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57TH ANNUAL MEETING
August 17, 18, 19, 20, 1970
Roosevelt Motor Hotel
Cedar Rapids, Iowa

Official Publication

International Association of Milk, Food and Environmental Sanitarians, Inc.

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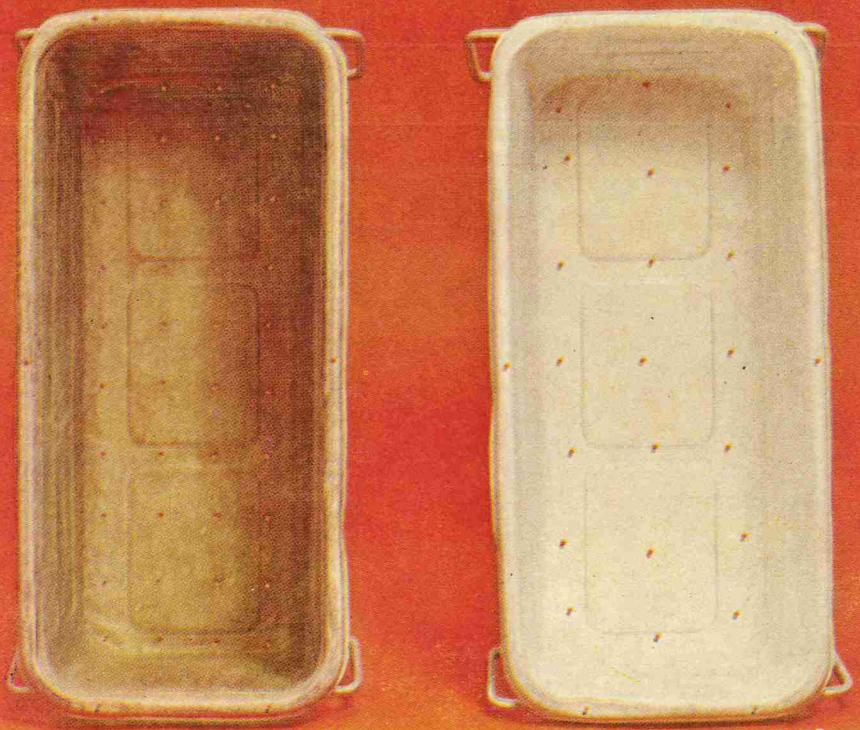

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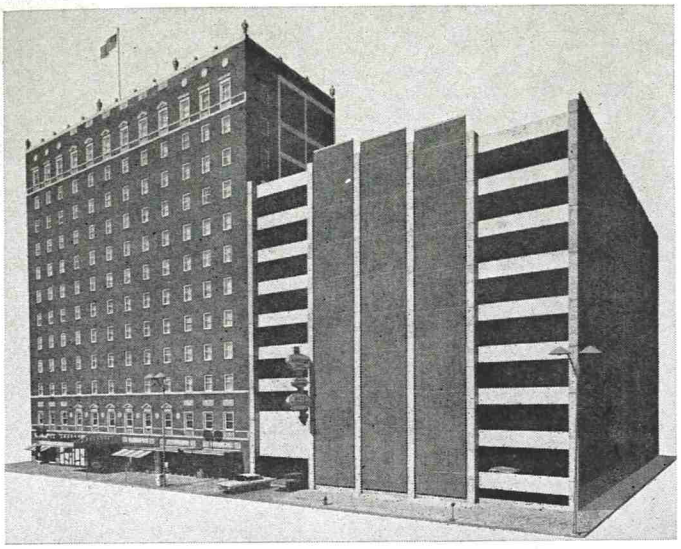

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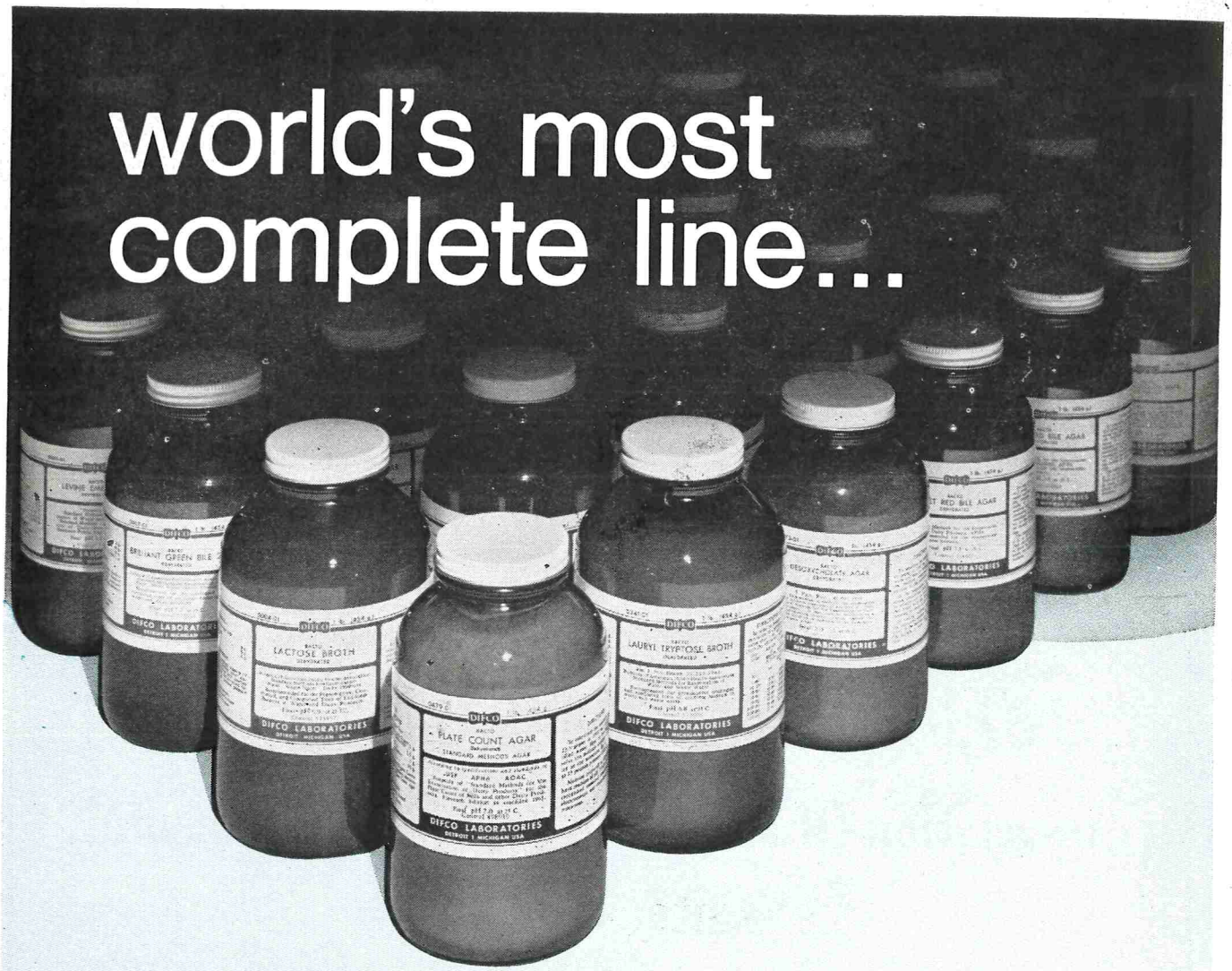

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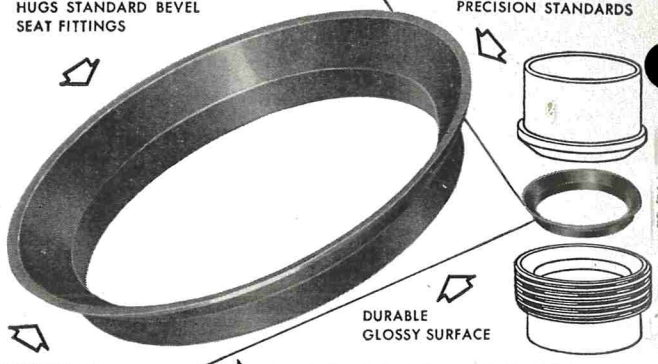

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BEHAVIORAL STRESS AND THE CELL COUNT OF BOVINE MILK

W. G. Whittlestone, R. Kilgour, H. de Langen, and G. Duirs

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(Received for publication September 8, 1969)

Abstract

Normal dairy cows were "stressed" by simple isolation from the herd and chasing by a dog. Quarter milk samples showed, in some instances, a marked rise in cell count, the quarters responding having, in general, a history of infection though the counts were normal before stressing. An injection of 50 units of ACTH produced similar though less marked effects.

The most commonly used diagnostic test for mastitis in the field is the California Mastitis Test *(7)* based on the rapid increase in viscosity which occurs when certain surface active agents are added to milk which contains cells. The reaction is thought to result from the "unravelling" of the nuclear DNA. The test is therefore an indication of the presence of nucleated cells of whatever origin.

There is evidence from a number of origins that "stress" can influence the cell count of bovine milk. Traditional farming lore includes an ancient belief that milk is changed in some way in the cow by a thunder storm, and many modern farmers attribute inflamed quarters to sudden changes in the weather. This belief is reinforced by the data shown in Fig. 1. During an experiment at this Station the level of DNA in two experimental herds was followed throughout a lactation. At one stage there was a sudden cold storm, the effects of which are shown in the rise in both herds of the average DNA level of the milk. Nelson et al. *(6)* have shown the effect of excessive midday heat on the cell content of milk and Elliott *(3)* has implicated management stresses in a rise in cell count.

Studies on large domestic animals including cows in a large scale Hebb-Williams' maze *(4)* suggested that the experimental animals may become stressed in circumstances which are not unlike many which arise in the course of normal dairying.

Methods

As an index of response to the injection of ACTH, blood cortisol levels were estimated using a modification of the method of Mattingly *(2, 5)*.

Cell count was estimated using the viscometric method of Whittlestone and Allen *(9)*, or by determining the DNA level of the milk sample *(1, 8)*. Viscosities are expressed as a ratio of the viscosity of the milk-reagent mixture to that of water at the same temperature, whereas DNA is given in micrograms per milliliter (7 μg of DNA corresponds to 10^6 cells *(8)*. The animals were "stressed" with two common farming procedures—the isolation of the cow in a paddock while the rest of the herd returned to pasture, and being chased by a dog along the road to the dairy.

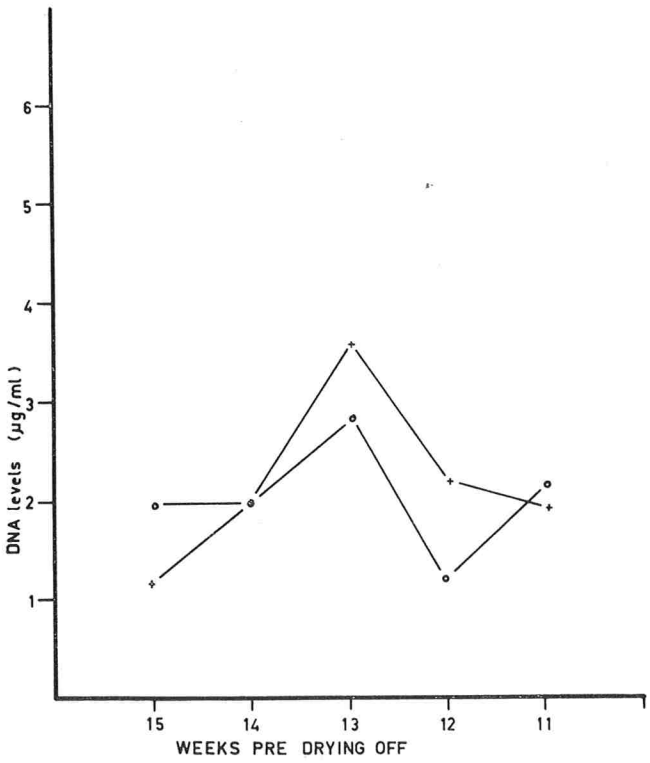

Figure 1. The effect of stormy weather on the cell count of bovine milk measured as DNA. Two groups of cows were being studied under two milking systems. Three days before the 13th week prior to drying off there was a sudden cold storm followed by a rise in the cell content of the milk of both groups.

Results

An indication of the cortisol response of a normal cow was obtained by injecting 40 units of ACTH into one of the herd. The response is set out in Fig. 2.

Six cows were chosen from the experimental herd for the first "stress" experiment. Just before normal milking, milk samples were drawn for leucocyte assessment, and one cow at a time was selected to remain behind after the remainder of the herd was driven back to the paddock. Milk samples were taken at intervals from each quarter and leucocyte

TABLE 1. THE EFFECT OF ISOLATION AND DOG-CHASING ON MILK CELL COUNT. VALUES ARE GIVEN AS VISCOSITY RATIOS.

		Control	Control	Isolated	Isolated	Isolated	Before dog chasing	Dog chasing	After dog chasing	Back to herd	Back to herd
Hours		0	16	19	24	40	41	41.5	41.75	48	72
Cow No.	LF	3.3	2.0	8.7	6.3	3.0	2.4	2.5	2.7	1.0	2.5
	RF	1.3	1.0	4.0	1.8	1.0	1.7	1.7	1.7	1.0	2.2
351	LB	2.8	1.0	5.3	2.8	1.8	2.6	2.4	2.2	1.6	3.0
	RB	1.5	1.0	2.0	2.3	1.4	1.7	1.9	2.0	1.0	1.5
	LF	7.0	1.8	8.0	20+	11.0	1.9	1.0	9.3	2.9	2.4
	RF	2.5	1.2	4.3	3.3	2.5	1.7	2.4	2.4	1.1	1.3
7183	LB	2.7	2.0	20+	20+	10.0	2.1	2.4	3.6	2.3	1.2
	RB	2.3	1.0	3.5	2.1	2.1	1.4	1.7	1.3	1.0	1.8
	LF	3.3	2.0	8.7	6.3	3.0	2.4	2.5	2.7	1.7	1.7
	RF	1.3	1.0	4.0	1.8	2.7	1.7	5.0	5.3	2.7	1.3
709	LB	2.8	1.0	5.3	2.8	1.8	2.6	2.4	3.2	1.5	1.7
	RB	1.5	2.7	6.0	2.3	1.4	1.7	1.9	2.7	2.3	1.7
	LF	2.2	1.2	1.7	1.3	1.2	1.5	1.7	1.7	1.7	1.0
	RF	1.2	1.0	1.2	1.3	1.8	1.0	1.0	1.4	1.0	1.0
7169	LB	1.2	1.0	1.3	1.3	2.7	1.0	1.4	1.0	1.0	1.0
	RB	5.0	2.0	20+	20+	1.3	2.3	7.0	20+	2.0	2.7
	LF	1.3	1.3	3.3	20+	1.3	1.3	1.3	1.3	1.3	—
	RF	2.7	1.7	8.3	20+	1.7	1.3	3.0	3.0	1.7	—
705	LB	1.0	1.3	2.0	3.3	1.3	1.3	2.0	1.3	1.7	—
	RB	1.0	1.3	1.7	2.0	1.0	1.3	1.3	1.2	1.2	—
	LF	1.0	1.2	1.2	1.2	1.3	1.2	1.2	1.3	1.0	—
	RF	1.0	1.0	1.2	1.2	1.3	1.3	1.3	1.3	1.0	—
6149	LB	2.7	1.7	1.3	2.0	1.8	2.7	3.8	3.7	2.0	—
	RB	1.2	1.0	1.0	1.2	1.2	1.3	1.3	1.0	2.2	—

assessments made. The cow remained isolated for the remainder of the day and after the next morning milking, was again subjected to a "stress" by being chased by a dog along the road to the dairy. Immediately after this, milk samples were taken. The results are shown in Fig. 3 and Table 1.

One of the cows used in the above experiment (No. 7169) was given 50 units of ACTH intravenously, and the milk leucocyte count estimated with the viscometer. In addition DNA determinations were carried out. Fig. 4 shows the results.

The infection history of the quarters of the cows involved in the stress experiment is set out in Table 2. During another experiment in which these cows were involved, quarters showing a raised leucocyte count were subjected to a cultural examination. The results of this are shown in the table. In general the quarters which showed an elevation of cell count during stress had been infected though at the time of the experiment the cell levels were more or less normal.

DISCUSSION

The results clearly show the effect of management stress on the cell count of milk of dairy cows belonging to a normally managed herd. The responses of some of the quarters were extremely high. The figure 20+ represented the limits of the timer of the viscometer and so is the maximum viscosity which could be recorded by the instrument. Several samples showed this level of increase in viscosity as the result of management stressing. Such a level was not achieved with a dose of 50 units of ACTH given to cow 7169 which showed 20+ responses in two quarters as a result of the management stress experiment.

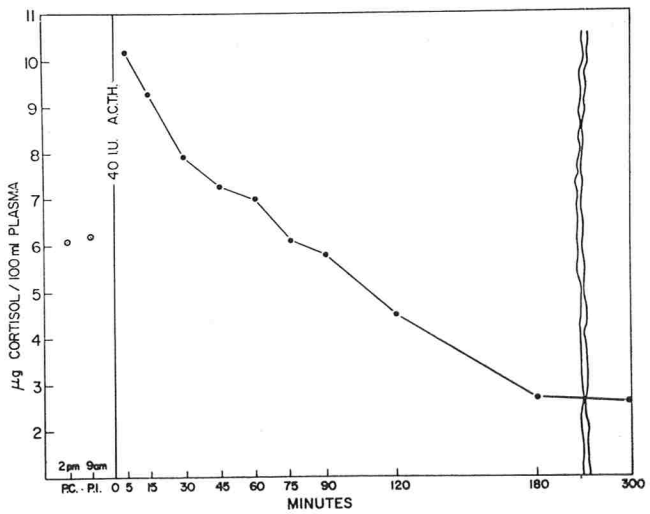

Figure 2. Cortisol levels in cow's blood following the intra-jugular injection of 40 units of ACTH.

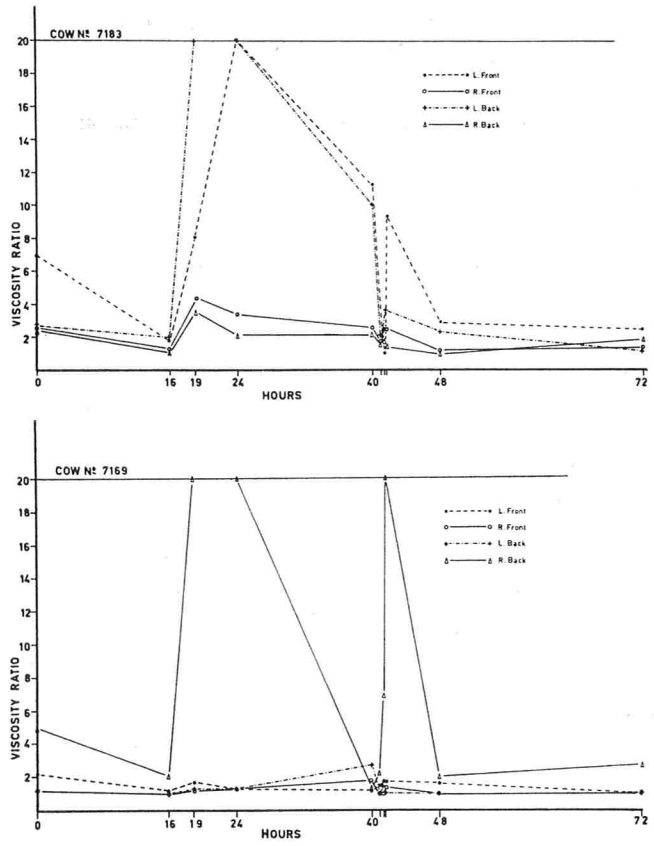

Figure 3. The effect of "stress" on the cell count of milk from two cows measured as CMT reaction viscosity. This is expressed as a ratio of the reacting milk viscosity to that of the reagent at the same temperature. Nineteen hours after the commencement of the experiment the cows were isolated representing the first "stress". At 41.5 hours after the commencement the cows were chased by a dog—the second "stress".

The very large difference in response of the individual quarters is a matter of great interest. This probably reflects the disease history of the individual quarters. At the time of the experiment there were no quarters showing a clincial response, and cow 705 had a quarter with the low viscosity reading of 1.3 which rose to 20+ as a result of stress, while two quarters with a similar viscosity reading immediately before the experiment, showed no marked change.

From the veterinarian's point of view, the most significant aspect of these results is the fact that the commonly used procedure of isolating a cow for examination can produce sufficient stress to cause a marked rise in the leucocyte count of the milk. However, it would appear that this rise reflects the disease history of the quarter. Milk samples taken under conditions not involving stress could be deceptive. Much more information on this phenomenon is needed before its practical implications can be fully understood.

