Culver Road, Rochester 9, New York.
- Thayer, Donald E., Poland Milk Producers Co-Op, Box 182, Poland, New York.
- Thompson, M. H., (Dr. Engr.) Rensselaer Co. Dept. of Health, 7th & State Street, Troy, New York.
- Turner, Harvey G., Jr., Sheffield Farms Co., Inc., 202 Lindbergh Blvd., Teaneck, New Jersey.
- VanStrander, Fredric, Hinman Milking Machine Co., 340 Seneca Street, Oneida, New York.
- VanVorce, Donald, Middletown Milk and Cream Co., 4 Griffin Avenue, Fort Edward, New York.
- Ward, J. L., Merchandising Manager, Kendall Mills, Walpole, Massachusetts.
- Warren, David, R. 4, Burlington, Wisconsin.
- Wehr, Charles R., Sheffield Farms Co., Inc., Bellefonte Pa.
- Weinberg, Sidney, Freeman's Dairy, Inc., 721 Manida Street, Bronx, New York City.
- White, James C., Cornell University, Ithaca, New York.
- Whitney, Lee, Dairymen's League Co-Op Assoc. Inc., 200 S. Walnut Street, Elmira, New York.
- Williams, Robert R., Sququoit Valley Farmers Co-Op Inc., 491 French Road, Utica, New York.
- Wilson, John L., Director of Research, Economics Laboratory, Inc., 914 Guardian Bldg., St. Paul, Minnesota.
- Wilson, Milo J., Mason County Health Dept., Ludington, Michigan.
- Wortman, George E., (Dr.) City Veterinarian, 139 Main Street, Beacon, New York.
- Ziegler, Ray E., Hovey Stanter & Co., N. Race Street, Richland, Pennsylvania.

Make room reservations now for the thirty-fourth annual meeting.  
Hotel Schroeder, Milwaukee, Wisconsin, October 16-18.

## “Dr. Jones” Says—\*

There’s a half-finished house I go by every now and then. This fellow started it just before the war. He was all one summer digging the cellar and laying the foundation. By the end of another year or so he’d got the side walls up. Then, whether he ran out of money, couldn’t get the material or what—he quit. He never did get a roof over it. It’s stood there, ever since, exposed to the weather: everything he put into it practically wasted. I don’t imagine he could afford to lose it. And I was thinking, the other day: that’s a perfect illustration of this experience we call frustration.

Most anywhere you go, you can see examples of frustrated people: folks that’ve failed at one thing after another ’til they’ve gotten discouraged and quit. The same time, you see people with poor heredity that, so far as you can see, had no better opportunities: they’ve had their failures but they’ve kept plugging. If they haven’t got to the top, they’ve become useful and respected citizens. What makes the difference? I wonder how The Quiz Kids’d answer that one.

Well, sometimes a difference in intelligence seems to be the big factor, though I’ve seen a supposed nitwit

grow into a successful business man. But, oftener than not, it goes back, again, to those early childhood impressions.

The life of every young child is a succession of frustrations. He reaches for the moon and it ain’t there. He’s told he’s “a little man”—tries to do what his father does and fails. He’s put up in front of a crowd, maybe in Sunday School, with his “piece” half learned and can’t remember it. That’s the time when he needs to be shown that, while no one can “unscrew the unscrutable,” because he can’t do everything don’t mean he can’t do anything. It’s experience (his and other folks’) that’ll develop the ability to select and accomplish undertakings that’re possible. He should learn that, if he has one success to a dozen failures, he don’t need to be discouraged over his batting average.

Belittling a child’s ability may be the wet blanket that’ll smother his initiative before he’s fairly started. He needs to learn, on the other hand, that it ain’t usually good judgment to go out with a slingshot to meet modern Goliaths. The better he’s prepared the less likely he is to fail. The jawbone of an ass that was reported to’ve slain a thousand Philistines—it was Samson and not the ass that did it.

PAUL B. BROOKS, M.D.

\* *Health News*, New York State Department of Health, Albany, N. Y., December 2, 1946.