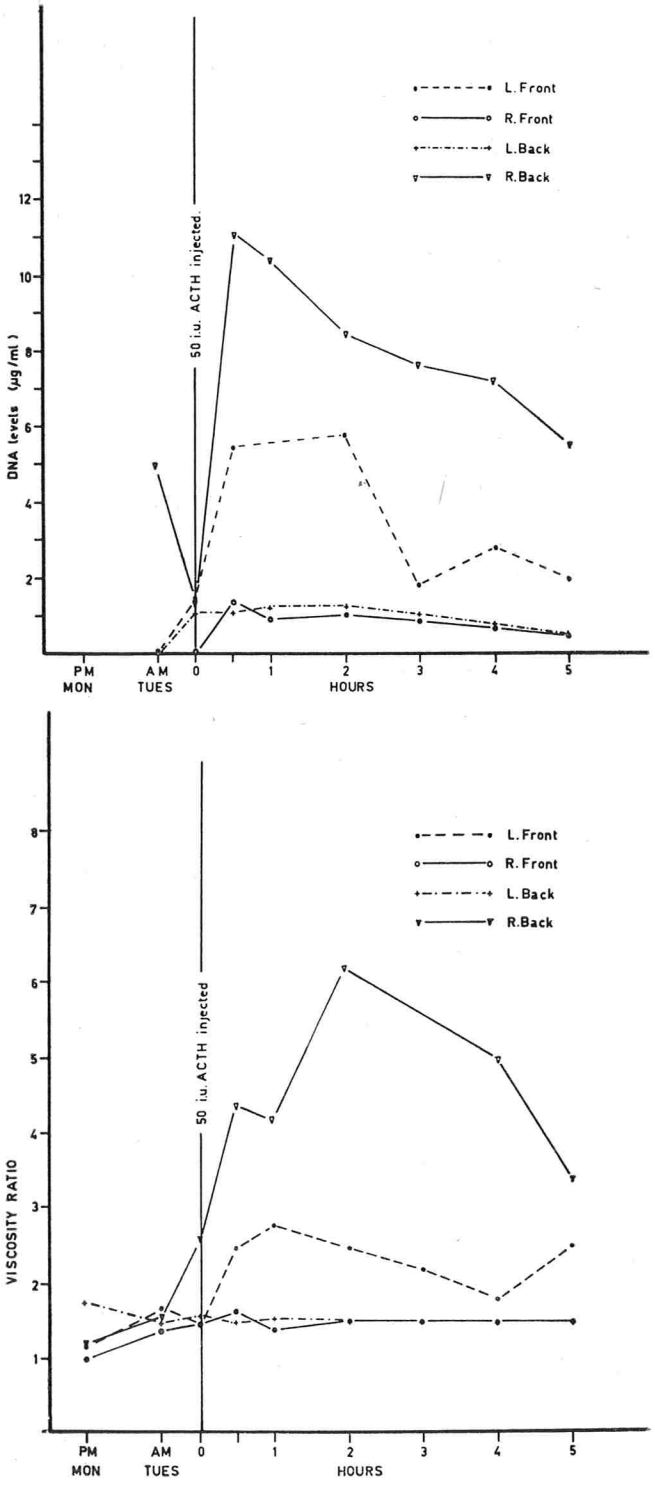

Figure 4. Cell count changes in milk following the injection of ACTH. Fifty units were injected into the jugular vein and the DNA level in the milk determined. CMT reaction was also measured using a viscometer.

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TABLE 2. THE INFECTION HISTORY OF THE QUARTERS OF THE COWS USED IN THE "STRESS" EXPERIMENTS. CULTURAL ASSESSMENTS WERE CARRIED OUT AT REGULAR INTERVALS AND THE RESULTS SET OUT AS FOLLOWS: M = MICROCOCCI; SP = STREPTOCOCCI; ST = STAPHYLOCOCCI; CB = *C. bovis*; – INDICATES THAT THE QUARTER WAS POSITIVE TO THE CMT BUT NEGATIVE BACTERIOLOGICALLY. THE NUMBERS INDICATE VISCOSITY RATIOS.[1]

Date	Cow 351				Cow 7183				Cow 7169				Cow 705				Cow 6149			
	LF	RF	LB	RB	LF	RF	LB	RB	LF	RF	LB	RB	LF	RF	LB	RB	LF	RF	LB	RB
(1968)																				
							ST						M		M					
10/24							3.7						65		20+					
														ST						
10/31														9.0						
														M						
11/ 7														20+						
														ST						
11/13														20+						
												ST								
11/22												11.7								
														ST				–		
12/12														7.8				1.7		
			ST									ST								
12/19			9.1									7.9								
(1969)	CB						CB													
1/2	4.3						4.9													
1/15			–																	
1/22			11.7																	
							ST	–									–	–	–	–
1/31							13.4	11.7									3.8	2.1	1.9	1.7
							ST					ST								
2/13							20+					5.0								
														ST						
2/21														8.5						
					ST		ST					SP								
2/28					7.8		20+					20+								
3/5																				
					ST							ST	M	M	–					
3/13					20+							20+	1.5	1.4	1.3					
												ST								
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					ST															
3/26					5.5															
4/11																				
					ST															
4/16					20+															
	ST																			
4/23	8.9																			
	ST				ST															
4/30	3.7				3.9															
												SP								M
5/7												6.7								4.7
			ST				–	ST												
5/12			20+				3.4	20+												

[1]No infection noted in cow 709.

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EFFECT OF NITROFURAN AND CHLORTETRACYCLINE ON THE MICROBIAL POPULATION OF SHRIMP

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(Received for publication October 17, 1969)

ABSTRACT

Chlorotetracycline (CTC) and two nitrofuran compounds alone and in combination were examined for their effects on extending the shelf life of iced shrimp. Nitrofuran AF-2 (furylfuramide) inhibited the growth of aerobes but was less effective against anaerobic bacteria. The growth of lipolytic and proteolytic bacteria was not significantly inhibited but some suppression was noted. Nitrofuran Z (nitrofuryl acrylamide) had no significant effect on the microbial population of iced shrimp. Both nitrofurans extended the shelf life of shrimp as detected organoleptically. Nitrofuran Z combined with CTC did not appreciably inhibit bacterial growth; whereas, nitrofuran AF-2 coupled with CTC was effective in extending the shelf life of shrimp as evidenced by both bacterial and chemical analyses. However, it should be pointed out that organoleptic differences between shrimp samples treated with nitrofuran AF-2/CTC and nitrofuran Z/CTC combinations were obscured by the use of the narrow five-point scale. Both the trimethylamine nitrogen and the indole tests were suitable for determining the quality and the extent of spoilage (when coupled with organoleptic scores) in both treated and untreated shrimp.

Shrimp, one of many perishable seafood items, are highly susceptible to spoilage by psychrophilic bacteria and by autolytic enzymes. The proper processing of these crustacea entails excessive handling which adds to the microbial populations; therefore, the shelf life could be extended by reducing the number of bacteria initially present on the shrimp. Frequently, as much as 10% of the catch is lost through improper handling.

The tetracycline antibiotics have long been held in high esteem as effective antibacterial agents in fish and shellfish *(4, 5, 8, 16)*. Camber et al. *(3)* examined the effect of chlortetracycline (CTC) dips and CTC incorporated into ice on the keeping quality of raw pink shrimp. Lerke and Farber *(11)* screened 19 antibiotics for their ability to prolong the storage life of Mexican shrimp with results that indicated the shelf life of shrimp could be extended for 4 days if dipped in CTC solution (15 ppm) and stored at 6 C. Although CTC has been very effective in preventing bacterial growth on fresh iced seafoods, resistant strains eventually emerge, and the antibiotic becomes ineffective. For this and other reasons, the Food and Drug Administration has withdrawn the tetracycline antibiotics from the list of approved food activities *(14)*. Consequently, other compounds which are not rendered ineffective by the emergence of resistant strains are sought to combat the ever-increasing microbial problems in seafoods. Green and Mudd *(9)* showed that strains of Gram-negative and/or Gram-positive organisms made resistant to streptomycin, penicillin, or sulfonamides remained sensitive to nitrofurazone, as did the parent susceptible strain. Paul et al. *(13)* showed that bacteria resistant to chloramephenicol or CTC remained susceptible to the nitrofurans.

The Minister of Welfare of Japan has approved several nitrofuran compounds as preservatives in the fish processing industry. Nitrofuran AF-2 (furylfuramide) and nitrofuran Z (nitrofuryl acrylamide) are two of the most effective compounds used in the preservation of fish sausage (kamaboko). Obatake and Matsuda *(12)* studied the preservative effect of AF-2 and Z in fish sausage and fresh fish and showed that AF-2 was more of an antibacterial agent than Z, although both chemicals were considered very effective against bacteria. Sasayama *(15)* stated that AF-2 prevented a bacterial buildup in fresh iced fish. Tetsumoto *(17)* reported that the effect of nitrofurans can be enhanced if coupled with sodium nitrite or parahydroxybutylbenzoate. Berkelhammer *(1)* recently synthesized the nitrofuran compound 2-amino-5 - (1 - methyl - 5 - nitro - 2 - imidazolyl) - 1,3,4, - thiadiazole and reported that this compound is highly active against a wide variety of Gram-positive and Gram-negative bacteria in mice and chicks as well as against a number of parasitic infections in rodents.

The present study was designed to investigate the effect of CTC and two nitrofuran compounds (AF-2 and Z) alone or in combination on the microbial population of ice-stored shrimp and to study some of the chemical changes associated with spoilage of both treated and untreated shrimp.

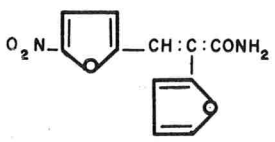
MATERIALS AND METHODS

Shrimp samples

Fresh raw headless brown shrimp *(Penaeus aztecus)* were obtained from a local seafood dealer. Different lots were taken from a conveyor belt used to transport shrimp from the vessel to the processing plant. The shrimp were transported to the laboratory in ice and immediately divided into sub-samples (2 lb. each) and treated as follows.

Chlortetracycline and nitrofuran treatments.

The samples were immersed in 2 liters of distilled water containing various concentrations (5 to 20 ppm) of chlortetracycline (CTC) alone and in combination with 2-(2-furyl)-3-(5-nitro-2-furyl) acrylamide or AF-2 (I) and/or 5-nitro-2-furfural acrylic acid amide or Z (II) with the concentrations of these nitrofurans ranging from 10 to 50 ppm. The nitrofurans were obtained from the Ueno Pharmaceutical Co., Ltd., 85 Shimoichiba, Itami, Hyogoken, Japan.



(I)

(II)

The CTC treated samples were immersed for 5 min, and the nitrofuran (AF-2 and/or Z) treated samples were immersed for 45 min. (The literature shows that a 5 min dip in a CTC solution is sufficient for extending the shelf life of shrimp while the Japanese have shown that a 45 min dip in a nitrofuran solution is sufficient for fish). Shrimp samples treated similarly, except for the absence of chemicals, were used as controls. No attempt was made, at this time, to determine the residual concentration of the CTC or the nitrofuran in the treated shrimp samples. The samples were then packed in crushed ice and held at 5 C until spoilage occurred. All the samples were repacked with fresh ice every 3 days, and the melted ice water was allowed to drain off during storage. At 3- to 4-day intervals during storage, representative samples were obtained from each lot and subjected to bacterial, chemical, and organoleptic analyses.

Bacterial analysis

A 50 g shrimp sample was homogenized for 2 min with sterile saline (1:10 ratio) in a sterile Waring[1] blendor, and the homogenate tested for total counts of aerobes, anaerobes, proteolytic, and lipolytic bacteria. The total aerobes were plated on nutrient agar, the anaerobes on tryptone glucose extract agar (TGEA) containing 0.1% Na-thioglycollate, the proteolytic bacteria on nutrient agar containing 1% skim milk (those colonies surrounded by a clear zone were counted as proteolytic bacteria), and the lipolytic bacteria on nutrient agar containing 0.25% fat (corn oil). After flooding plates with saturated copper sulfate solution for 5 min, lipolytic colonies were detected by their green color which resulted from the reaction of copper with free fatty acids produced. All plates, except those used for anaerobic bacteria, were incubated at 22 C for 5 days; anaerobic plates were incubated at 35 C for 2 days.

Trimethylamine nitrogen (TMAN)

Dyer's *(7)* method was used to determine chemical spoilage through a correlation between the content of TMAN and organoleptic judgment.

Indole

Method of Duggan and Strasburger *(6)*, as modified by Turner *(18)*, was employed to follow the extent of spoilage of shrimp.

pH

The pH of the shrimp homogenate was determined using a Zeromatic Beckman pH-meter.

Picric acid turbidity test (PAT)

The procedure of Kurtzman and Snyder *(10)* was followed to estimate the onset of spoilage, and the degree of turbidity of the filtrate was used as a measure of spoilage.

Organoleptic scoring

Organoleptic scores based on a scale of 0 to 5 (0 indicating putrefaction, and 5 denoting excellent quality), as reported by Kurtzman and Snyder *(10)*, were used. An experienced panel of 6 people judged the samples based on odor and appearance.

RESULTS AND DISCUSSION

Effect of chlortetracycline

Results of the organoleptic scores, and both the chemical and bacterial analyses of shrimp treated with CTC are presented in Table 1. Results of the 9th day examination are only shown because the overall data obtained indicated that increasing the CTC up to 20 ppm had little effect on the shelf life of treated shrimp. The organoleptic results showed that the control spoiled after 6 days of storage and all CTC treated samples spoiled after 9 days. Bacterial results showed that by increasing the CTC concentration, the count did not differ significantly from

TABLE 1. EFFECT OF CTC, NITROFURAN AF-2 AND Z ON ORGANOLEPTIC SCORES, PH, AND BACTERIAL FLORA OF ICED SHRIMPED EXAMINED AFTER 9 DAYS OF STORAGE

Treatment	Organoleptic scores	pH value	Total bacterial counts (log no./g sample)			
			Aerobes	Anaerobes	Proteolytic	Lipolytic
CTC						
Control	2	8.2	9.4	5.6	8.5	8.2
20 ppm	3	8.1	9.4	5.6	8.5	8.3
Nitrofuran AF-2						
Control	3	8.2	5.3	3.4	3.3	3.0
50 ppm	3	8.2	4.5	3.6	3.3	2.0
Nitrofuran Z						
Control	3	8.3	8.7	5.2	8.4	8.2
50 ppm	4	8.3	8.6	5.6	8.3	8.0

[1]Use of trade names does not imply endorsement.

that of the control. This was true with the aerobic, anaerobic, proteolytic, and lipolytic bacterial counts. The predominant aerobic bacteria found were Gram-negative non-spore forming rods. No attempt was made to further characterize and identify these organisms.

The pH of the control samples increased on the third day of storage, then decreased at a faster rate than the CTC treated samples. At the end of storage, the pH of the control was less than that of all treated samples. The breakdown of proteins, producing ammonia and other amines, increased pH during early storage, then the production of acids (formic, acetic, etc.) overcame the effect of the bases produced, thus causing the pH to decrease. Spoilage of shrimp seemed to be caused primarily by the action of both proteolytic and putrefactive microorganisms.

Effect of nitrofuran AF-2

The effect of nitrofuran AF-2 on the bacterial flora and on the quality of shrimp after 9 days storage is also shown in Table 1. In considering all storage data of AF-2 treated samples, the highest concentrations did not differ from the control significantly. The reduction in bacterial count (all types considered) of the treated samples over the control was less than one log cycle. It was noted, however, that AF-2 delayed spoilage (organoleptic analyses) 4 days while CTC delayed spoilage only 2 to 3 days.

The pH of the control increased rapidly at the beginning of storage followed by a slight decrease. The pH of the treated samples did not increase as rapidly as the control but continued to increase throughout storage, indicating that the control was spoiling at a faster rate than the treated samples. Bethea and Ambrose *(2)* concluded that pH values could be used in conjunction with other tests to measure the quality of shrimp.

Effect of nitrofuran Z

Nine day storage data is shown in Table 1. Treatment of fresh iced shrimp with nitrofuran Z offered little effect on the microbial flora. An increase in the concentration of the chemical did not hinder microbial growth, however, organoleptic scores showed some extension of shelf life. The pH remained about the same as the control.

An overall observation revealed that AF-2 is somewhat a better bacteriostat than Z, and Z displays about the same effectiveness as CTC.

Synergistic effect of CTC with nitrofuran AF-2

The previous experiments indicated that nitrofuran AF-2 and Z offered some inhibitory effect on cer-

TABLE 2. EFFECT OF CTC, NITROFURAN AF-2, NITROFURAN Z, CTC PLUS NITROFURAN AF-2, AND CTC PLUS NITROFURAN Z ON ORGANOLEPTIC SCORES AND ON SOME CHEMICAL ANALYSES.

Treatment	Storage	Organoleptic scores	pH value	TMAN	PAT	Indole
(ppm)	(days)			(mg/100 g)	(O.D.)	(μg/g)
None	0	5	7.7	0	0.44	0
(Control)	3	5	8.0	0.8	0.46	0
	9	1	8.2	4.5	0.50	30.4
	16	0	8.4	14.5	0.50	194.0
10 CTC	3	5	7.9	0	0.34	0
	9	2	8.4	3.5	0.10	10.4
	16	0	8.5	5.0	0.49	29.5
20 AF-2	3	5	8.0	0	0.42	0
	9	2	8.4	2.0	0.05	7.3
	16	0	8.5	2.0	0.25	37.1
10 CTC	3	5	8.1	0	0.46	1.0
+ 10 AF-2	9	3	8.3	2.3	0.10	5.8
	16	0	8.6	6.0	0.25	21.6
10 CTC	3	5	8.1	0.8	0.43	0
+ 20 AF-2	9	3	8.4	1.5	0.16	17.1
	16	0	8.6	2.8	0.27	30.5
20 Z	3	5	8.0	0	0.36	1.0
	9	2	8.5	2.5	0.48	10.7
	16	0	8.5	4.5	0.67	17.8
10 CTC	3	5	8.0	0	0.30	0.5
+ 10 Z	9	3	8.3	3.0	0.08	8.5
	16	0	8.5	10.0	0.11	25.5
10 CTC	3	5	8.0	1.0	0.27	0
+ 20 Z	9	3	8.5	2.7	0.07	4.5
	16	0	8.5	6.5	0.30	30.5

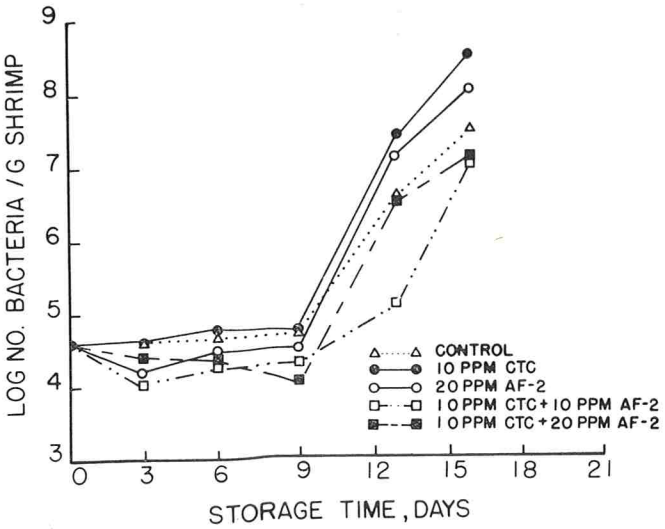


Figure 1. Effect of CTC and nitrofuran AF-2 on the number of aerobic bacteria in shrimp.

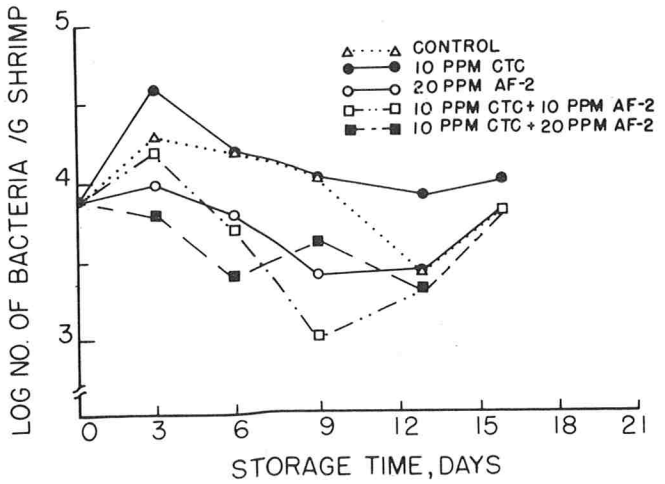


Figure 2. Effect of CTC and nitrofuran AF-2 on the number of anaerobic bacteria in shrimp.

tain microorganisms; however, the results were not conclusive enough to recommend their use as preservatives for shrimp. Therefore, it was decided to combine CTC with each nitrofuran and determine if the presence of CTC and a nitrofuran would produce a synergistic effect. The shrimp were immersed in solutions containing CTC and nitrofuran AF-2 in various concentrations and combinations. They were then drained, stored in ice, and samples obtained at intervals and an untreated sample as control.

Results (Fig. 1) showed that 10 ppm CTC alone did not affect the growth of aerobes, rather it seemed to stimulate growth. Twenty parts per million of AF-2 prevented growth to some degree until the 9th day of storage and then the counts increased beyond that of the control. CTC combined with nitrofuran AF-2 (10 ppm and 20 ppm) was effective throughout the storage period with a combination of 10 ppm CTC and 10 ppm nitrofuran AF-2 being superior.

Results of the total anaerobic counts shown in Fig. 2 indicate that shrimp treated with 20 ppm nitrofuran AF-2 alone, or nitrofuran AF-2 in combination with CTC, had a significantly lower count than the control throughout storage.

A solution of 20 ppm nitrofuran AF-2 retarded growth of proteolytic bacteria through the 9th day (Fig. 3); whereupon the counts increased beyond the control. However, the CTC plus nitrofuran combinations demonstrated a good inhibitory effect during the entire period of storage. The 10 ppm CTC plus 20 ppm nitrofuran AF-2 proved to be the best combination. CTC alone was ineffective.

CTC alone had no effect on the lipolytic organism count (Fig. 4). Treatment with CTC plus 20 ppm nitrofuran AF-2 was effective only through the 6th day, and CTC with 10 ppm nitrofuran AF-2 was inhibitory during the entire storage time. Nitrofuran AF-2 did not show any inhibitory effects against lipolytic bacteria. It can be stated that 10 ppm CTC served as a synergist with nitrofuran AF-2 in both 10 and 20 ppm levels.

Results of the chemical analysis of control and treated shrimp are shown in Table 2. Picric Acid Turbidity (PAT) tests were quite erratic and seemed to fit no particular pattern. Kurtzman and Snyder *(10)* and Bethea and Ambrose *(2)* used the PAT test to follow spoilage of untreated shrimp. They assigned Klett readings to different organoleptic classes and reported good correlation between these two tests. Our results showed that the PAT test cannot be recommended for following spoilage of chemically treated shrimp. Trimethylamine nitrogen (TMAN)

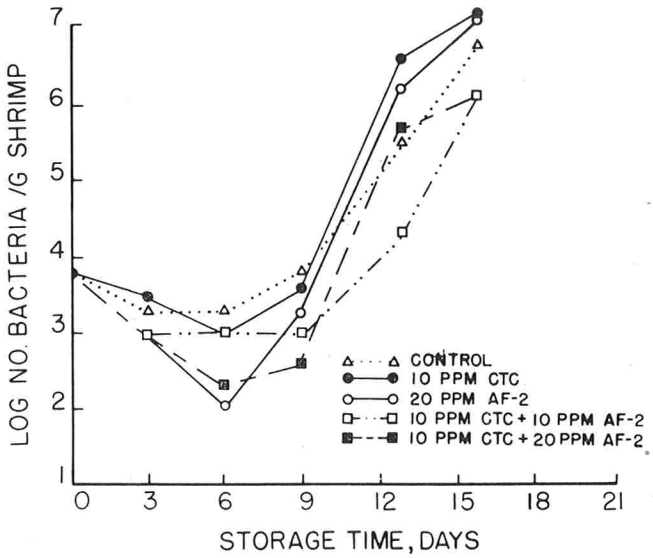


Figure 3. Effect of CTC and nitrofuran AF-2 on the number of proteolytic bacteria in shrimp.

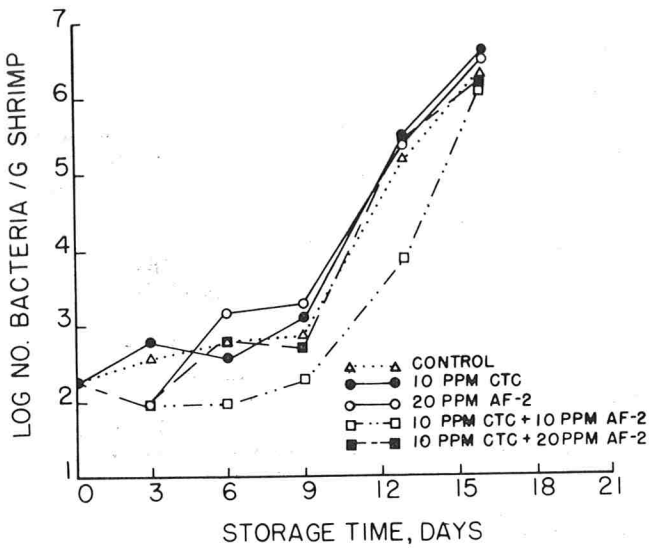


Figure 4. Effect of CTC and nitrofuran AF-2 on the number of lipolytic bacteria of shrimp.

in the untreated shrimp increased gradually up to the 13th day and rapidly on the 16th day. In the treated samples the TMAN level also increased during storage but was less than the control at all times. The 20 ppm nitrofuran AF-2 and the CTC plus 20 ppm nitrofuran AF-2 treatments were most effective in reducing the TMAN value to one-third that of the control after 16 days of storage. The TMAN results correlated well with organoleptic scores and the proteolytic bacterial count. For example, in any given treatment, as the TMAN increases, the organoleptic score decreases.

Indole content of the samples during storage showed that the control had a high level when the sample was considered spoiled (score 1). Indole was detected in the treated samples, but its value never reached the control level. A sudden increase in indole formed, coupled with a significant change in organoleptic analysis, appeared to be a suitable method for the estimation of spoilage. The increase in indole and bacterial counts correlated well with the organoleptic change.

The pH of the control increased rapidly, reaching a peak on the 13th day followed by a slight decrease on the 16th day. The difference in pH values between the control and treated samples were apparent.

The organoleptic scores of the treated samples were somewhat higher than control scores. Both control and CTC treated samples received a score of 3 on the 6th day. The control was inedible on the ninth day and putrid on the thirteenth. However, the treated samples were judged organoleptically better than controls throughout storage, and the CTC-nitrofuran combinations maintained the highest scores during storage.

Synergistic effect of CTC with nitrofuran Z

This experiment was conducted in a manner similar to that previously outlined except for the use of nitrofuran Z. The results showed total aerobic counts of the treated samples were not significantly different when compared to the control during storage for 9 days. Some inhibition was noted in the growth of the aerobes on the thirteenth and sixteenth days in the shrimp treated with 10 ppm CTC plus 20 ppm Z. It is concluded that CTC does not offer a synergistic effect to nitrofuran Z in inhibiting the growth of aerobic bacteria. CTC alone did not inhibit the growth of anaerobic organisms; whereas, nitrofuran Z alone and in combination with CTC decreased the counts up to the thirteenth day. It is obvious that the degree of inhibition was affected when the two chemicals were combined. As with nitrofuran AF-2, the retardation may be effective only on certain species of the anaerobic flora; however, no attempt was made to study this effect. Proteolytic bacterial counts showed that each chemical, alone or in combination, did not retard their growth. The CTC plus 10 ppm nitrofuran Z treatment was more consistent in its inhibitory action against the lipolytic bacteria, although CTC plus 20 ppm nitrofuran Z was effective through the ninth day of storage.

The results of the chemical analysis of control, CTC, and nitrofuran Z treated shrimp are recorded in Table 2. The PAT test data showed that the turbidity of the control increased slightly during storage, whereas the PAT values for shrimp treated with CTC or nitrofuran Z alone were inconsistent and in some instances were higher than that of the control. Results for the CTC plus nitrofuran treatments were erratic, but it is interesting to note that the values never reached the level of the control, CTC, or nitrofuran Z. It should be pointed out that the products being measured in the PAT tests have not been identified. The inconsistencies found in the application of this test cannot be explained until the mechanism of reaction is clearly understood. TMAN levels in the control increased slowly up to the 13th day and rapidly thereafter. Although all treatments showed a reduction in the amount of TMAN produced during storage, nitrofuran Z alone was the most effective. The mixture of CTC and nitrofuran Z was not as effective as treatment with each chemical alone. This mixture was effective, however, when compared to the control.

Indole concentration in the control increased rapidly on the ninth day when the sample was given a score of 1, inedible. Although the indole concentration in the treated samples increased to a maximum of 30 μg/g, the samples were judged inedible when the indole content increased beyond 10 μg/g sample. It

is evident that compound(s) other than indole, such as skatol, H_2S, mercaptans, and others, contributed to the odor of the spoiled shrimp samples since the organoleptic scores given to these lots did not correlate well with the indole content. It appears that the compounds used in this experiment prevented the growth of those putrefactive species of bacteria which produce the enzyme(s) responsible for indole formation as a result of tryptophan degradation. There appeared to be little difference in pH values during storage between control and treated samples. The control increased at a greater rate than the treated samples, but all samples reached approximately the same pH level by the end of the storage period. Organoleptically, the control spoiled to the inedible stage by the ninth day of storage, but the treated samples were judged spoiled and unfit for consumption on the thirteenth day. The treatments thus increased shelf life of shrimp about four days.

It is concluded that a combination of CTC and nitrofuran Z did not offer the inhibitory effect desired. On the other hand, CTC added to nitrofuran AF-2 was effective in extending the shelf life or shrimp as judged both chemically and bacteriologically. Organoleptic differences between shrimp samples treated with the nitrofuran AF-2/CTC mixture and with nitrofuran Z/CTC combinations were obscured by the use of the narrow five-point scale. Of the chemical tests used, TMAN and indole were sufficient to determine the effectiveness of the chemical treatments versus the control.

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ESTIMATION OF SOMATIC CELLS IN MILK USING MEMBRANE FILTER SEPARATION AND DNA DETERMINATION WITH DIPHENYLAMINE[1]

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Abstract

A diphenylamine-DNA method of estimating somatic cell concentration in milk was studied in two separate trials. Trial I involved 68 bulk milk samples and a comparison of detergent and centrifuge procedures for separation of milk fat prior to estimation of somatic cells. Membrane filters of 3μ-pore size were used to concentrate cells. Color developed with diphenylamine was measured in a spectrophotometer. The detergent preparation was superior to centrifuging, as judged by correlation coefficients between the direct microscopic cell count (DMSCC) and optical density (OD) of 0.93 and 0.82, respectively, for the two methods. Coefficients of variation of duplicate optical density readings were 9.4 and 16.7 for the detergent and centrifuge methods, respectively. Regression equations revealed a linear relationship between OD and DMSCC for the detergent, but a curvilinear relationship for the centrifuge procedure.

In Trial II, 40 bulk milk samples were analyzed with an improved procedure involving detergent preparation, use of membrane filters to collect cells, and modifications of reagents to increase color development with diphenylamine. Correlations of 0.94 between OD and DMSCC and 0.95 between calculated micrograms of DNA and DMSCC were obtained. The coefficient of variation on optical density values was 3.5. An estimate of 9μg of DNA per million somatic cells was calculated, assuming 100% purity of the DNA standard used. This final procedure has been described in detail.

The number of somatic cells found in milk has been used extensively as an index of udder inflammation and mastitis. Four different mastitis screening tests are currently in use in state mastitis control programs *(12)*. Confirmation of estimated somatic cell numbers is being accomplished by the direct microscopic somatic cell count *(1)* or electronic cell counters *(7, 9)*. However, there is a need for an improved objective method of estimating cell numbers which could be mechanized at a reasonable cost and which could be used on preserved milk.

Since the deoxyribonucleic acid (DNA) content of milk somatic cells was responsible for the gel formation in the California Mastitis Test (CMT) reaction *(3, 10)*, Paape *(6)* used a DNA-specific Feulgen reaction for estimating somatic cells found in cow's milk. Stability of reagents and accuracy of estimating cell counts at usual bulk tank levels has hindered application of the Feulgen method.

Schneider *(11)* reported another DNA-specific reaction involving diphenylamine. Purine bound sugars of extracted DNA bound to diphenylamine produced a blue color directly proportional to the amount of DNA present. Procedures using the diphenylamine-DNA analysis *(2)* have been reported for sperm, brain, thalmus, and other tissue.

The objectives of this research included the following: *(a)* develop a procedure for estimating somatic cells in milk using a diphenylamine-DNA method, *(b)* measure the correlation between optical density and DMSCC and the repeatability of duplicate determinations, *(c)* develop a preservation procedure which would not affect the results, and *(d)* prepare a DNA standard which could be used to minimize daily variation and standardize laboratories using the new test.

Materials and Methods

Two methods of separating somatic cells from milk fat were employed in Trial I, the centrifuge and the detergent methods. In Trial II the centrifuge procedure was discarded in favor of detergent. In the centrifugal method 10 ml of milk were mixed with 20 ml of normal saline (0.85% NaCl) and spun at 2,400 g for 15 min in a 50 ml polycarbonate centrifuge tube. Milk fat rose to the top and was removed by aspiration leaving the somatic cells in a button on the bottom of the tube. The detergent method employed 20 (Trial I) and 50 (Trial II) ml of warm (50 to 60 C) dilute triton[1] (0.1% v/v). The centrifuge or detergent solutions were filtered through a one-inch diameter membrane with a pore size of 3μ[2]. The filters were made from an acrylonitrile polymer and were acid and heat resistant. The filtering unit consisted of a barrel of a 50 ml syringe, shut-off valve adapter, filter holder[3] with membrane, and a 13 gauge needle inserted into a rubber stopper fitted to a one liter suction flask. After filtration, the sides of the syringe barrel and filter were washed three times with 10 ml of normal saline to remove interfering materials.

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[1]Published with the approval of the Director of the Wisconsin Agricultural Experiment Station.

[1]Triton X-100, Sigma Chemical Company, St. Louis, Mo., 63118.

[2]Gelman A-N Acropor.

[3]Gelman Instrument Company, Ann Arbor, Mich. 48106.

The filter was transferred with a fine tweezers to a screw-cap, conical glass centrifuge tube of 10 ml capacity, being careful not to touch the filter with fingers. Three milliliters of 5% trichloroacetic acid were added to the tube, heated for 15 min at 90 C and cooled. Heating with trichloroacetic acid resulted in solubilization of DNA and precipitation of any protein entrapped in the filter.

The solubilized DNA was mixed with diphenylamine reagent (1% w/v in Trial I or 2% w/v in Trial II) and incubated at 30 C in a water bath for 16 hr. Various intensities of blue color developed depending upon level of DNA present. Optical density values were read against a reagent blank at 600 mμ with 0.75 inch cuvette in a Bausch and Lomb Spectronic 20 spectrophotometer.

In Trial I, readings at 700 mμ (ultraviolet range) were taken and subtracted from the readings at 600 mμ to correct for interfering materials *(5)*. Also diluted acetaldehyde was added to serve as a catalyst to increase color intensity.

Formaldehyde (40%), added at the rate of 0.01 ml per 5 ml of milk, was investigated as a milk preservative. Both diphenylamine-DNA procedures (detergent and centrifugal) in Trial I were carried out on three consecutive days. Fresh milk was analyzed on day 1 and compared with preserved milk on days 2 and 3. Samples were held at room temperature.

In all trials, standard DNA was analyzed daily with the milk samples to standardize the procedure. The stock standard DNA was prepared by dissolving 25 mg of calf thymus DNA[4] in 250 ml of 5% trichloroacetic acid by heating at 90 C with constant stirring (thermo-stir-plate) followed by storage at room temperature. Diluting 5 ml of stock standard to 25 ml with 5% trichloroacetic acid resulted in a working standard DNA containing 20 μg DNA per ml. Daily K values were obtained by dividing micrograms of DNA in the standard by the optical density of the standard. Micrograms of DNA in milk samples were calculated by multiplying milk sample optical density by the K value, adjusting as necessary for the amount of milk used.

Somatic cell levels were estimated by counting two horizontal and two vertical strips on two circular milk smears (DMSCC) *(1)*. The Wisconsin Mastitis Test, the California Mastitis Test, and the Catalase Test were performed using standard methods *(8, 10, 13)*.

Milk samples in the preliminary work were cow samples since samples with high counts were desirable. In Trials I and II, bulk milk samples were obtained from a local dairy[5] in an attempt to test the new procedure under actual field conditions. All samples were from daily pickup with analyses in Trial II conducted the day after collection. Samples were refrigerated.

RESULTS

Several preliminary trials were conducted to determine optimal amounts and concentrations of reagents, speed of centrifugation, aliquots of milk, type of filter, and pore size of filter. All preliminary studies used centrifugal force to separate somatic cells. Correlations between OD and leucocyte counts, WMT, and the CMT were +0.87, +0.81 and +0.70, respectively, based on 72 cow samples. The coefficient of variation of duplicate OD values was 18%.

In Trial I, the use of detergent to remove milk fat was compared to the centrifugal method. Ten milliliters of milk was used in both methods. Twenty milliliters of triton solution was employed to disperse the fat in the detergent procedure. After heating the filters with TCA, differential evaporation losses were corrected and a 2 ml aliquot of DNA extract was mixed with 4 ml of 1% DPA and 0.1 ml of dilute acetaldehyde *(5)*. Table 1 shows that the detergent procedure was superior in accuracy. In addition, it

TABLE 1. COMPARISON OF CENTRIFUGE AND DETERGENT METHODS OF FAT REMOVAL IN THE MILK SOMATIC CELL DNA PROCEDURE.

	Trial I		Trial II
	Centrifugal[a]	Detergent[a]	Modified detergent[b]
Number of samples	63	48	40
Correlations			
OD vs. WMT	.50	.78	—
OD vs. catalase	.63	.67	—
OD vs. DMSCC	.82	.93	.94
Micrograms DNA vs. DMSCC	—	—	.95
Mean OD of n samples	0.088	0.174	.124
Mean OD expressed as somatic cells/ml	533,300	586,100	653,100
Standard error of estimate (cells/ml)	—	—	15,000
95% confidence interval for predicting cells at the mean (cells/ml)	—	—	30,600
Coefficient of variation of duplicate samples	16.7	9.4	3.5

[a]Ten milliliters of milk with 1% DPA plus catalyst as color reagent; read at 600 mμ corrected with a reading at 700.
[b]Five milliliters of milk with 2% DPA; read at 600 mμ.

TABLE 2. EFFECT OF FORMALIN PRESERVATION OF MILK ON THE SOMATIC CELL DNA PROCEDURE[a].

	Centrifugal	Detergent
Number of samples	31	32
Mean optical density (OD)		
Day 1[b]	0.072	0.194
Day 2	0.072	0.197
Day 3	0.085	0.198
Mean somatic cells/ml predicted from OD		
Day 1	461,042	647,210
Day 2	461,042	656,487
Day 3	532,706	659,554
Coefficient of variation of duplicate samples		
Day 1	16.7	9.4
Day 2	11.3	11.8
Day 3	16.9	8.9

[a]40% formaldehyde added at a level of 0.01 ml per 5 ml of milk.
[b]Day 1 value obtained on unpreserved milk.

[4]Type I, sodium salt, highly polymerized, Sigma Chemical Company, St. Louis, Missouri, 63118.
[5]Madison Milk Producers Co-op, Madison, Wis.

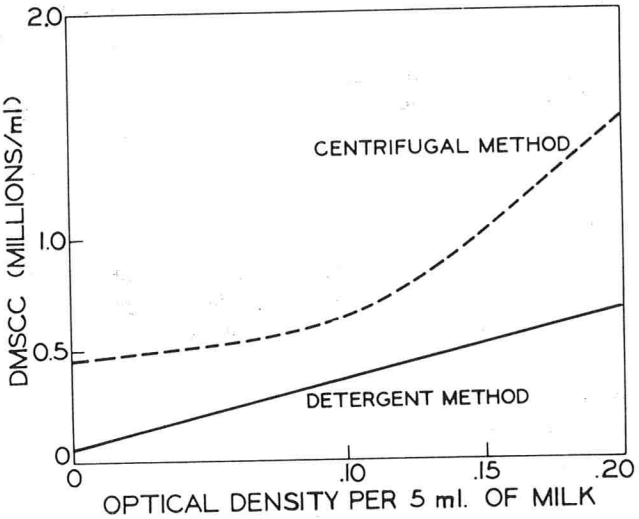

Figure 1. Effect of method of milk preparation on the relationship between the direct microscopic somatic cell count (DMSCC) and optical density in Trial I. (Regression equation for the detergent method: Y = 3.060 X + .054).

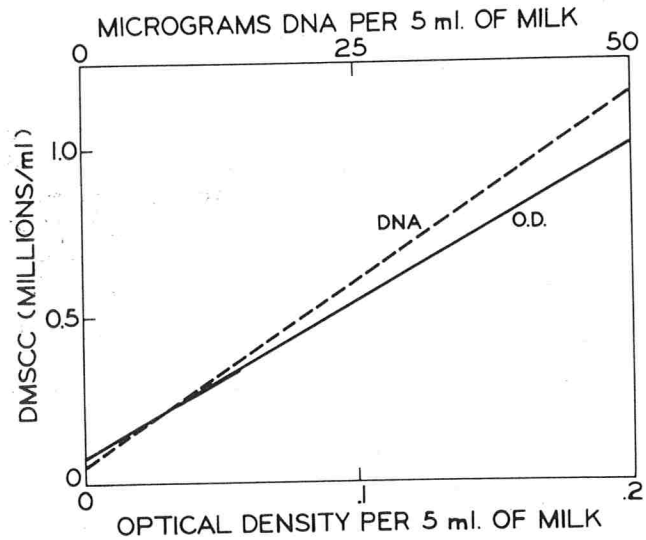

Figure 2. Relationship between the direct microscopic somatic cell count (DMSCC) and optical density or calculated DNA content of milk in Trial II. (Regression equation using optical density: Y = 4.572 X + .087; using DNA: Y = .022 X + .058).

was simpler and faster. Another advantage for the detergent procedure was that the relationship between the number of somatic cells and OD was linear compared to a curvilinear relationship with the centrifuge methods (Fig. 1). Loss of somatic cells in the aspirated fat layer would possibly explain the curvilinear relationship with larger cell losses at high somatic cell levels. Table 2 illustrates the effectiveness of formaldehyde as a preservative. Day 1 represents results obtained on fresh unpreserved milk on the day it arrived in the laboratory. After the fresh milk was tested, formalin was added and the procedure repeated on days 2 and 3. Analysis of variance indicated that there were no significant changes in OD due to aging of samples containing formaldehyde. Coefficients of variation of duplicate samples indicated little difference caused by aging.

Trial II was conducted on 40 bulk milk samples utilizing an improved detergent method. In Trial I, 10 ml of milk with high levels of somatic cells plugged the filter. In Trial II, 5 ml of milk was mixed with 50 ml of triton solution and filtered. No problems of blockage were experienced. After heating the 3 ml of TCA with the filter, 3 ml of 2% DPA was added directly to the extracted DNA and filter. This was incubated overnight in capped tubes for color development. This procedure had the following advantages: *(a)* color intensity was increased (all DNA extract was diluted by diphenylamine in a ratio of 1:1 instead of 2:1 in Trial I), *(b)* no correction for differential evaporation loss was needed, and *(c)* no acetaldehyde had to be added as a catalyst. Results of Trial II, summarized in Table 1, indicated improved accuracy and repeatability. Figure 2 illustrates the linear relationship between OD or calculated DNA and somatic cell numbers. No distinct advantage was seen for converting OD values to micrograms of DNA, using the K value determined from the standard thymus DNA, to estimate cell numbers. The K value was comparable for the several days in Trial II. If slight variations in conditions or methodology resulted in variations in K values from day to day, obviously use of a corrected K value to estimate cells would be desirable.

Figure 3 shows the linear relationship between optical density and standard DNA. Values for DNA assume 100% purity of the preparation, which may not be true. Regardless of purity, however, it would

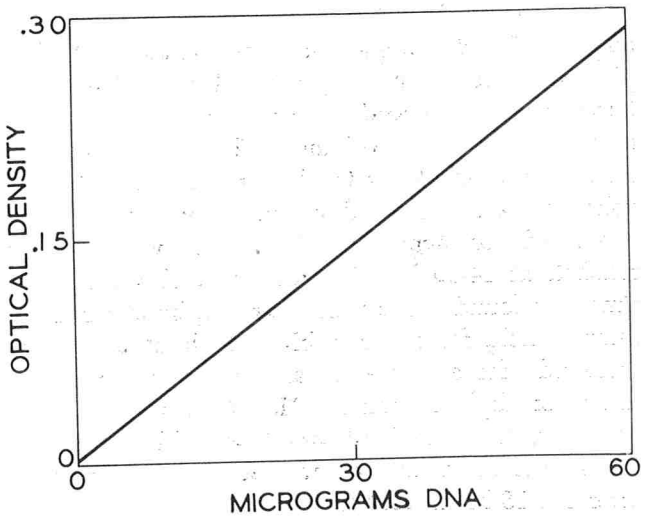

Figure 3. Relationship between optical density and micrograms of standard beef thymus DNA. (Regression equation: Y = .00477 X + .00042).

be possible to standardize procedures within and between laboratories using a common standard.

DISCUSSION

The authors refer to this procedure as the Filter-DNA method of estimating somatic cells in milk. It is felt that it has distinct advantages over existing methods and that it could serve as a confirmatory test for existing screening tests, or better yet, as a single test to estimate cell numbers.

The linear relationships between optical density and DMSCC, as well as standard DNA, indicate that the procedure will accurately measure DNA and that DNA content is an accurate reflection of cell numbers. The data support the concept that the DNA content per cell is constant. Using the data in Trial II, and assuming that the DNA preparation used was 100% pure, 1 million cells contained approximately 9 μg of DNA. De Langen *(4)* used a value of 7 μg of DNA per million cells. If the DNA used in this study were 78% pure, the values would be comparable.

The low standard error of estimate (15,000 cells) and 95% confidence limits (30,600 cells) suggests superiority of this procedure over conventional cell counting procedures in terms of accuracy. The low coefficient of variation of duplicate samples (3.5) also suggests superiority over existing procedures in repeatability, possibly permitting single determinations. The coefficient of variation between duplicate strips in the DMSCC in Trial II was 29.6, with the same person doing all the counting.

The use of a chemical procedure removes the element of subjective judgment involved in many of the present tests. Reagent costs are minimal. However, individual filters cost approximately ten cents each. Reuse of filters was not investigated but they appeared to shrink. Using a very simple setup with only one filtering apparatus, approximately 100 samples could be processed per day by one technician. Obviously, the procedure could be mechanized to permit much larger volume. There was some disadvantage in the 16 hr incubation step needed to develop the color. Color development was gradual and continued for approximately 12 hr, with stability reached at 14-16 hr. No means of shortening this time was found. The procedure can be stopped and samples held for considerable periods of time (over weekends, for example) at any step prior to the addition of diphenylamine. However, for maximum accuracy, once the DPA has been added, the samples should be incubated and read within a few hours after the 16 hr incubation.

The use of 5 ml of milk has obvious advantages over procedures using smaller amounts, particularly the 0.01 ml used in microscopic counting. It appears that 5 ml would also be satisfactory for bucket samples of individual cows, although less may be required for some quarter samples.

The use of a preservative to prevent changes occurring with age is a distinct advantage. More work needs to be done with longer holding periods. Limited tests to check bacterial growth were made on milk samples held at room temperature with preservatives for three days. Although some bacterial growth occurred, as observed under the microscope, optical density values did not change significantly. It was assumed that the bacteria, which could be a source of DNA, were washed through the 3μ pores in the membrane. It must also be assumed that the somatic cells remained intact enough to be retained. Use of a preservative would be the preferred procedure whenever very long holding periods were anticipated.

The use of a DNA standard would be an important tool for a daily check on variation in the procedure or for standardization of procedures between laboratories. The standard DNA was somewhat difficult to solubilize, but remained stable over an extended period of time.

In initial studies attempts were made to increase the intensity of the color reaction with the use of acetaldehyde as a catalyst. However, this appeared to introduce more variability. It was found in Trial II that simply increasing the concentration of diphenylamine gave a satisfactory color increase without increased variability, so the acetaldehyde was eliminated.

In both Trials I and II, the regression line had a positive intercept, in contrast to the line using standard DNA. There are several possible explanations. First, there could have been an over-estimation of cells on the DMSCC. The magnitude of this error would have to be approximately 9 cells per strip. Secondly, some of the cells could have been lost in the procedure. Third, some substance present in the milk, triton, or saline wash could be remaining on the filter and interfering in some way so as to reduce the color reaction. Further investigation in this area is planned. Whatever the factor, it appeared to be a constant one since the relationship was linear over the ranges of cell counts used.

There is certainly no need for additional screening or confirmatory tests for somatic cells in milk unless they have distinct advantages over existing procedures. The authors feel that this procedure does merit further examination by other laboratories.

SUMMARY OF FINAL RECOMMENDED PROCEDURE

Reagents (all reagents are of *reagent grade*)

1. 0.9% sodium chloride solution (normal saline)—dissolve 9 g NaCl in 1,000 ml distilled water.

2. 0.1% triton solution—dissolve 1 ml triton X-100 in 1,000 ml normal saline.
3. 5% trichloroacetic acid solution—dissolve 5 g TCA in 100 ml distilled water.
4. 2% diphenylamine reagent—dissolve 2 g diphenylamine in about 70 ml glacial acetic acid, add 3 ml concentrated sulphuric acid and make up the volume to 100 ml with glacial acetic acid. Store in a brown bottle.
5. Standard DNA solution—
   (a) Stock standard—dissolve 25 mg calf thymus DNA (Type I—Sigma) in 250 ml of 5% trichloroacetic acid by heating at 90 C with constant stirrmg (use thermo-stir-plate). Store at room temperature.
   (b) Working standard—dilute 5 ml stock standard to 25 ml with 5% TCA solution. Gives 20 μg DNA/ml.

Procedure

Milk Sample

1. Heat triton solution at 55 C in a water bath.
2. Assemble filtering unit consisting of a barrel of 50 ml syringe, shut off valve adapter, filter holder with a 3 μ filter, and a 13 gauge needle inserted into rubber stopper fitted to a 1 liter suction flask.
3. Close the valve and add 50 ml warm triton solution to the syringe barrel. Use a 50 ml dispenser head.
4. Add 5 ml milk with an automatic pipette and mix well with triton solution by drawing the solution in and out three times.
5. Open valve and apply suction.
6. Wash the sides of the syringe barrel and filter paper three times with about 10 ml volumes of normal saline with the help of a wash bottle.
7. Dismantle the filter holder and transfer the filter with fine tweezers to a 10 ml screw cap conical glass centrifuge tube. Do not touch the filter with fingers.
8. Add 3 ml 5% TCA (with dispenser), stopper with teflon cap, and shake on minishaker.
9. Heat the contents at 90 C for 15 min in a water bath and cool.
10. Add 3 ml diphenylamine reagent (with dispenser), stopper again and shake on minishaker.
11. Incubate the tubes at 30 C in a water bath for at least 16 hr.
12. Read against reagent blank at 600 mμ with a 0.75 inch cuvette in Spectronic 20.
13. Calculate cell numbers using regression equation: Somatic cells in millions/ml = 4.572 x OD + 0.087.

Standard DNA

1. Prepare following concentrations of standard DNA by using working standard.
   (a) 0.5 ml standard + 2.5 ml 5% TCA. Represents 10 μg DNA.
   (b) 1.0 ml standard + 2.0 ml 5% TCA. Represents 20 μg DNA.
   (c) 2.0 ml standard + 1.0 ml 5% TCA. Represents 40 μg DNA.
   (d) 3.0 ml standard + *no* ml 5% TCA. Represents 60 μg DNA.
2. For Reagent Blank use 3 ml 5% TCA.
3. Follow all steps from 10 through 12 given under milk samples.
4. Plot OD units vs. μg DNA and calculate the K value

$$K = \frac{\mu g \text{ DNA (standard)}}{\text{OD (standard)}}$$

5. To obtain μg DNA in milk samples multiply the milk sample OD by K. Take into account the amount of milk used.

Principle

Diluted warm triton solution emulsifies and disperses the milk fat to particle size smaller than 3μ and as a result milk fat passes through the 3μ filter. The milk somatic cells are larger in size and are retained on the filter. Interfering materials are removed by washing with normal saline. Heating with trichloracetic acid solubilizes DNA of somatic cells. The extracted DNA gives a color reaction with diphenylamine reagent. The intensity of color measured by spectrophotometer is directly proportional to the amount of DNA.

ACKNOWLEDGMENTS

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SOME OBSERVATIONS ON THE QUALITY OF THE WEATHERVANE SCALLOP *(PLATINOPECTEN CAURINUS)*

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Abstract

The meats of the weathervane scallop (*Platinopecten caurinus*) were stored at 32 F and the major chemical and physical changes were defined. Storage at 32 F for up to 10 days caused little or no undesirable change in flavor; however, storage did result in a pronounced toughening of cooked texture of meat. Treatment of meats with sodium tripolyphosphate reduced the degree of toughening of stored meats, but this treatment did not appear to control the texture change sufficiently to justify its use. The pH, salt solubility, content of adenine nucleotides, phosphorylated sugars, and glycogen were determined on stored meats. It was suggested that a product of superior quality could be produced through the processing of freshly shucked scallops.

The weathervane scallop *(Platinopecten caurinus)* was first harvested commercially in Alaskan waters in 1968. Since this was the first time that this species was commercially utilized, various quality parameters of this seafood were not known. Although experience obtained through processing and handling of the scallop *(Platinopecten magellanicus)* harvested from off the East Coast of the United States and Canada was of great value in the initial development of this new industry, it soon became evident that there were some quality problems with this West Coast species. For example, some scallops, after freezing and cooking, appeared to exhibit a toughness not normally found in scallops. Also, there was observed what appeared to be an excessive amount of cook drip associated with this species.

In the studies reported here, emphasis was placed on the quality changes that could result from the postmortem storage of scallop meats held at 32-34 F because in the current commercial method of handling on the vessel, the shucked meats are stored on ice until the vessel returns to port, and the meats are transferred to the freezer plant.

Specifically, the objectives of these studies were to define the major chemical and physical quality changes resulting from storage at 32 F and to suggest methods or changes in practice to control the undesirable quality changes.

Materials and Methods

Samples and storage

All weathervane scallops *(Platinopecten caurinus)* used in these tests were obtained live from the Strait of Georgia near Blaine, Washington. The scallops were transported to the laboratory in fresh seawater and maintained live in a seawater holding tank until the time the animal was shucked (the removal of the adductor muscle from the shell). Shucked scallop meats were stored in glass jars and the jars were buried in crushed ice.

Texture evaluation and cooked drip measurement

Objective measurement of the texture of raw and cooked meats was made by testing a 15 g portion (muscle fibers were oriented parallel to the shearing surfaces) of scallop meat in the shear device that was described by Dassow and coworkers *(1)*.

Meats were cooked by steaming for 5 min and cook drip volume was measured by collecting the exudate resulting from the cooking of 8 scallop portions which had a total weight of 120 g.

Phosphate treatment

Meats were treated with phosphate by dipping in solutions that contained 2% sodium chloride and 7.5% sodium tripolyphosphate or sodium hexametaphosphate for periods of 10 sec to 15 min (at a temperature of approximately 34 F).

Protein extraction and analysis

Protein was extracted from scallop meats by the procedure of Matsumoto and coworkers *(4)*. Protein determinations were made by the method of Lowry et al. *(3)*.

pH measurement

The pH of the meat was estimated by placing a standard combination electrode against the freshly cut surface of a scallop meat. The electrode was maintained in contact with the flesh until the meter reading stabilized (about 1-2 min). The pH obtained by this method is only an estimate of the pH of the extracellular tissue fluids; however, such data can prove valuable if its limitations are observed.

Preparation of scallop meat extracts

Raw or cooked samples were immersed in 2 volumes of chilled 3% perchloric acid, homogenized for 2 min, and filtered. The filtrate was immediately adjusted to pH 6.5-6.8 with 10% KOH, then held at 32 F for at least 1 hr before the insoluble potassium perchlorate was removed by filtration. The filtrates were stored at 0 F until analyzed.

Phosphorylated sugars and glycogen

Phosphorylated ribose and fructose in neutralized perchloric acid extracts were fractionated by using a Dowex 1-Cl[1] column *(9)*. Pentose sugars were measured in the column eluates by the method of Mejbaum as given in Umbreit, Burris, and Stauffer *(10)*. Fructose sugars were measured in column extracts using the method of Roe *(6)*. Glycogen was determined in unneutralized perchloric acid extracts by the method

[1]Use of trade names does not imply endorsement by the Bureau of Commercial Fisheries.

TABLE 1. TEXTURE EVALUATION OF SCALLOP MEATS

Treatment	Treatment variables: Iced storage (Days at 32 F before freezing)	Treatment variables: Frozen storage (Months at 0 F)	Number of evaluations	Mean pressure to shear 15 g sample (lb)	Standard deviation	Significance[2]
A	0	0	16	3.9	1.08	
B	1	0	8	6.5	1.69	Means of A & B, A & C, and A & D were significantly
C	2	0	8	9.9	1.27	different at the 0.1% level.
D	10	0	16	10.2	1.62	
E	0	6	16	4.1	1.47	Means of D & H and D & I were significantly different
F	1	6	8	6.9	2.37	at the 1% level.
G	2	6	8	11.2	2.73	
H	10	6	16	15.3	4.3	Means of B & F, C & G, and A & E were not significantly
I	9 (polyphosphate treated[1])	0	24	9.3	0.98	different.

[1]Samples were dipped in a solution that contained 2.0% sodium chloride and 7.5% sodium tripolyphosphate for 15 min prior to storage.

[2]These comparisons were made using the t-test.

of Roe and Daily *(7)* with the anthrone reagent prepared after the procedure of Morris *(5)*.

Nucleotide analysis

Ion-exchange chromatography of the extracts was carried out by placing an amount of extract equivalent to approximately 5 g of muscle on a multibore column (4.5 x 1.8, 4.5 x 1.0, 4.5 x 0.2 cm) *(8)* of Dowex 1 x 8 (formate)[1] 200-400 mesh. Columns were washed with water until the effluent was free of material absorbing at 260 mμ. The nucleotides were eluted according to the procedure of Jones and Murray *(2)*. The column effluent was continuously monitored at 260 mμ with a UV analyzer. Fractions common to individual peaks were pooled, the absorbance measured, and the amount of nucleotide calculated by using the molar extinction coefficient.

Flavor evaluation

Triangle tests were made to determine whether a difference could be detected between freshly shucked and stored scallop meats.

RESULTS AND DISCUSSION

Preliminary quality evaluation of stored scallops

Taste panel results indicated that little or no flavor differences could be detected between freshly shucked scallop meats and those held at 32 F for up to 10 days. However, the stored meats did have a somewhat firmer texture. This observation led to an examination of the relationship of storage time to texture changes.

Texture changes in stored meats

Storage of scallop meats did not affect the texture of the uncooked scallop, but did result in firmer cooked meat and an increased volume of cook drip compared to unstored samples (Tables 1 and 2). A statistically significant increase in firmness was shown by a shear test and increased volumes of cook drip were found for iced samples held for only 1 day. The rate of change in firmness and cook drip leveled off after 2 days of storage and showed only small increases with storage beyond 2 days.

Since most of the scallop meats harvested from Alaskan waters are held in frozen storage prior to use by the consumer, the combined effects of postmortem storage at 32 F and frozen storage at 0 F were studied. Frozen storage caused an apparent additional increase in firmness, over and above that caused by postmortem storage alone. However, only the samples stored 10 days at 32 F followed by 6 months of frozen storage at 0 F had statistically significant increases (Table 1).

The degree of firmness that is caused by postmortem storage was judged by the authors as an important negative change in quality. These texture differences were not, however, evaluated from a preference standpoint by a sensory panel, because only limited numbers of live scallops were available for experimental use.

The cook drip losses can be considered undesirable, both from the standpoints of appearance and of yield.

Phosphate treatment

It would, of course, be highly desirable to be able to control the degree of texture change and the amount of drip in postmortem-stored meats. Since phosphate treatment has been found useful in controlling the loss of moisture from other types of

TABLE 2. VOLUME OF COOK DRIP FROM SCALLOP MEATS AFTER VARIOUS TREATMENTS

Treatment		Number of evaluations	Volume of drip from 120 G meats	
Postmortem storage (Days at 32 F)	Frozen storage (Months at 0 F)		(ml)	(mean)
0	0	2	7,11	(9)
1	0	1	17	
2	0	1	33	
10	0	2	34,39	(36.5)
0	6	2	10,13	(11.5)
1	6	1	16	
2	6	1	38	
10	6	2	33,44	(38.5)
9 (polyphosphate[1] treated)	0	2	34,28	(31.0)

[1]Samples were dipped in a solution that contained 2.0% sodium chloride and 7.5% sodium tripolyphosphate for 15 min prior to storage.

TABLE 3. RELATIONSHIP OF pH OF SCALLOP MEAT AND STORAGE

Days at 32 C	Number of observations	pH	
		Range	Mean
0	8	6.8-7.1	7.0
1	9	6.0-7.0	6.5
2	9	5.8-6.6	6.3
3	9	5.8-6.0	5.9
4	9	5.8-6.0	5.9
5	9	5.7-5.8	5.7
10	9	5.6-5.8	5.7
14	5	5.8-6.0	5.9

fishery products, tests were carried out to determine its effectiveness when used on scallop meats.

Treatment with sodium hexametaphosphate gave little or no control over texture changes. Sodium tripolyphosphate caused a significant decrease in development of toughness (Table 1), but it did not occasion a significant decrease in the volume of cook drip. The amount of control realized through the use of polyphosphate on scallop meats stored postmortem does not appear to justify its use.

Salt-soluble protein

In an effort to explain production of the greater amount of drip or the loss of the water-holding capacity of stored scallop meat after cooking, the effect of postmortem storage on solubility of proteins of scallop meat was measured. The solubility of these proteins in 0.3 and 0.5 ionic strength salt solutions did not change during the 10 days of storage of the meat at 32 F. However, solubility in 0.15 ionic strength solutions decreased about 30% between 1 and 6 days of storage after which time solubility did not appear to change.

Loss of solubility of this protein fraction occurred during the same period of storage time in which greatest losses of water-holding capacity of cooked meats also occurred. However, no further work was done to determine if this decrease in solubility was the direct cause of the loss of water-holding capacity. Matsumoto and coworkers *(4)* reported that the solubility of muscle proteins of the scallop *(Placopecten magellanicus)* decreased as a result of postmortem storage of the muscle. These authors explained this loss of solubility in the following way: In freshly shucked meats or in meats that have been stored only a short time, structural proteins are present as a dispersion of particles resulting from the effect of endogenous adenosine triphosphate, (ATP) rather than a true solution. As storage progresses, ATP content of the muscle falls to very low values causing the subsequent precipitation or gelling of the protein in the extracts. If this explanation is accepted, failure to extract these proteins from weathervane scallop meat which has been stored for extended periods would be expected since little natural ATP is present after several days of storage (Table 5).

TABLE 4. CONTENT OF PHOSPHORYLATED SUGARS AND GLYCOGEN IN STORED SCALLOP MEATS

Days at 32 C	Glycogen (g/100 g)	Fructose phosphate (μM/g)	Hexose phosphate (μM/g)
0	3.3 (3)	1.9	6.1
1	—	8.9	18.3
2	—	6.1	22.0
6	2.1 (4)	12.9	19.9
8	—	9.2	40.3
10	2.2 (4)	13.7	36.5
15	2.0 (4)	—	—
0 (cooked)[1]	—	1.2	7.5
0 (frozen-thawed)	—	7.1	29.0

[1]Cooked in oven at 500 F for 7 min.

pH of the stored scallop meats

A decrease in the pH of muscle during early postmortem storage is expected since the metabolic products of glycolysis are acidic. The rate of this pH change is related to the rate of formation of

TABLE 5. CONTENT OF NUCLEOTIDES IN STORED SCALLOP MEATS (μM/G WET MUSCLE)

Days at 32 F	AMP	ADP	ATP	Total
0	0.08	1.08	6.25	7.41
1	1.9	1.6	0.91	4.44
2	1.8	1.5	0.63	3.99
4	1.8	0.99	0.28	3.10
6	1.9	0.96	0.18	3.08
8	2.0	0.75	0.47	3.22
10	1.9	0.04	0.04	2.0
0 (freeze-thawed)	4.06	not detected	0.11	4.17
0 (cooked)[1]	3.05	0.69	0.14	3.97

[1]Baked in oven at 500 F for 7 min.

acidic metabolites and the buffering capacity of the muscle. The pH values of the scallop meats held at 32 F for up to 14 days are given in Table 3. The pH decreased from approximately 7 in freshly shucked scallops to 6.5 after the first day and to 5.9 after the third day; additional storage did not appreciably change the pH. From this, it appears that pH might be a useful object criterion for evaluating the postmortem age of very fresh scallops.

Phosphorylated sugars and glycogen

The rapid pH decrease observed for the stored scallop meat suggested rapid changes in the carbohydrate food stores of the scallop muscle. This was substantiated through the measurement of glycogen, fructose phosphate, and hexose phosphate (Table 4). The glycogen content decreased approximately 36%, fructose phosphate increased 7-fold, and hexose phosphate increased 3-fold. Freeze-thawing appeared to increase the rate of formation of the fructose and hexose phosphates and the degradation of glycogen. During the early postmortem storage period, fructose phosphate or hexose phosphate content appeared to be useful as a measure of postmortem age of the scallop meat.

Adenine nucleotide content

Nucleotides have importance, in general, because of their flavor enhancing effect. In the meat of the scallop, this flavor-enhancing effect of nucleotides [mainly inosine monophosphate (IMP) and guanosine monophosphate] is relatively unimportant since these nucleotides are either not present or are only present in sub-threshold flavor potentiating concentrations.

The nucleotides are pertinent in this scallop study because of the suggested effect of ATP content on the solubility of the actomysin of the meat and because of the potential usefulness of nucleotide degradation rates as indices of postmortem age.

The content of the individual nucleotides in scallop meats stored at 32 F for up to 10 days is given in Table 5. Since only trace amounts of IMP were detected at the different levels of storage, its values have not been included here. During the first day of storage, total nucleotide was degraded rapidly, after which, upon further storage, the rate decreased. ATP was rapidly degraded during the first day of storage. One possible effect of this loss of ATP was mentioned earlier in reference to the loss of scallop protein in 0.15 ionic strength salt solutions. Adenosine monophosphate (AMP) accumulated rapidly during the first day of storage and was then maintained at 1.8-2.0 μM/g during the 10-day test period. Freeze-thawing or cooking resulted in greater levels of AMP than was found in samples stored 10 days at 32 F. Adenosine diphosphate (ADP) content reached a maximum after 1-2 days of storage and then gradually decreased until at 10 days of storage, only trace amounts remained. From this pattern of nucleotide degradation, it appears that the rate-limiting step is degradation of AMP.

Although there is interest in the use of degradation rates of nucleotides for quality measurement, the very rapid changes that occur in scallop during the early period of storage seems to preclude their value as quality indices for this species.

GENERAL DISCUSSION

Although storage at 32 F for up to 10 days causes little or no undesirable change in the flavor of scallop meats, storage does cause a pronounced change in the cooked texture of the meat. This texture change is objectionable because it results in a firmer cooked product with increased cook drip. Actually the loss of the drip can be considered a loss of yield which could be an important factor in some product end-uses.

Freshly shucked scallop meats are a more high desirable product than a meat that has been held in storage at 32 F before processing. The processing of freshly shucked scallops, however, would require a major change in scallop harvesting practices. Probably the freezing of the meats aboard the scallop vessel would be the most practical way to process freshly shucked scallops. The higher quality product which can be produced by this innovation would most probably justify this change in practice.

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REPORT OF THE COMMITTEE ON FOOD EQUIPMENT SANITARY STANDARDS, 1968-1969

The IAMFES Committee on Food Equipment Sanitary Standards, known hereafter as the Committee, is charged with the responsibility of cooperating with other interested health organizations and related industries in the formulation of sanitary standards and educational materials for the fabrication, installation, and operation of food equipment and to present to the membership those standards and educational materials which the Committee recommends be endorsed by the Association.

The purpose of this cooperative program is to aid industry in improving the design, construction, and installation of equipment so that it will lead to easy cleaning and proper functioning when placed into service in food establishments. It is the Committee's further purpose to cooperate with industry in the preparation of standards or guidelines which public health agencies will accept, thereby securing uniformity in the manufacture and nationwide acceptance of such equipment.

The following report will outline the Committee's activities during the past year in working with two health and industry organizations (National Sanitation Foundation's Joint Committee on Food Equipment Standards and the National Automatic Merchandising Association's Automatic Merchandising Health-Industry Council) and progress in meeting its purposes and objectives. It is expected these organizations will be the two groups that the Committee will work with during the coming year.

National Sanitation Foundation (NSF)

The Committee was represented at the 1969 meeting of the National Sanitation Foundation's Joint Committee on Food Equipment Standards, where action was taken on several proposals; and prior to the meeting, the Committee reviewed and submitted comments on each draft of these proposals. Since the meeting, the Committee has also reviewed and submitted comments on proposed changes to existing standards.

Standards No. 1 and 2. Attempts have been made during the past year to alert members of public health and the food service industry that NSF Standards 1 and 2 provided for cold pans—both mechanically and non-mechanically "refrigerated" units not capable of maintaining foods at safe temperatures. According to the manufacturers, the typical units are not designed and constructed to maintain food at 45 F or less. Nevertheless, a proposal was defeated at the 1969 meeting that would have required mechanically refrigerated cold pans not capable of maintaining foods stored therein at 45 F or less to bear a permanent, legible, easily readable label as follows: "This cold pan is not designed to maintain foods at 45 F or less." With the defeat of this proposal, the Foundation's former policy on approving cold pans on the basis of cleanability rather than on the basis of cleanability and also their ability to maintain food at safe temperatures or so inform the buyer will be continued for another year.

The open refrigerated cases normally found in grocery stores to refrigerate dairy products have proven that effective cold pans can be built to hold foods on display at safe temperatures. When the sanitarians demand such principles be applied in the construction of cold pans for the food service industry, cold pans will be designed to properly refrigerate potentially hazardous foods.

At the 1968 Joint Committee meeting, the public health representatives recommended that all wheeled utensil storage equipment be tightly enclosed to a height of 18 inches from the floor. However, during the past year, industry reviewed this proposal and experiencing some difficulty to comply therewith received approval of its request to delay enforcement of this new proposal for the next year. The Foundation staff was requested to further study, during this period, the need and feasibility of including all types of utensil storage equipment (mobile, fixed, self-leveling, and stationary). The proper height of the enclosure would also be a part of this study. After receiving a report of this study and comments of this and other Committees, the Joint Committee would determine the inclusiveness of the proposal for enclosure of utensil storage equipment.

Standard No. 4. Item 4.06 was amended to permit exposed threads, screws, bolts, rivet heads, nuts, and studs to be used in fastening thermostat bulbs and heating element supports in deep fat fryers or in fat filters. Apparently, a large per cent of the manufacturers of deep fat fryers and filters have been unable, to date, to fabricate equipment which would comply with the Standard without these objectionable exemptions.

The need for thermometers in hot food holding equipment was reviewed with the public health representatives, and the Foundation was requested to contact the Industry Advisory Group and the thermometer manufacturers for the purpose of discussing the feasibility of requiring thermometers on all hot food handling equipment. It is believed that all

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COMPARISON OF TWO PROCEDURES FOR ENUMERATION OF MICROORGANISMS FROM FROZEN FOODS[1]

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Abstract

Microbial counts of frozen raw shrimp, frozen processed shrimp, and frozen mixed vegetables were obtained by various combinations of recovery media, diluents, spread or pour-plating, and incubation temperatures of 27 C and 35 C.

Greater numbers of microorganisms were recovered after incubation at 27 than at 35 C. Spread-plating yielded higher counts than the pour-plating. The addition of 0.5% NaCl and peptone to the agar medium resulted in a greater recovery of microorganisms from frozen raw shrimp, but had no effect on frozen processed shrimp or frozen mixed vegetables. Butterfield's phosphate buffer was slightly superior to 0.2% peptone as a diluent.

Consistently higher microbial counts from seafoods obtained by this laboratory in comparison to results of others prompted us to examine the two methods used and evaluate the factors that were responsible.

Our method employed surface spread-plating and an incubation temperature of 27 C *(2)*. This procedure was compared to that of Surkiewicz *(8)*, which employed pour-plating and 35 C incubation. The two methods also differed in recovery medium and diluent.

Three frozen foods, mixed vegetables, and raw and processed shrimp, were examined by combinations of the two procedures and the microbial counts obtained by each method compared.

Material and Methods

Media and ingredients.

The plate count agar (PCA) contained 0.5% tryptone, 0.25% yeast extract, 0.1% glucose, and 1.5% agar. The medium being compared (TPN) contained all the ingredients in the concentrations listed above plus 0.5% peptone and 0.5% NaCl.

Butterfield's phosphate buffer, henceforth referred to as buffer, was prepared according to the formula of Surkiewicz *(8)*. The buffer was compared to 0.2% peptone as a diluent *(7)*.

Unless otherwise noted all ingredients used were Difco products and reagent grade chemicals.

Foods

Frozen raw shrimp and frozen processed shrimp were obtained from a local seafood processor and the frozen mixed vegetables were purchased from a local retail market.

Test procedures

The 10 g portions of frozen shrimp samples and 20 g portions of frozen mixed vegetables were weighed aseptically in sterile petri dishes and placed in bottles containing 5 g of glass beads and 90 ml of the respective diluents. Subsequent dilutions were made in tubes containing 9 ml of the respective diluent.

The spread-plating was done using 0.1 ml of the diluents on both PCA and TPN. Agar for spread-plating had been poured 24 hr previous to the experiment and the excess moisture evaporated by overnight incubation at 27 C. The pour-plating was done using 1.0 ml diluent. The molten agar was maintained at 45 C in a water bath. All samples were plated in triplicate. One group of plates were incubated at 27 C and the other at 35 C.

Results and Discussion

The microbial counts of the frozen raw shrimp enumerated by 16 combinations of procedures are presented in Table 1. The microbial counts of this sample varied from 3.3 x 10^5 to 4.1 x 10^6, or by a factor of more than 10, depending on the method of enumeration. The maximum count was obtained by spread-plating the buffer dilution on TPN and incubating the plates at 27 C. The lowest count was

Table 1. Microbial count of frozen raw shrimp enumerated by various methods

Media	Diluent	Plating method	Microbial count (x 10^4)[a] at 27 C	Microbial count (x 10^4)[a] at 35 C
TPN	Peptone	s.p.[b]	328.8	163.4
		p.p.	238.0	183.8
	Buffer	s.p.	414.7	230.0
		p.p.	265.5	75.0
PCA	Peptone	s.p.	267.0	209.5
		p.p.	242.6	64.5
	Buffer	s.p.	304.7	50.3
		p.p.	257.8	33.3

[a]An average from six replicates.
[b]s.p. = spread-plating, p.p. = pour-plating.

[1]Technical Paper No. 2795, Oregon Agricultural Experiment Station.

obtained by the method recommended by Surkiewicz *(8)*. The incubation temperature was the major contributing factor for this difference. The least number of colonies obtained at 27 C was still greater than the maximum number of colonies obtained by 35 C incubation.

The original intent of the aerobic plate counts was to evaluate the sanitation in the processing plant *(8)*. While the mesophilic count would have been sufficient for this purpose, such counts would not reflect the microbial load of foods where the psychrotropic species are expected to be present in large numbers *(9)*. The 27 C incubation temperature was selected as a best compromise to permit the growth of psychrotropic and the mesophilic species *(2, 7)*. While 27 C might have been too high for some obligate psychrophiles to grow, the possibility of this group of microorganisms contributing to seafood spoilage is considered remote *(5)*. All microorganisms which grew at 5 C were able to grow at 27 C but over 90% had failed to grow at 35 C (Unpublished observation).

The microbial flora of raw shrimp contained species of which nearly 90% might be classified as psychrotrophs *(3)*. It is not surprising, therefore, that the 27 C incubation could have contributed to a greater recovery of microorganisms from this sample.

With one exception, the spread-plates yielded more colonies than the pour-plates. The reasons for this difference may be similar to those proposed by Clark *(1)*. Spreading could have dispersed clumped cells, and perhaps it was an added stress to some cells to form visible colonies when submerged in agar. It also could result from the inability of freeze-damaged bacteria to survive exposure to 45 C agar. Psychrophilic bacteria have been shown to be sensitive to plating medium temperature *(9)*.

The difference between spread-plating and pour-plating was not as pronounced in the processed frozen foods, which were subjected to heat during processing (Tables 2 and 3). It is reasonable to assume that heat-processing had selected more heat-resistant microorganisms. The microbial flora of ready-to-freeze shrimp contained 76% gram-positive cocci which were more tolerant to freezing and to heat than the Gram-negative bacteria, that were found in large numbers in raw seafoods *(3, 4)*.

The TPN was slightly better than PCA for the recovery of microorganisms from frozen raw shrimp. As observed previously with raw fish *(2)*, 0.5% NaCl, and perhaps to some extent, the complimentary effect of nutrients provided by 0.5% peptone could have helped recover some of the bacteria which would otherwise have been lost during enumeration.

Although 0.2% peptone has been judged superior to distilled water, 0.067M phosphate buffer, and 0.1% peptone *(7)*, it apparently was not as effective as Butterfield's phosphate buffer as a diluent for the foods examined.

TABLE 2. MICROBIAL COUNT OF FROZEN PROCESSED SHRIMP ENUMERATED BY VARIOUS METHODS

Media	Diluent	Plating method	Microbial count (x 10^2)[a] at 27 C	Microbial count (x 10^2)[a] at 35 C
TPN	Peptone	s.p.[b]	125.8	92.2
		p.p.	103.0	95.7
	Buffer	s.p.	115.2	59.3
		p.p.	87.4	66.2
PCA	Peptone	s.p.	120.0	80.8
		p.p.	130.3	80.7
	Buffer	s.p.	135.7	49.6
		p.p.	88.0	46.5

[a]An average from six replicates.
[b]s.p. = spread-plating, p.p. = pour-plating.

TABLE 3. MICROBIAL COUNT OF FROZEN MIXED VEGETABLES ENUMERATED BY VARIOUS METHODS

Media	Diluent	Plating method	Microbial count (x 10^2)[a] at 27 C	Microbial count (x 10^2)[a] at 35 C
TPN	Peptone	s.p.[b]	135.8	118.1
		p.p.	114.8	95.3
	Buffer	s.p.	238.6	198.3
		p.p.	205.1	202.3
PCA	Peptone	s.p.	161.1	98.5
		p.p.	127.1	102.6
	Buffer	s.p.	224.2	174.6
		p.p.	189.0	175.5

[a]An average from four replicates.
[b]s.p. = spread-plating, p.p. = pour-plating.

The microbial load of processed shrimp was reduced to less than 1/100th of the raw shrimp (Table 2). The 35 C counts of the shrimp and those from the mixed vegetables were only slightly lower than the comparative values at 27 C (Table 2 and 3).

The microbial flora of raw shrimp was shown to contain mostly *Acinetobacter-Moraxella* and *Flavobacterium* species. On the other hand, the processed

shrimp contained up to 76% gram-positive cocci *(3)*. The selection of heat-resistant species as a result of cooking shrimp and blanching vegetables, coupled with the elimination of a large number of psychotrophic species, could have been the reason for the limited difference between 27 C and 35 C counts. The 27 C counts, however, were always greater than the comparable 35 C counts in all 48 combinations tested. Perhaps the microbial flora difference was responsible for the lack of advantage shown by TPN over PCA for the heat-processed foods.

There was very little difference between spread-plating and pour-plating when the incubation temperature was 35 C (Tables 2 and 3). Since the spread-plates yielded more colonies than the pour-plates at 27 C, the difference cannot be attributed to the improved dispersion of the cell clumps alone. It appears that the higher counts obtained by 27 C incubation resulted from additional growth of psychrophiles, some of which could not survive in 45 C molten agar *(10)*.

The implication of this study is limited by the number of samples and the methods of enumeration tested. The data, nevertheless, point out the significance of selecting a procedure which will best reflect the microbial flora of a food.

ACKNOWLEDGMENT

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REPORT OF COMMITTE ON FOOD EQUIPMENT

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food temperature control equipment (hot and cold) should be equipped with appropriately located accurate temperature indicating equipment.

Standard No. 7. In order to provide for more uniformity among the Standards and to keep in line with current technology and practices, definitions for the following terms were approved for use in the Standard: plastic, plastic resin systems, thermo-plastics, and thermoset plastic.

Item 3.08 on shelves was amended to read as follows: Shelves in reach-in refrigerators and freezers shall be considered food zone and the shelves in walk-in refrigerators and freezers shall be considered splash zone.

Item 4.052 on joints and seams in the food zone of reach-in refrigerators provided that effective July 1, 1969, such joints and seams must be filled and finished to conform with Item 3.01. However, it was reported that only a small number of the manufacturers had equipment which would comply with this provision. At the industry's and Foundation's request, the deadline for compliance with this requirement was extended until July 1, 1970.

Item 4.19 on louvers and openings was amended to conform with provisions incorporated in Basic Criteria No. 2 and reported in detail to the membership by this Committee in 1968.

Item 5.02 on joints and seams in walk-in refrigeration equipment was amended to read as follows: Joints and seams in the inside liner shall be kept to a minimum. All necessary fabrication joints and seams resulting from assembly shall be designed to permit sealing in an effective manner on erection. Shelf supports . . .

Item 5.03 on doors of walk-in refrigerators was amended to require doors to be equipped with a mechanism to permit their being opened from the interior of the unit even when locked on the exterior.

Standard No. 18. According to the NSF staff, the term "readily accessible" in Item 4.241 as it related to access panels was in direct conflict with U. L. safety requirements which the manufacturers were also required to meet. Consequently, public health representatives concurred in deleting the term "readily" from this Item at least until this matter could be further explored.

The public health representatives also recommended amending Items 4.011 on cleanability by adding the following sentence at the end of the paragraph: Equipment intended for in-place cleaning shall have attached in a conspicious place, a permanent, legible, and easily understood set of cleaning instructions.

The representatives also recommended including a new Item, 4.38, on exposed locations to read as follows: Dispensing equipment intended for use in exposed locations (open front markets, fairs, and the like) shall have covers on food and beverage storage compartments designed in such a manner

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A Research Note

EFFECT OF 5′-RIBONUCLEOTIDES ON HEAT-INDUCED OFF-FLAVOR OF HYDROLYZED VEGETABLE PROTEIN

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Abstract

The effect of an added mixture of IMP:GMP (1:1) on heat-induced off-flavor in solutions of commercial samples of hydrolyzed vegetable protein (HVP) was evaluated with a trained sensory testing panel using a standard paired comparison method. Samples were prepared with and without addition of nucleotide, vacuum sealed in cans, and heat processed at 250 F for 35 min. In every comparison, the panel was able to detect differences between samples at a very high level of significance, statistically, and indicated that IMP:GMP at 0.005% or 0.01% definitely suppressed apparent intensity of the typical off-flavor of heated solutions of HVP.

Several applications of the 5′-ribonucleotides, disodium 5′-inosinate (IMP) and disodium 5′-guanylate (GMP), to improve the acceptability of processed foods have been described recently (Kuninaka et al., *5;* Shimazono, *6, 7;* Caul and Raymond, *1;* Hashida et al., *3, 4;* Stier et al., *8;* Dannert and Pearson, *2*). Among these applications, IMP and GMP have been said to modify the flavor of hydrolyzed vegetable protein (HVP) products. Most, if not all, HVP materials develop, on exposure to heat, a characteristic, unpleasant, off-flavor. The present investigation was carried out to evaluate the effect of IMP and GMP on this heat-induced off-flavor produced in commercial samples of HVP representative of those on the U.S. market at present.

Materials and Methods

Eight commercial preparations of HVP were obtained from four important manufacturers. They were in both liquid and powdered form and differed considerably in flavor quality. A 1% or 2% (w/v) solution of each HVP product was prepared in distilled water. This solution was mixed thoroughly and divided into three lots: one served as control, to another was added 0.005% of a 1:1 mixture of IMP:GMP (Ribotide, supplied by Takeda U.S.A., Inc., New York), and to the third was added 0.01% of the mixture of IMP:GMP. Each solution was transferred to cans, No. 303 with fruit enamel lining, which were vacuum sealed and heat processed at 250 F for 35 min. For panel evaluation, samples were warmed to 68 C and served in 2 oz portions.

Samples were evaluated by standard paired comparison method in a specially designed sensory testing laboratory equipped with isolation booths, and provision for control of light intensity, temperature, and humidity. Panelists were selected and trained for the study on the basis of their sensitivity in detection of the typical heat-induced off-flavor in HVP and on consistency of performance. Training was accomplished by a series dilution technique—unheated HVP solution was diluted with a severely heat processed solution of the same HVP which exhibited a typical pronounced off-flavor. In each panel session, two coded heat-treated samples were presented in random order, one control and the other containing IMP:GMP. Sessions were carried out at mid-morning and afternoon (time of day had no effect on panel performance). Panelists were asked to indicate which of the two samples had the greater off flavor. Panel size was 10 or 11 persons and 4 replications were accomplished for each comparison.

Table 1. Paired comparison test data: HVP with IMP:GMP (1:1) vs. HVP alone. Solutions were compared after both were heat processed at 250 F for 35 min.

Product	HVP conc., %	IMP:GMP conc., %	No. judgments expressing greater off-flavor: HVP alone	HVP with IMP:GMP	Signif.
1	1	0.005	32	10	***
	1	0.01	34	4	***
2	1	0.005	32	10	***
	1	0.01	29	7	***
3	1	0.005	40	4	***
	1	0.01	40	4	***
4	1	0.005	34	10	***
	1	0.01	42	2	***
5	1	0.005	37	7	***
	1	0.01	35	9	***
6	1	0.005	41	3	***
	1	0.01	38	6	***
	2	0.005	42	2	***
	2	0.01	42	2	***
7	2	0.005	37	7	***
	2	0.01	37	7	***
8	2	0.005	40	4	***
	2	0.01	41	3	***

***Difference significant at the 0.1% level.

Results and Discussion

In Table 1, sensory test data are presented for evaluation of the effect of 5′-ribonucleotides on heat-induced off-flavor of HVP. In every comparison studied, the panel was able to detect differences between samples at a very high level of significance, statistically. The difference observed consistently in-

dicated that the added mixture of IMP:GMP at a concentration level of 0.005% or 0.01% was responsible for a reduction in apparent intensity of the typical off-flavor of heated solutions of HVP. Whether or not this effect also would occur in a more complex food system, remains to be determined.

No attempt was made in this study to measure the degree of suppression of off-flavor. According to panelists' comments, considerable variation in intensity of off-flavor, and in degree of suppression, occurred with different manufacturers' products. Additional study will be required to establish optimal levels of IMP:GMP for maximum suppression of this off-flavor.

Hydrolyzed vegetable protein materials are being used widely in our food industry as flavor additives. Recently, the high cost and variable quality of beef extract has led to the introduction of new HVP materials which contain 5′ribonucleotides. These products have been found capable of providing total or partial replacement of beef extract in certain applications (Shimazono, 7).

An important implication of this development should be mentioned. It is well known that the nature of the flavor modifying effect of the 5′-ribonucleotides may differ in accordance with the flavor characteristics of the particular food system employed (Titus, 9). In tests with aqueous solutions, Woskow *(10)* has shown that a 1:1 mixture of IMP:GMP may suppress the bitterness of quinine sulfate and the sourness of citric acid, whereas it may enhance the sweetness of sucrose and the saltiness of sodium chloride. If they can suppress, in certain instances, metallic, sulfury, salt, or bitter flavor notes, and enhance sweet or other notes, use of these nucleotides in product formulation should be approached with caution. Flavor potentiators can be important tools for the manipulation of flavor, but it is important to recognize that indiscriminate application can cause undesirable imbalance of flavor components. A better understanding of the nature of interactions among chemical components of consequence to flavor in food systems is necessary, and especially with regard to the influence of flavor potentiators, such as the 5′-ribonucleotides.

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REPORT OF COMMITTEE ON FOOD EQUIPMENT

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as to exclude dust and insects and to prevent unintentional displacement or removal of the cover. The dispensing head on such equipment shall also be protected against dust and insects. The equipment may be so designed and equipped to effect this additional protection, or the manufacturer shall offer optimal equipment or devices to effect same.

New standards. The final draft of the proposed NSF Standards relating to "Chemical Feeders for Use with Commercial Spray-type Dishwashing Machines" and to "Commercial Cooking Equipment Exhaust Systems" was thoroughly reviewed; and after several amendments incorporating suggestions of this Committee and other public health oriented groups and members of the industry, they were both approved by the Joint Committee. Copies of these new standards as well as other standards and criteria may be obtained from the National Sanitation Foundation.

Basic criteria C-2. Two terms, sealed and splash zone, were redefined as follows: Sealed spaces shall have no openings that will permit the entry of dirt or moisture (the former additional words—rodents and insects were deemed superfluous and objectionable); and splash zone or splash contact surfaces shall mean those surfaces which are subject to continued splash, spillage, or other soiling during normal use.

Further, for the purpose of promoting uniformity, the Foundation was requested to review all common definitions and to suggest appropriate revisions of the definition of terms contained in all of the criteria and standards. These proposals should be ready for consideration by this Committee and the Joint Committee within the next year.

Sink—water heating equipment. The Joint Committee felt that some help should be given to persons seeking assistance in obtaining water heating equipment which could attain and maintain 170 F water temperatures in one compartment of a sink for manually washing and sanitizing utensils. Therefore, it recommended that the Foundation consider developing guidelines, charts, or tables relating to the sizing of sink heaters for inclusion in the new NSF Installation Manual for Food Service Equipment.

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A NEW APPROACH TO CONSUMER PROTECTION AND ENVIRONMENTAL HEALTH[1]

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Editor's Note: Another reorganization of the Food and Drug Administration has occurred since this paper was prepared. Even though these organizational details are no longer accurate, the paper is being published because it offers views on a wide range of topics dealing with food protection and environmental health.

ABSTRACT

Recently, the Public Health Service (PHS) milk, food service, shellfish, and interstate carrier sanitation programs were transferred to the Food and Drug Administration (FDA) within the Consumer Protection and Environmental Health Service.

To administer these programs, a Division of Sanitation Control has been created within FDA's Bureau of Compliance. The Division consists of three branches: the Milk and Food Service Sanitation Branch, the Interstate Travel Sanitation Branch, and the Shellfish Sanitation Branch. Field operations will be under the administrative control of the Associate Food and Drug Directors in the ten regional offices of the Department. Scientific activities associated with the programs will continue primarily at the laboratories in Cincinnati, which are now a part of the FDA Bureau of Science.

The transfer of these voluntary, cooperative programs does not imply any change in their direction or philosophy. The programs have been shifted to the FDA so that our total effort in food protection can be more closely coordinated and can have the benefit of the strongest possible scientific base. The FDA will work with State agencies and private industry to continue and strengthen the voluntary, cooperative approach which has characterized the PHS programs in the past.

Maintaining the purity and safety of the nation's food supply encompasses problems that grow more complex with every innovation in food technology and with the changing life-style that marks contemporary life. New ways of preparing, packaging, and distributing food introduce new problems, while some of the old familiar hazards of food-borne diseases are intensified or complicated.

The Consumer Protection and Environmental Health Service was established to provide a single agency that can take into account the relationship of all environmental problems, coordinate activities, and provide leadership to the nation's effort to maintain environmental quality and protect the consumer. It includes, in addition to the Food and Drug Administration, the National Air Pollution Control Administration, and the Environmental Control Administration.

We live in a time when many people, particularly the young, are questioning all sorts of cherished ideas, hallowed by age-old tradition. Now, having said that, I want to assure you that I am not going to discuss the "generation gap." I mention this questioning spirit of the time simply because, stimulated perhaps by this spirit, I found myself recently thinking of how often certain platitudes and so-called truisms—the old aphorisms which used to be found in McGuffy's Reader, for example, seem to remain a part of our speech and often shape our outlook long after events have proved them false.

About 300 years ago, for instance, Will Shakespeare announced, "Frailty, thy name is woman." Men have been quoting Shakespeare to that effect ever since, while all the time women have been proving him wrong. The latest example is the gentle lady who is determined to invade the rough, tough world of baseball as an umpire, no less. I read a quip the other day that "American men believe that a woman's place is in the home, and expect her to go there right after work." So I guess most of us are still trying to reconcile some preconceived ideas about women with the evidence that confronts us every day of our lives.

And, just recently, a team of scientists, engineers, and astronauts have shown us very well that "what goes up" does not necessarily "have to come down." I wonder how long its going to take most of us to really revise our thinking in connection with that punctured platitude?

WHAT ARE NECESSITIES?

Then we come to that old saw, "Necessity is the mother of invention." It's been with us a long time and has the true ring of authority. Yet we have only to look around us, or to look inward perhaps at what makes us tick, to recognize that it is not nearly so true as it might seem.

In fact, most anthropologists and historians have concluded that real human creativity does not often emerge from the desperate struggle for existence. As Eric Hoffer, the longshoreman philosopher puts it, "The creative impulse does not flash forth when necessity takes us by the throat . . . The urgent search for the vitally necessary is likely to stop once we have found something that is more or less adequate, but the search for the superfluous has no end."

Hoffer points out, in fact, that most of man's inventions—including probably the wheel and the sail, and certainly the telescope and the microscope—were originally conceived not out of any recognized need, but as toys. Men made ornaments before they made clothes. And Columbus was seeking spices and the other luxuries of the Indies when he stumbled on America. Coming closer to our own time, I

[1]Presented at the Fifty-Sixth Annual Meeting of International Association of Milk, Food & Environmental Sanitarians, Inc., Louisville, Kentucky, August 17-21, 1969

think it fair to say that there was no public clamor, back in the nineties, for someone to invent an automobile. In fact, even after it was invented, it seems to have been regarded as a fascinating but somewhat ridiculous toy by most of the inventor's contemporaries. But, by now, that "unnecessary" invention has changed our lives in more ways than we can count and has created its own necessities.

Here's another example: within the last few years, few of us could have perceived any crying necessity for "non-returnable" bottles, as opposed to the old-fashioned variety, or for frozen TV dinners, or for food vending machines, or lasers, or a lot of other things we now think we can't do without. Now that we have these things, we would find it pretty hard to go back to the old ways. But there is no doubt they have presented some new and very real problems for us.

This may seem a rather long preamble to a discussion of the environment, and specifically of the problems you and I face in maintaining clean and wholesome food and milk for the citizens and consumers we all serve. I hope you will agree with me, however, that it does have relevance for us.

We live today in that "most civilized" society where luxuries are regarded as necessities. The creative and exciting and productive search for the things that enrich our lives goes on, and will go on at an even more energetic and exuberant rate. But just as the discovery of America complicated, even as it enriched the life of Europe, our contemporary explorations on the vast Sea of Technology present many inadvertent complications and some new challenges of necessity to modern man. The truth is, we are being far more successful in creating the luxuries of life than we are in meeting these challenges of necessity.

Our generation, and those who come after us, have to learn to "do with" what men have naturally, through most of their history, learned to do without. And that, in a nutshell, is a pretty good definition of the problem that faces the environmentalist today.

In the course of solving that problem, we're going to have to reexamine and reassess our old ways of doing things and maybe throw out a few more shibboleths and truisms. For I think we're finding, in all our areas of environmental and consumer protection that there's plenty that's "new under the sun" and that in those circumstances, "practice" has *not* necessarily "made perfect."

Safe and Nutritious Foods

I don't need to tell you how true this is in your own area of activity. I know you are finding that maintaining the purity and safety of food and milk, and the other problems you as sanitarians are concerned with, grow more complex with every innovation in food technology, and with the changing lifestyle that marks contemporary life.

Certainly not one of us would be willing to turn our backs on the modern supermarket or give up our pampered life, in which anyone can pass as a Cordon Bleu graduate if he can open a few enticing packages and follow the simple instructions on the back. We live in a marvelous age of food technology—and yet, in this, as in other facets of environmental change, our ability to understand and control the hazards of technological progress lags far behind our capacity for environmental manipulation.

In food protection, as well as other environmental areas, the methods of the past are not adequate to deal with the problems of the space age.

Over 50,000 plants throughout the Nation are today involved in the production of food products. Our people are eating more than 25% of their food in restaurants, institutions, or other food service establishments. We are succeeding beyond our fondest expectations in the development of new food products and new ways of distributing and serving those products.

But we are failing, not only to keep pace with the new problems, but even to control the oldest and best recognized of the food hazards such as the microbial and viral diseases. It is conservatively estimated that the Nation suffers from 2 to 10 million cases of such food-borne illnesses annually—and we have to estimate because we are lacking even an adequate reporting system which would give us a clear reading on the extent of the problem. Salmonellosis is, of course, a case in point and its prevalence constitutes, as we all know, a national disgrace. But this is only a part of the problem.

We know far too little about how various processing methods affect food products, in some cases, toxic substances may be introduced, or nutrients may be removed or destroyed. Potential carcinogens may result from irradiation, or even from smoking, broiling, or deep frying.

And, of course, the widespread use of chemicals in food production, processing, preservation, and packaging presents problems we are only beginning to understand: Each of us now consumes about 3 lb of chemical food additives—for color, preservation, or flavor every year; food is, of course, the principal source of human intake of pesticide residues, and, as you know, pesticide use has from time-to-time affected our milk supply in various places; antibiotics administered to food animals sometimes leave residues in milk, meat, or eggs.

All this, of course, in addition to the chemical barrage reaches man from every part of this environ-

ment today.

Fina'ly, I think we cannot, as environmentalists, ignore the potential effects which innovations in food technology may have on basic nutrition. Imitation milk and texturized vegetable protein foods can provide cheaper substitutes for foods of animal origin. But I think we can all agree that the public is entitled to assurance that such "imitations" at least provide the basic nutritional values of the original.

The Public Health Service, is, as you know, conducting nutritional studies in various parts of the Nation. The President has indicated his intention to call a White House Conference on Food, Nutrition, and Health. I think it is incumbent upon all of us to move toward a new approach to these problems, in which consideration of the total relationship of food to human health must replace the narrower concepts of food sanitation which have characterized our past efforts.

Environmental Problems are Related

Furthermore, I think we are all coming to realize more clearly with every passing year that no single environmental problem—whether it is food, drugs, pollution, noise, or any of the others—can be fully understood except in relation to the whole.

One weakness that has characterized our past efforts to deal with these problems has been a degree of fragmentation that was clearly undesirable—which grew, quite naturally, out of our desire to break the problem down into sort of "manageable pieces." But we have found that man does not live in "manageable pieces" of the environment. He is a whole man and he lives in a whole environment. Likewise, there are few "single causes" of disease. In assessing the effect of the environment on man's health, we have come to see that it is the combined, the multiple, the synergistic impacts that reach him from every part of his surroundings that make the difference between sickness and health.

Consumer Protection and Environmental Health Service

The Consumer Protection and Environmental Health Service, was established last summer in recognition of the need for new approaches to these problems, to give new impetus to our National effort to improve the environment, and to provide a focus on the *whole* man in his interaction with the *total* environment.

As you know, it includes the Food and Drug Administration, the National Air Pollution Control Administration, and the Environmental Control Administration. For the first time in the Department of Health, Education, and Welfare, we have brought all these organizations, dealing with protecting human beings from environmental hazards, together in a situation where they can be mutually supportive. We are finding that we are now able to take a more coordinated approach to environmental problems, and we are moving ahead as rapidly as possible to create a program which will have a real and lasting impact on these problems.

Food and milk programs

As a part of this new effort, we have made some internal program shifts as well. The one which most concerns you, of course, is the consolidation of all the food and milk programs within the Food and Drug Administration.

Let me say first, that I am much more interested in program functions than I am in the layout of organizational charts. Food protection programs are being brought together within FDA, not to tidy up these management charts, but to provide unified planning and support for these functions. Broadening the base of scientific support for these programs is particularly important in the light of the complex technological innovations about which I have been speaking.

Having said that, let me add that these voluntary, cooperative programs are not going to change in purpose or direction.

Some members of the dairy industry, in particular, have expressed concern about being brought within the jurisdiction of a regulatory agency. I can only tell them that they *have* been within the jurisdiction of the FDA—and for many years. The FDA has the same statutory responsibility to insure the wholesomeness of milk in interstate commerce as it does for other food products.

However, the Food and Drug Administration, as those of you who have worked with the Agency already know, is no stranger to cooperative undertakings with State agencies and private industry. Some of you may have participated in the voluntary educational program initiated by FDA two years ago to combat the problem of salmonella contamination in instant non-fat dry milk. The Agency also has expanded its voluntary compliance program among the many other industry groups whose products come within the scope of the Food, Drug, and Cosmetic Act and other consumer-protection laws. The pilot self-certification agreements in effect with two major food manufacturers also reflect our intention to utilize cooperative, voluntary approaches wherever possible.

FDA will continue to work, as has the PHS in the past, with State departments of both health and agriculture to assure a uniformly safe product for the consumer that can move freely in intrastate and interstate commerce.

To administer the milk, food, and sanitation programs, a Division of Sanitation Control has been created within the FDA's Bureau of Compliance. The Division consists of three branches: the Milk and Food Service Sanitation Branch, the Interstate Travel Sanitation Branch, and the Shellfish Sanitation Branch.

Field operations will be under the administrative control of the Associate Food and Drug Directors in the 10 regional offices of the Department. Scientific activities associated with the programs will continue primarily at the laboratories in Cincinnati, which are now a part of the FDA Bureau of Science. The acting director of the Bureau is Dr. Keith H. Lewis, whom you know from his many years of association with the milk and food programs of the Public Health Service.

As we move ahead within this new organizational structure, our aim will be to encourage the establishment and maintenance of effective, well-balanced, food, milk and sanitation programs in each State and to provide technical assistance toward that end.

The aim of all who are engaged in food protection —as in other environmental control programs—should be toward developing a system in which government at all levels, industry, voluntary standards setting groups, and the individual consumer all accept their full share of responsibility. We need to fill the gaps that now exist in our food protection efforts, but at the same time we need to avoid costly duplication of effort.

I mentioned a moment ago some of the activities of the FDA which are designed to promote cooperation and voluntary compliance. We are seeking and experimenting with other ways. Recently, FDA has provided a training course for New York City food inspectors, which will be followed by on-the-job training and by their commissioning as FDA officers, with primary responsibility for all food inspection in their jurisdiction. We believe this "single-system" approach can help us avoid confusion and duplication, and set a uniform standard for compliance. Similar programs have been carried out with inspectors of the New York State Board of Pharmacy and the New Jersey Department of Health.

There are many areas in which this approach could be applied: There is a great need, for example, for State and local agencies to work toward fuller reciprocity, especially in the milk program, to avoid duplication of effort and the consequent drain on scarce manpower and resources. Certainly we need better co-ordination for our pesticide activities at the Federal, State, and local level.

In my view, one of the most important needs at the State level is the modernization and strengthening of State food and drug laws, for an adequate legal base is the first requirement for consumer protection. Many States have food and drug laws based on the original 1906 Federal statute, now grossly out of date and inadequate. Others have patterned their laws after the more modern Federal Act of 1938, but do not include important later provisions requiring preclearance of additives and pesticide chemicals. Federal regulatory authority, as you know, covers only interstate shipments, and effective State surveillance is a practical necessity.

The same is true with regard to pesticide protection. Most States are not doing enough to protect their consumers against ingesting pesticide residues in food or milk. An adequate State program cannot be a hit-or-miss thing. It requires laboratories, crop analysis and inspection, control or permit systems to deal with major spraying and dusting operations, and a program of information and education!

Most important of all, we need to be better able to anticipate and prevent the problems which arise from the changing circumstances which affect our food supply—just as we need to be able to foresee and forestall contamination and deterioration in other facets of the environment. The time has come when reacting to problems as they arise is not enough.

Environmental programs

And, finally, we must not lose sight of the larger problems—the preservation of the total environment which can ultimately determine the destiny of the human species.

No matter how vigorous and dedicated we may be in our efforts, we cannot maintain safe and wholesome food and milk in a grossly contaminated world. Air and water pollution, the mountains of solid waste that contaminate the soil, and all the other problems associated with urbanization are already damaging our rural as well as our urban environment. We need rural areas, essentially free from man-made contamination, for food production. Unless we maintain this, no amount of man-made manipulation of agriculture products can assure their purity.

We shape our environment, and then our environment shapes us. This is something that people all over the world are beginning to recognize—if not, perhaps, to fully understand. In the years ahead, the creative, productive spirit that impels man in his never-ending search for the "good things in life" is going to accelerate environmental change—either for the enrichment of human life or for its degradation. The answer lies in how well we learn to *do with* that abundance of things that earlier generations learned to do without.

REGISTERED PROFESSIONAL SANITARIAN IMPORTANT PERSON ON THE PUBLIC HEALTH TEAM OF THE FUTURE[1]

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I predict that the *Registered Professional Sanitarian will be the very important person on the health team of the future.* To make this prediction become a reality we must be objective and understand that as Registered Professional Sanitarians we have certain obligations and responsibilities which we must accept if our profession is to be recognized by the public and by professional health groups. To achieve this recognition we must establish high standards of uniform academic and training requirements in the field of environmental health. We must be able to assure a standard of professional competence through the use of a recognized examination service. We must establish uniform public and environmental health practices to assure the maintenance of public confidence in a vital health service. We must be able to avoid conflict with responsibilities of other professions by defining our activities. We must assist public and private agencies in the identification and selection of qualified personnel. We must be able to protect the public interest against unscrupulous actions through misrepresentation.

We must never forget our obligation for the advancement and protection of Public Health. We must provide the highest attainable standards of health to every human being without distinction of race, religion, cultural background, economic, or social conditions. We must become involved in a *total effort* to create an environment that will serve the people and not entrap them. To do this, we must remove the blinders that force us to look at the problem from a narrow viewpoint. The Professional Sanitarian who is working to improve the environment of his community, must and can find ways to assist in the *total effort.*

It has been my experience that the Professional Sanitarian working in the field of Environmental Health has broad vision, deep dedication, and a spirit of cooperation, which are the essential characteristics for helping him and the Professional Associations in reaching these objectives.

TEAMWORK BY ASSOCIATIONS

These associations, namely, The Council of State Sanitarian Registration Agencies, The American Public Health Association, The National Association of Sanitarians, The Sanitarians Joint Council, The International Association of Milk, Food, and Environmental Sanitarians, Inc. as well as, The National Society Of Professional Sanitarians, must work as a team to: *(a)* provide a uniform sanitarian's registration model Act; *(b)* formulate and recommend uniform grandfather clauses and uniform entrance requirements; *(c)* promote the use of one uniform national sanitarian's registration examination; *(d)* develop criteria to implement reciprocal agreements among states; and *(e)* cooperate and work with all other interested organizations to achieve these aims and objectives.

The primary program control is to set qualifications for the profession and then to give recognition to the sanitarian as a professional member of the health team. The sanitarian who is technically equipped to function effectively in public health will unquestionably gain professional status through a properly enacted registration act. But, keep in mind, such an act should not be so restrictive that personnel with long experience and demonstrated ability are excluded.

REGISTRATION AND TRAINING OF SANITARIANS

Registration for professional workers must be based primarily on demonstrated ability to perform effectively in a field where application of technical skills is necessary for the betterment of the health and environment of our fellow man. Attainment of this professional knowledge comes primarily through practical experience with a health agency and through serious study of organized knowledge at a university.

Priority must be given to establishing minimum educational requirements for Registration of Professional Sanitarians. Personally, I agree with the recommendations of the APHA Committee on Manpower, which would require a Baccalaureate Degree in Environmental Science, Biological Science, or Basic Natural and Physical Sciences relating to Environmental Health, plus two years of experience.

As demands for environmental health services increase, the need for educated and trained sanitarians from colleges and universities also increases. College graduates most ready to step into the field

[1]Presented at the Annual Meeting of the National Society of Professional Sanitarians, Tampa, Florida, November 20, 1969.

are those who have participated in undergraduate programs in environmental health and we certainly know that graduates with an orientation to public health and environmental health reduce the length of time required for new personnel to become productive in the environmental health field.

During the past years, an intensified interest in undergraduate programs in environmental health has resulted from increased emphasis on environmental health programs and from the need for more qualified sanitarians in Federal, State, and Local programs. To help meet the need, the Bureau of Health Services and the Department of Health, Education, and Welfare initiated an intern training program in May, 1968. The program emphasizes broad, multi-program training and practical field experience in environmental health. The purpose of the program is to bridge the gap in professional development of young college graduates between academic study and practical application.

We must be sure that the graduates of the accredited schools offering environmental health courses have been indoctrinated with a philosophy toward environmental control that is not limited to only the traditional approach to sanitation programs but is one that incorporates the broadest spectrum of new approaches to all of the environmental problems which will face us in the years to come.

NEW FIELDS FOR PROFESSIONAL SANITARIAN

You and I know there are many things going on in the field of environmental health that must be discussed with emphasis and conviction. I believe the most happening is the progress being made by the *Registered Professional Sanitation,* by demonstrating his ability to work in the new fields of environmental health, such as:

The Radiological Health Sanitarian, as an inspector, consultant, or instructor, in short-term, Technical Radiological Health Training Programs.

The Accident Control Sanitarian, who is concerned with the human as well as the environmental factors which contribute to accidents.

The Professional Housing Sanitarian, as an inspector of single and multiple family housing, motels, hotels, and lodging places or as an evaluator of living conditions and standards for control.

The Professional Hospital Sanitarian, working on a hospital program to control environmental problems.

The Professional Campus Sanitarian, working to create a continuing standardized program of constant surveillance to immediately identify and seek control of environmental hazards.

We must all realize that the next five to ten years will be a time of challenge and opportunity for Professional Sanitarians working in the field of environmental health. Challenge because changing concepts are modifying the role of the health professionals in American life. Opportunity, because, as never before, Americans are recognizing the seriousness of environmental hazards and expecting protection against them. The need is for positive, effective, direct action not only toward minimizing environmental hazards, but also toward developing positive attitudes among people, who are, in reality factors of the environment.

If the sanitarian accepts the challenge and seizes upon the opportunity, he will become the principal professional on the environmental health team. The sanitarian is uniquely fitted for this role by his education and experience, which fuse the biological, physical, and behavioral sciences with management into a unique profession. There is need for intensive in-service training to keep Professional Sanitarians abreast of developments in the rapidly evolving field of environmental health.

Also, the profession must adjust to changing patterns in the philosophy of environmental practices which are producing dramatic modifications in everyday environmental activities. The most acute problem facing the profession is quality. As in other professions, future sanitarians must be better qualified than the sanitarians of today. To maintain leadership and perform effectively, tomorrow's sanitarians must be better educated, more flexible, and certainly as skillful and dedicated as you are in the field of Environmental Health.

QUALIFICATIONS AND PROFESSIONAL SOCIETIES

You, as members of the profession, can guarantee that tomorrow's sanitarians will have all of these qualifications by demanding that the professional associations, whose membership is made up of professional sanitarians and sanitarian's aides, be vitally concerned with the development and establishment of quality standards. We must increase the stature of sanitarians and, most important, establish a functional relationship that can be made without a structural change in any of the profesional associations.

As I have implied by previous comments, the responsibilities and functions of the professional association should be objective—without bias or prejudice, detached—and, above all, impersonal. Everything must be pointed to what is best for Public Health and the activities necessary to promote and gain recognition for the Professional Sanitarian. We

must eliminate the confusion caused by disagreement regarding what should be covered, who should be responsible, and how the desired results should be attained. If we do not do this, the result will be the division of authority and a variation in procedures so different in structure that they would almost defy classification and description in accordance with any pattern that we could devise. We can hope that the results of the deliberations of the various professional associations, that are concerned, will be the ultimate unification of programs and the clear-cut definition of responsibilities.

In the final analysis, no Professional Sanitarian or Professional Association can hope to succeed if it is not prepared to meet its obligations. Respect for our profession and for related Health Associations must be constantly in the forefront of our thinking. If we are to work together harmoniously, it is important that we work with an awareness, not only of what is good for us, but what is good for Public Health. If we can do this, my prediction that the *Registered Professional Sanitarian is destined to be the very important person on the health team of the future* will become a reality.

REPORT OF COMMITTEE ON FOOD EQUIPMENT

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General. The public health representatives discussed the potential problems associated with the backflow and back siphonage of carbon dioxide and carbonated water into copper and brass components of soda fountains, vending machines, and all other types of food equipment wherein carbon dioxide or carbonated water is used. It was recommended by the representatives that the Foundation coordinate any study and action in this matter with the Public Health Service and National Automatic Merchandising Association which is currently attempting to determine the extent that beverage vending machines may be involved with this potential problem.

Plans to develop a standard for mobile food service establishments have been discontinued after several years of exploring the feasibility of such a guideline because of lack of interest by industry. Several public health representatives have felt for sometime that such a complex program may have been premature, as it would have required other standards or criteria, such as for walls, ceilings, floors, toilet facilities, lighting, etc., to be developed first before mobile equipment could have been evaluated.

The Foundation reported that Standards Numbers 5 "Commercial Hot Water Generating Equipment" (for dishwashing machines) and 6 "Dispensing Freezers" are being reviewed by special committees for possible revision. Members with suggestions for improving these two documents are urged to submit their recommendations to this Committee as soon as possible. In addition, proposals are being studied by an Advisory Task Committee for the development of Standards for Pot, Pan, and Utensil Washing Machines; Refrigerated Retail Food Market Equipment; Laminated Plastic Coatings; and Dinnerware. Some of these proposals should be available for review and comment by this Committee during the next year, and final approval of these additional guidelines should promote more uniformity among public health and industry hopefully for the benefit of the consumer.

National Automatic Merchandising Association (NAMA)

The National Automatic Merchandising Association's Automatic Merchandising Health-Industry Council (AMHIC) held its thirteenth annual meeting during September 1968, and this Association and other public health organizations and the affected industries were represented and participated in AMHIC's discussions.

The afternoon of the first day was reserved solely for a meeting of the public health representatives and was used by them to discuss and clarify their view on public health objectives and policies to be followed in their work with the entire membership of the AMHIC. The Chairman of IAMFES Food Equipment Committee was re-elected Chairman of the Public Health Group and also served as Co-Chairman of AMHIC during 1968-1969.

Evaluation manual. The members of AMHIC received a report that no requests for changes in the Evaluation Manual or checklist had been received during the year. It was reported, however, that through the cooperation of the AMHIC Manual Revision Committee and the NSF Joint Committee on Food Equipment the new NSF Vending Machine Standard was uniform with the NAMA Evaluation Manual even though the layout of the two documents varied to some extent. Both the NAMA and the NSF are to be commended for working together to develop uniform evaluation guidelines.

Ice-maker studies. It has been recognized for several years that in order to dispense quality cold drinks from vending machines, ice-making and dispensing equipment must be properly protected from contamination and be of cleanable construction. Studies to aid in accomplishing these features are being carried out by a member of this Committee and other members of AMHIC to determine the bacteriological, design, and construction aspects of current ice-making equipment being used in vending machines. These studies, which have been underway for about 2 years, are being continued; but findings and recommendations to construct and maintain an even easier to clean ice-maker should soon be available to this Committee for consideration and review.

Other-than-new-machines. The final draft of the proposed program for Other-Than-New-Machines (reconditioned machines) was reviewed; and after a few modifications were incorporated into the proposal, it was approved to become Part III of the Administrative Policies of the NAMA Vending Machine Evaluation Program.

In addition, it was requested that a report be presented at the 1969 AMHIC meeting on the acceptability of this new NAMA policy and program. Initial studies of some of the larger rebuilders have revealed that the program to bring used machines into compliance with the NAMA Evaluation Manual and USPHS Code is being implemented; and it should prove of value to public health personnel, the manufacturers, and the operators.

Copies of this policy for Evaluation of Other-Than-New-

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A CRITICAL LOOK AT OUR CONSERVATIVE DAIRY INDUSTRY[1]

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Abstract

Many feel that the dairy industry is far too conservative, meaning it is reluctant to adapt or change when the need arises. Seven conservative conditions, designated "sacred cows" of the dairy industry, need a major overhaul. These are: outdated recruiting methods and industry image; a reluctance to adopt new testing procedures which could increase milk volume and producer returns, especially for the manufacturing milk industry; conservatism in adopting new testing procedures, with particular reference to the electronic fat-testing devices; segmentation and isolation of industry components; producer thefts by fieldmen functioning as procurement personnel rather than trouble-shooters for farm problems; duplication and non-uniformity of inspections; a low priority for promotion and new product development.

Elimination of the sacred cows could be accomplished by: tearing down prohibitive and conflicting legislative standards; ceasing to push for restrictive and discriminatory legislation which prohibits the manufacture of wholesome food products; adopting the Interstate Milk Shipments Agreements; placing more emphasis on market orientation and product promotion; encouraging producers to enroll in herd-testing programs; recruiting industry personnel with zeal and a new image; and accepting and utilizing new testing procedures which can save time and money.

The word "conservative" in this discussion will simply mean a reluctance to adapt or to change when the need arises. And let's be intellectually honest—the dairy industry needs some overhauling done on many conditions which are stifling its growth and development potentials.

These "conservative" conditions which need a major tune-up will be designated "sacred cows." This paper will consider seven "sacred cows" which directly influence all segments of our great industry—producers, fieldmen, processors, sanitarians, and regulatory personnel.

The "blessed bovines" are as follows: *(a)* outdated recruiting methods and image; *(b)* reluctance to adopt herd-testing programs (WADAM, OS, DHIA); *(c)* conservatism in adopting new testing procedures, with particular reference to the electronic fat-testing devices; *(d)* segmentation and isolation of industry components; *(e)* producer thefts—a case of fighting and switching rather than fusing and strengthening; *(f)* over-regulation (duplication and non-uniformity of inspections); and *(g)* low priority for promotion and new product development in the midst of a tremendous imitations impact.

Outdated Recruiting Methods and Image

Hundreds of dairy journal position ads read: "Wanted: Man with d a i r y manufacturing background to supervise large plant. Excellent salary, full benefits, etc."

These positions go "a-wanting." Where are the dairy industry replacements? Where do we find qualified fieldmen, h e a l t h department personnel, plant managers, and supervisors? This situation is chronic and chaotic now, and it is getting worse. What can be done to alleviate this situation?

Here are some suggestions:

(a) A closer working relationship is needed between the dairy industry and universities to develop and implement active recruiting programs. An example of this cooperative relationship can be seen at a Virginia college in the area of poultry science. Students preparing for a career in the poultry industry have the opportunity to gain educational experiences beyond those made available in the classroom. For the first two or three quarters, the student attends classes on campus. Afterwards, those students qualifying for the 5-year cooperative program will alternate their quarters of classes with quarters of work in the poultry industry.

Two advantages accrue from this cooperative effort. The student gets an opportunity to become acquainted early with the poultry industry. Then, too, he is offered significant financial assistance. During the work periods, the company pays the student a graduated-scale salary beginning at $100 a week. The student may earn enough money to pay for most of his entire college education. He also can start his actual career at a higher salary because of his previous work experience.

(b) Hold high-powered dairy industry career days (once or twice a year) with all segments of our industry cooperating, including the health departments. T h e n, too, perhaps these "dairy career days" could be taken to

[1]Presented at the National Mastitis Council regional meeting, Louisville, Kentucky, August 18, 1969.

the high schools.

(c) Start talking up the dairy industry in a positive light. Yes, we've got some of the "world's worst" problems, but let's present them in terms of *challenges* rather than *corpses*. For example, health department and field positions require dedication, endurance, hard work, and a high degree of academic and experiential education. These can be positively accentuated in a recruiting program.

(d) The day of university department mergers is with us. The dairy sections are being absorbed into food and animal science programs. People whose training has been strictly in dairy products are becoming fewer and fewer, but food technologists are on the increase. Recruit these men and give them jobs which are commensurate with their ability.

It is absolutely necessary for anyone hiring college graduates to evaluate the exact reason these graduates are to be added to the staff. It is no longer possible to hire a college graduate holding a degree in food processing to work on a bottle washer for two years at $5500 per year to "learn the business." He wants a challenge!

(e) Start "telling" the story of food science or dairy science "like it is." The dairy industry isn't all cows. Yes, we all love the cows, but one can't turn on sophisticated high school graduates with brochures stressing strictly production aspects.

The dairy industry is a food industry. Properly trained men require business, chemistry, and engineering backgrounds. How many of the high school students realize this? Let's change the concepts that say dairy science is strictly cows and food science is strictly home economics. In the past we have done a fine job of stressing the vocational aspects of all phases of dairying. However, herdsmen and farm managers, plant operators and managers, animal nutritionists, and bacteriologists are also needed throughout the dairy industry. It is high time that we stress the business and scientific aspects also of this great profession–dairy science.

(f) Perhaps all universities could emulate the highly successful program started in North Carolina. The North Carolina Dairy Products Association and North Carolina State University recently teamed up on a concerted recruiting drive. The North Carolina extension agents made contacts in the counties, telling the people the food science story. The DPA provided funds for a former 4-H student, now in his second year of college, to do full-time recruiting in the summer among the young people in the 4-H groups.

(g) High school assembly programs are another outreach which remains untapped by the dairy industry. New recruiting brochures with an emphasis on challenges in the dairy foods industry should be in the hands of guidance counsellors. These should be followed up personally by our industry with some concrete plans for getting the information to the students.

(h) Public awareness of the dairy industry as a profession is desperately needed. True, the dairy industry is well thought of by members of the community, but how many of them know the job opportunities that exist in dairy foods processing? Perhaps our industry could begin in-depth advertising about career opportunities in this field by using newspapers, radio, TV, and billboards. The "awareness gap" must be bridged.

(i) Dairy plant tours for "kiddie" groups and various organizations require much time and effort. However, this time and effort is well spent. Hosts of future dairy industry personnel may result from the tour contact with the dairy plant. We, as an industry, reap what we sow.

Reluctance to Adopt Herd-Testing Programs

Both manufacturing and Grade A milk processing plants are continually crying, "We want more milk!" This lament is heard the loudest and longest from the manufacturing milk industry. Could it be that a reluctance to adopt herd-testing programs is partially responsible for the lack of milk volume?

Records are the number one tool available for dairy farm management today. Too many of the decisions necessary for profitable dairy farming can be only as sound as the information on which these decisions are based.

Braund *(1)* has stated that today's dairy farmer must use facts on production, costs, and returns to analyze and evaluate his farm business. He can get these facts if you encourage him to enroll in one of the following production-testing programs available to almost every milk producer in the United States.

DHIA–Dairy Herd Improvement Association: *(a)* provides complete milk and butterfat production figures on every cow and totals for the herd; *(b)* gives feed consumption and returns over feed costs; and *(c)* records are accepted as official because a disinterested party (DHIA supervisor) weighs milk, re-

cords information, and performs butterfat tests.

OS—Owner-Sampler: *(a)* provides exactly the same information as DHIA; *(b)* not considered official because herd owner weighs milk—DHIA supervisor performs butterfat tests; and *(c)* less costly than DHIA.

WADAM—Weigh-A-Day-A-Month: *(a)* least costly program available; *(b)* provides milk production only for individual cows—no butterfat tests performed; and *(c)* excellent for culling and feeding based on milk production.

Please keep in mind that there has been more than a two ton difference per cow in annual milk production between cows on test and the average of all cows in Kentucky for each of the past 10 years. Tested cows in other states yield a similar milk bonus every year. Hence, producers that are not on a herd-testing program are throwing money away. And yet, only 62,879 herds consisting of 3,028,267 cows are on test according to the March 1968 Dairy Herd Improvement Letter. This represents only 22.4% of the nation's dairy cow population. However, some progress is being made in getting herds on testing programs, but it is slow. The following figures tell the story *(6)*.

	DHIA		OS		WADAM		All Programs	
	1967	1968	1967	1968	1967	1968	1967	1968
Percent of Cows on: United States	14.9	15.8	5.8	6.3	0.4	0.4	21.1	22.4

Yes, everyone in the dairy industry wants more milk. The milk producer desires increased production, and the processing plant personnel want more volume run through their facilities. Adoption of herd-testing programs by dairymen would certainly be a step in the right direction to increase milk volume.

Babcock or Bust

A hypothetical advertisement might read:

> "Ready to order: An electronic fat-testing apparatus that can get fat test results in less than 1 min; save on labor, glassware, and test-bottle washing; and eliminate the handling of dangerous acid. The machine requires less precision on the part of the operator and precludes a high fatigue factor."

As you know, this machine, the electronic transistorized Milko-Tester, is a reality.

Accuracy? Early research done at Cornell University involved the comparison of butterfat test results made with the Milko-Tester and the Babcock method on low, medium, and high fat composite milks that had not been homogenized. This research indicated that the variations between the Milko-Tester and the Babcock test can be held to ± 0.1% with a bias of no more than 0.02%. Research done on the Milko-Tester by other schools confirmed these findings.

At the 1968 American Dairy Science Association meeting at Ohio State University, more data were presented by Purdue University researchers *(3)* which showed a very close comparison of the Babcock and Milko-Tester results, providing the Milko-Tester was properly calibrated.

Samples for the analyses were obtained from producers shipping to Indiana dairy plants. Both composite and fresh milk samples were checked.

The results of tests completed on preserved (mercuric chloride) and fresh milk samples are summarized in Tables 1, 2, and 3. Note how close the fat test comparisons were.

Table 1. Composite milk tests—average tests

Test	No. of samples	Average test (%)	Difference (%)
Milko-Tester	690	4.301	.018
Babcock	690	4.283	
Babcock	255	4.123	.002
Babcock duplicates	255	4.125	
Milko-Tester	245	4.146	.003
Milko-Tester duplicates	245	4.143	

Table 2. Fresh milk samples—average tests

Test	No. of samples	Average test (%)	Difference (%)
Milko-Tester	3,007	3.856	.016
Babcock	3,007	3.840	
Babcock	938	3.840	.014
Babcock duplicates	938	3.854	
Milko-Tester	342	3.704	.009
Milko-Tester duplicates	342	3.695	

Ginn and Packard *(4)* recently undertook a study to determine the relative accuracy and precision of the Milko-Tester procedure when compared to the Babcock method on fresh milk and (mercuric chloride) composite milk samples. The Milko-Tester calibrated on "fresh" milk was found to average 0.059% lower on composite than on fresh samples. For fresh milk and composite samples, respectively, the standard error of the paired methods was 0.0482 and 0.0370. The standard error of the mean difference was only .0122 and .0262. On 1,457 fresh milk samples the average Milko-Tester and Babcock results were 3.799 and 3.809%, respectively. The average

TABLE 3. STANDARD DEVIATION: MILKO-TESTER VS MILKO-TESTER, BABCOCK VS MILKO-TESTER, AND BABCOCK VS BABCOCK FOR COMMERCIAL FRESH HERD MILKS AND COMMERCIAL PRESERVED HERD MILKS

Type of sample	Test method	Bias (%)	Standard deviation of differences (%)	No. of samples compared
Preserved milk	Babcock duplicates	.002	.05	255
Preserved milk	Milko-Tester duplicates	.003	.04	245
Preserved milk	Milko-Tester vs Babcock	+.018	.08	690
Fresh herd milk	Babcock duplicates	.014	.05	938
Fresh herd milk	Milko-Tester duplicates	.009	.03	342
Fresh herd milk	Milko-Tester vs Babcock	+.016	.07	3,007

test on 188 composite samples by the two methods was 3.8192 and 3.7979, respectively. Again one can note how close the fat test comparisons are between the two testing methods.

Other research has shown, however, that there are a few things that can influence the fat test results obtained by the Milko-Tester. Milk homogenized at excessive pressures, sour milk, mastitic milk, and preserved milks can give slightly inaccurate readings.

Nevertheless, the advantages for this apparatus far outweigh its disadvantages. The AOAC has officially adopted (first action) the Milko-Tester method for determining fat in raw unhomogenized milk. Could the dairy industry be accused of foot-dragging because it has failed to get the state regulatory agencies to approve this testing method for official producer payments? Is our motto still, "Babcock or Bust?"

State DHIA organizations have obviously found this testing procedure to their liking. Many are now using it to determine official fat tests. Kentucky has a Milko-Tester located in Shelbyville which processes 7,000 samples per month.

SEGMENTATION AND ISOLATION OF INDUSTRY COMPONENTS

For years, the prevalent thinking in our industry has been, "What affects the Grade A people doesn't affect me as a manufacturing processor. The field personnel of our Grade A and manufacturing milk segments have nothing in common. Neither do the haulers. The producers are out to rob the processors. The regulatory agencies aren't in sympathy with processor and producer problems."

If ever a time was needed for a unified dairy industry, it's now! There has never been a more trying yet challenging time in our industry's history. All of you know the potential of the imitations impact.

There is a need for specific training programs for haulers, fieldmen, processors, producers, and sanitarians as individual groups. However, only as a unified industry, with each group functioning autonomously within the broad dairy framework and working towards a common goal can this industry continue to grow.

PRODUCER THEFTS: A CASE OF FIGHTING AND SWITCHING RATHER THAN FUSING AND STRENGTHENING

Someone has suggested that if the dairy industry companies spent less time stealing each other's producers and spent more time strengthening and improving the ones each now has, milk production would increase drastically.

Let's not kid ourselves. This practice costs thousands of dollars for all concerned, especially when a fieldman's visit to a producer costs in the neighborhood of $9. We're losing producers at an ever-increasing rate. Is this practice of producer swapping at the expense of education aiding in a dairyman's decision to get out of the milk business?

Today's fieldmen are well trained and well educated in most instances. They are far more valuable to the dairy industry as trouble-shooters for farm problems rather than procurement personnel.

Most dairy companies are concerned about the producer theft situation and have made these suggestions to help rectify the problem: *(a)* Remove the premium for volume on bulk tank manufacturing milk. This would cut down on the watering and help prevent the producer from switching to another company when he is reprimanded or cut off by his handler. *(b)* A common set of voluntary guidelines should be written and adhered to for taking action on producer infractions by ALL of the dairy processing companies. *(c)* Uniform inspection standards should be set up for all of the states. This would eliminate the "soft" inspection area which allows the processor in this locale to "woo" the producers from the "hard-nose" inspection area. *(d)* Perhaps one grade of milk would eliminate much of the producer theft problem.

OVER-REGULATION (DUPLICATION AND NON-UNIFORMITY OF INSPECTIONS)

From an article which appeared in Readers Digest,

"Is That Really Milk You're Drinking?" *(2)* we read—

"Understandably, the imitation milks have the dairy industry in a turmoil. Dairy farmers have already lost one-fourth of their butterfat market to substitutes in the last 25 years. Imitations have stolen 35% of the coffee-cream market and 80% of the whipping-cream market. Margarines outsell butter almost two to one.

A basic reason for all this is that in the past the dairy industry so shackled itself by laws designed to protect it from competition that it can no longer compete effectively by tailoring its products to consumer demands and improved technology. Butter, for instance, has been actually defined by an Act of Congress. Permission to add a new ingredient would take, literally, a *new* Act of Congress. Thus, butter has remained unchanged throughout the years, while margarine has accommodated itself to consumer demands. When consumers complained that imitation cream didn't keep well enough, processors simply added a preservative. Real cream cannot, by law, have such an additive.

Almost equally shackling are sanitary regulations, enacted in a day when milk was produced locally and peddled door-to-door by horse and buggy. Today there are over 21,000 municipal, town, county, state, and federal health and sanitation jurisdictions in the United States. One dairy that I know of must get licenses from 250 local governments, three states, and 20 other agencies, and during a single month is inspected 47 times."

The over-regulation of the dairy industry no doubt stifles new product development and creativity. As one example, Dr. Graham of Pet, Incorporated, St. Louis, Missouri, (now of the Department of Food Science and Nutrition, University of Missouri, Columbia) gave a presentation entitled "Processors Look at Substitutes for Fluid Milk" at the Southeast Dairy Conference in Columbia, South Carolina on November 6, 1968. He mentioned that under the pretenses of guarding the public health and promoting honesty and fair dealing, we have created a "Frankenstein monster" of sanitary rules, licenses, composition requirements, and pricing formulas from which we must escape. These limitations, he said, stifle creativity and innovation, as there is little incentive to spend money in the face of the barriers against prompt and efficient introduction of the new product to the market.

Two years ago Dr. Graham developed a very simple new product, evaporated skimmilk, which is identical to evaporated milk except for the removal of the fat. This product retails for about 25% less than evaporated milk and is well received by consumers. However, conflicting regulatory views on labelling delayed the national introduction of this product for a year and cost more than $10,000 in legal fees alone. Double inventories of labels, cases, and finished goods must be maintained because there is not one label which is acceptable to all states.

USDA has estimated duplicate sanitary regulations and inspection costs for milk processors, distributors, and farmers at one million dollars per year *(5)*. In addition, substantial tax funds are wasted to support regulations and inspection.

A few states already have adopted legislation to eliminate this waste. For example, Indiana has enacted a law which vests the authority for sanitary regulation of milk plants and milk supplies entirely in a single agency. This has eliminated much of the duplicate inspections within the state. Other states such as Kentucky are contemplating similar legislation.

Dairy-industry-sponsored legislation such as this will certainly help unshackle us from the maze of regulatory programs. Then, too, adoption of reciprocity agreements by all states would certainly help remove barriers against milk movement. The fine efforts of the National Conference on Interstate Milk Shipments are directed towards this end.

Low Priority for Promotion and New Product Development in the Midst of a Tremendous Imitations Impact

Did you know that research and development expenditures for milk and milk products are about the lowest in the food industry?

Milk and dairy products are competing with all other foods to fill the "hungers" in the consumer's stomach. The dairy industry, nevertheless, compares unfavorably with its competitors as to money spent in research and development for new consumer products. The total business economy spends 3% in research and development. The dairy industry spends less than 1% in this area, and one-half of this is estimated to be going into the development of imitations.

Ben F. Morgan of the Southeast Division of Dairymen, Inc. mentioned in an address to the 1968 Southeast Dairy Conference (Columbia, S. C.) that the lack of research and development on new products for real milk is part of the reason consumer expenditure for dairy products is now only 12% of total food dollars spent instead of 18% as it was not too many years ago. We can and must look forward to getting involved in the marketer's world, beginning with research on the consumer's needs and wants. Mr. Morgan gave an example of imaginative marketing which increased consumer consumption with a correspondingly higher profit to the producer-processor.

Cranberry juice cocktail has been around for a long time. About 5 years ago, a man employed by a cooperative marketing association conducted market tests and found that the average consumer thought that his association's cranberry juice cocktail was too strong, so he added water and dropped unit costs. The increased sales on this watered product were fantastic. It turned out to be the first of some 108

new products researched and developed by this association.

Our industry now fully realizes the necessity for product research, development, and promotion, and is doing a commendable job in these areas. An example—Mrs. Housewife wanted low fat products and the industry was quick to provide them for her. However, we still have a long way to go.

Obviously this discussion has emphasized the shortcomings of the dairy industry. The intention in doing so was to make you aware of its problems and to get you to think about ways of alleviating them.

Suggestions for eliminating the "sacred cows" could include the following: *(a)* tear down prohibitive and conflicting legislative standards; *(b)* cease pushing for restrictive and discriminatory legislation prohibiting the manufacturing of wholesome food products; *(c)* adopt the Interstate Milk Shipments Agreements, especially those on reciprocity; *(d)* place more emphasis on market orientation and product promotion; *(e)* encourage producers to enroll in herd-testing programs; *(f)* recruit personnel with zeal and a new image; and *(g)* accept and utilize new testing procedures which can save time and money.

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REPORT OF COMMITTEE ON FOOD EQUIPMENT

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Machines as well as the Evaluation Manual and other Materials concerning work of the Automatic Merchandising Health Industry Council may be obtained from the National Automatic Merchandising Association.

Refrigeration cut-off controls. The members of AMHIC received a report on the problems and possible new requirements for the automatic cut-off controls relative to their location, accessibility, field testing, and control modification for machines vending cold potentially hazardous foods.

The USPHS Vending Code has provided the Cut-Off Control Requirement to safeguard the food in two respects: *(a)* To interrupt vending of food if the machine has not recovered safe temperatures within a specified period after loading or serving; and *(b)* to discontinue vending after temperature stabilizations if, for any reason, the air temperature rises above safe limits in the storage compartment. The first function is to guard against delivery of foods to the machine at illegal or dangerous temperatures. The second guards against power interruptions, system failure, high thermostat settings, etc.

There have been several problems associated with these controls since 1957, earlier reported as mostly caused by operating personnel but more recently reported as resulting from failure of the controls involving both the manufacturer and the operator. These problems are listed and identified as follows: *(a)* wide tolerances and controls overlap (problems of the manufacturers of the controls); *(b)* premature cut-off controls and discontinuation of vending due to a forgetful routeman (problems of the operators); and *(c)* by-passing of controls, failure to provide access of controls for field testing (problems for the public health personnel).

In order to help resolve these problems, the members of AMHIC recommended that the Committee on Cut-Off Controls continue its program of investigating manufacturers, operators, and health officials concerning problems with these controls. They further charged this Committee with four specific tasks for 1968-1969: *(a)* to recommend standards for location of controls; *(b)* to establish a rapid field test for operability; *(c)* to standardize accessibility for testing purposes; and *(d)* to explore avenues for operator education. This Committee should soon have an opportunity to review findings and recommendations of the Cut-Off Controls Committee and to offer comments.

Labeling guide. The advent of the Fair Packaging and Labeling Act, the Wholesome Meat Act, and the Wholesome Poultry Products Act has extended uniform Federal labeling requirements to a vast majority of foods prepared and packaged by vending operators—even in intrastate commerce. A Committee of AMHIC has already taken some initial steps to develop a uniform labeling guide in cooperation with the FDA and USDA for the purpose of aiding industry in complying with the Federal Acts and also to aid in promoting uniformity in their interpretation and application. Principles developed and applied with these two agencies in developing guidelines to comply with the Federal labeling requirements may be used with possibly some minor modification with foods vended only in intrastate commerce.

Post-mix machine study. The current U.S. Public Health Service specifications as well as those of most States for the design and construction of food and beverage vending machines require such machines which dispense carbonated beverages, and which are connected to a water supply system, to be equipped with two (2) check valves; or an air gap; or a device to vent carbon dioxide to the atmosphere; or other approved devices, which will promise positive protection against the entrance of carbon dioxide or carbonated water into the water supply system.

The New York City Health Department has experienced carbonation backflow problems with both manual and automatic post-mix dispensing units even with double check valves of approved construction and installation. An initial proposal was to rule out all copper within post-mix water

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ACCOMPLISHMENTS AND PROBLEMS OF THE NATIONAL CONFERENCE ON INTERSTATE MILK SHIPMENTS[1]

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The National Conference on Interstate Milk Shipments (NCIMS) first met in St. Louis, Missouri on June 1, 1950, and was attended by representatives from 22 states.

J. L. Rowland, the Chairman, said, "Absence of recognized uniform standards of quality, differences in interpretation by state and municipal enforcement agencies, and the apprehension of receiving area authorities concerning poor quality milk led them to insist on making inspections of farms and milk plants in the producing areas." This led to multiplicity of inspections; application of a variation in regulatory standards and interpretations; confusion; misunderstanding; and added costs to shippers, receivers, and consumers. In the second Conference, representatives from 27 states were present. Currently, virtually all states are participating in objectives of the Conference. These were, and are: *(a)* To do all possible to furnish the public with an adequate supply of dairy products of high quality, thus the slogan, "The best possible milk supply for all the people." *(b)* To simplify inspection requirements to include only those related to quality and safety. *(c)* To emphasize the principle that certification of the quality of milk and cream samples by responsible authorities will promote their acceptability where needed.

The first several Conferences dealt with methodology, and designing Policies of Understanding for evaluation, certification, and identification of milk supplies for interstate shipments. The Conferences, subsequently, have dealt with redefining these Policies in the light of developing modernity in the dairy industry. The Conference has a Constitution, by-laws, and duly representative delegates; and procedures for considering and acting upon Policies and Procedures. There are seven major sections to Policies of Understanding for voluntary transhipments of milk interstate.

Section 1—Standards in Procedures: Identifies sanitation standards, methods of making compliance ratings, and quality of product.

Section 2—Supervision Requirements: Stipulates qualifications for supervision, and the degree of supervision for milk for interstate shipment.

Section 3—Rating and Certification: Stipulates procedures in requests for ratings, enforcement ratings of supervising agencies, certification of sanitation officers, use of area ratings, and ratings of agencies.

Section 4—Uniform Bill of Lading and Seals: Stipulates information on bills of lading accompanying each shipment.

Section 5—Responsibilities of State Agencies: Certification of shippers supply, record keeping on Grade A sources and disposition of product, performance records of laboratories, and laboratory certification.

Section 6—Responsibilities of Public Health Service (PHS): Standardization of PHS and regional state officers making ratings, publishing ratings thereto, training personnel in this task, check ratings, and laboratory evaluations.

Section 7—Procedures for Handling Complaints and Challenges: The Conference involves: *(a)* Voluntary participation; a meeting of minds, the confidence of regulatory officials and their agencies in meeting requirements of their jurisdictions. *(b)* Reference bases of standards for quality of milk and how it is determined for making ratings, capability of supervising sanitarians, and identification of product in transfer. *(c)* Means of considering problems which affect understanding in the acceptance of milk through use of task forces and committees. The objective of these groups is to bring to focus in logical manner proposals for consideration for action by the delegates to the Conference.

The procedures of the Conference have been used increasingly since its inception. The current PHS listing cites 1,450 plants in 47 states rated for milk and cream, and 60 plants in 24 states rated for nonfat dry milk. Unfortunately, information on the actual quantities of milk being shipped on the basis of the procedures of the Conference is not currently being developed. It is important for the purposes of record of this Conference that this information be

[1]Presented at the Twelfth National Conference on Interstate Milk Shipments, Denver, Colorado, May 25-29, 1969.

TABLE 1. MILK PRODUCTION, AND POPULATION IN THE UNITED STATES

State or District	Milk production[1]					Population[2]		
	Millions of lb[3]		% change[4]	% of total in U.S.		Millions[3]		% change[4]
	1950	1968	1950-1968	1950	1968	1950	1967	1950-1967
Wisconsin	15.6	18.2	+17	12.9	15.5	3.4	4.2	+23
Minnesota	8.2	10.2	+24	6.8	8.7	3.0	3.6	+20
New York	10.2	9.0	+13	7.5	8.7	14.8	18.3	+22
California	6.0	8.9	+30	4.9	7.6	10.5	19.1	+82
Pennsylvania	5.9	6.9	+17	4.9	5.9	10.5	11.6	+15
Iowa	5.9	5.2	−13	4.9	4.4	2.6	2.3	−11
Michigan	5.8	4.6	−21	4.8	3.9	6.4	8.6	+34
Ohio	5.5	4.5	−19	4.6	3.8	7.9	10.5	+33
Illinois	5.1	3.1	−40	4.3	2.6	8.7	10.9	+25
Missouri	4.4	3.0	−31	3.6	2.6	3.9	4.6	+18
Texas	3.8	3.0	−21	3.2	2.5	7.7	10.8	+40
Kentucky	2.4	2.5	+ 7	1.9	2.1	2.9	3.1	+ 7
Indiana	3.5	2.4	−28	2.9	2.0	3.9	5.0	+28
Tennessee	2.3	2.1	− 9	1.9	1.8	3.3	3.9	+18
Washington	2.0	1.9	− 5	1.7	1.7	2.4	3.0	+25
Virginia	2.1	1.7	−17	1.6	1.5	3.3	4.5	+36
Kansas	2.7	1.7	−38	2.2	1.4	1.9	2.3	+21
South Dakota	1.4	1.6	+17	1.1	1.4	.6	.7	+ 7
Nebraska	2.2	1.6	−27	1.8	1.4	1.3	1.4	+ 7
Florida	.6	1.5	+171	.5	1.3	2.7	6.0	+122
Maryland	1.3	1.5	−13	1.0	1.3	2.3	3.7	+60
Vermont	1.8	1.5	+25	.1	1.6	.3	.4	+ 8
North Carolina	1.7	1.5	−11	1.2	1.3	4.0	5.0	+25
Idaho	1.4	1.2	+20	1.0	1.2	.6	.7	+17
Oklahoma	2.1	1.2	−40	1.7	1.0	2.3	2.5	+ 9
North Dakota	1.7	1.1	−33	1.4	1.0	.6	.6	+ 3
Mississippi	1.4	1.1	−22	1.1	.9	2.1	2.3	+ 9
Georgia	1.3	1.0	−21	1.1	.9	3.4	4.5	+33
Louisiana	.7	1.0	+52	.6	.9	2.7	3.6	+33
Oregon	1.3	.9	−25	1.0	.8	1.5	2.0	+33
Colorado	.9	.8	−14	.8	.7	1.3	2.0	+53
New Jersey	1.1	.8	−29	.9	.7	4.8	7.0	+46
Alabama	1.4	.8	−43	1.1	.7	3.0	3.5	+17
Utah	.6	.7	+12	.6	.6	.7	1.0	+43
Massachusetts	.7	.6	− 9	.6	.6	4.7	5.4	+15
Arkansas	1.3	.7	−48	1.0	.6	1.9	2.0	+ 5
Connecticut	.7	.7	− 2	.6	.6	2.0	2.9	+45
Maine	.7	.6	− 7	.5	.5	.9	.9	+ 6
Arizona	.3	.5	+108	.2	.5	.7	1.6	+56
South Carolina	.6	.5	−18	.5	.4	2.1	2.6	+24
West Virginia	.8	.4	−52	.7	.3	2.0	1.8	+10
New Hampshire	.3	.3	+ 6	.3	.3	.5	.7	+32
Montana	.5	.3	−37	.2	.3	.7	1.0	+17
New Mexico	.2	.3	+40	.2	.3	.7	1.0	+42
Delaware	.18	.1	−27	.1	.1	.3	.5	+66
Wyoming	.2	.1	−41	.3	.1	.3	.3	0
Rhode Island	.1	.1	−71	.1	.1	.8	.9	+14
Alaska	---	.001	---	---	.01	.12	.27	+125
District of Columbia	---	---	---	---	---	.8	.8	0
Total	120.1	117.2	−2.4			150.7	197.8	+31

[1]Milk Facts, 1951; 1968. Milk Industry Foundation, Washington, D. C. 20006.
[2]The World Almanac and Book of Facts, 1969. Newspaper Enterprise Association, Inc., New York, N. Y. (for 1950 data); Britannica Book of the Year, 1968. Encyclopedia Britannica, Inc., Chicago, Illinois.
[3]Figures rounded.
[4]Calculated from original data.

cited on all shipping forms and properly reported for summary evaluation.

CHANGES IN PRODUCTION AND MARKETING

Changes in considerable number have been, and are affecting, the perspective of the procedures and conditions under which milk is being produced and handled. In concise form, these changes are in the agricultural procedures, in physical facilities, in investments, and in economic factors.

Dairy farms

Some 25 years ago, there were 2,200,000 dairy farms in the U. S. Presently there are 450,000 dairy farms. At present rates of contraction, it is estimated that in 10 years there will be 225,000 dairy herds. Concurrent with this change has been an increase in the size of dairy farms, the number of cows per herd, an increase in production of milk per cow and per farm, and greater capital investment per farm for handling milk. Interestingly, for purposes of comparison, the number of farms in operation in the U. S. is now approximately that in 1875. There has been comparable contraction in the numbers of milk plants, and a scale-up of their operations.

The programs for improving the quality of milk have had their effects. In 1950, 40% of milk produced in the U. S. was Grade A; now 69% is Grade A. In 1950, 15% of the milk produced in Wisconsin was Grade A; now 44% is Grade A. It is of interest to note that the ratios of change for the U. S. and Wisconsin are 1.0 and 3.0, respectively.

There are those who propose that, for economic reasons, virtually all milk produced 10 years from now will be Grade A. Manufacturing milk standards are approaching Grade A standards. The average price differential for Grades A and B milk is currently $1.50 in the U. S., and $.70 in Wisconsin. There are factors inducing producers to shift to Grade A, and for processing plants to shift to total Grade A. Plants with A and B intakes are shifting to only Grade A operations, since it costs less to handle only one grade of milk. There are further economies in procurement by eliminating truck overlaps in handling one grade of milk equivalent to 10-12¢ per cwt. for milk in cans, and 45-60¢ per cwt. for milk in bulk. The significance of this is evident in the observation that 20% of Wisconsin plants each have 20 or more plants competing for milk.

About half of the milk produced in the U. S. is now under Federal Marketing Administration, and the trend is toward more. As more Grade A milk is produced, more is regulated. Plants have to affiliate into federal marketing orders and Grade A milk provides a better price, which is important competitively.

It is of interest to note that the prices for milk today are essentially the same as in 1952, yet wages have increased in this interim 75¢/hr. Relatively, milk is a good buy which consumers apparently like. It is important to note how this should be possible.

Shift in production

There is a significant shift in the production of milk in areas in the United States. Table 1 shows where gains and losses in milk production in states are occurring. The major producing states are Wisconsin, California, Minnesota, New York, and Pennsylvania. Wisconsin and Minnesota produce 28% of the nation's total milk supply. These shifts in areas of production in relation to urban concentrations are of significance to the NCIMS program for interstate shipments. They imply burdens on authorities for supplies of milk when needed.

Shift in milk marketing organization

Milk marketing organizations have in the past been primarily local, developing into regional organizations, and more recently into large scale area marketing cooperatives. Currently, programs are under way to consolidate marketing organizations into five National regional marketing groups. The principal areas in development are: Pacific Dairymen, Mountain Dairymen, American Milk Producers, Penn Marva, and Great Lakes-Gulf.

The objectives of these groups are to improve milk prices, influence more orderly marketing, strengthen stand-by pools for market needs, push programs for research and development, and improve production systems. In all probability, these blocks of large organizations will have considerable influence on marketing procedures and regulatory practices. It appears that the extensive support for dairying and the marketing of dairy products in land grant institutions is undergoing contraction and dairymen are focusing more attention on organizational development.

CHANGES IN INSPECTION AND STANDARDS

Duplication

Recently published studies show great variance in frequency and presumably degree of inspection of fluid milk plants. In a survey of 1,200 plants bottling 42.5% of the nation's milk supply, the average number of inspections was 24/plant, and in some states reached 85 and 95/plant. The average number of inspectors visiting plants was 4.8/plant, and ranged as high as 21, 17, and 15 in several states. The number of licenses required per plant ranged from 4 to 103, at an average cost of $1,366.

Overlap of agencies

There are currently three federal agencies engag-

ed in developing or modifying standards for dairy products whose activities can lead to proliferation of standards and lack of uniformity. Fragmentation of health agencies and services is going on at both federal and state levels; state services are being restructured to meet rapidly growing social problems. Proliferation of standards is not in the best interest of the consumer, the regulatory agency, or the industry. The tightening of budgets for milk regulation and surveillance is a real problem everywhere in the face of other urgent social finance requirements. Consolidation and re-evaluation of effort is more urgent than ever.

Re-evaluation of standards

The standards for grade have undergone revision since first published in the early 1920's. There are, today, in all probability, requirements in milk handling which do not yield significant returns public health-wise in the light of modern methods, and other stresses. Among reviews which might well be considered, for example, are the use of frequency sampling and testing based on performance record, and relative quantity; methods of compositing samples from bulk supplies; and newer less costly methods of surveillance. There is probably need for improving, as in all operations, administrative procedures in surveillance of quality of milk supplies. The Grade A program grew, in part, originally, from the effort of sanitary districts to achieve better quality at less cost.

There is need, too, to reassess the relative emphasis on degree of surveillance at the points of production and processing of fresh product in the light of apparent imbalance in surveillance at points of distribution. There is a decided imbalance in degree of surveillance of milk and for other food products, including milk substitutes, which is not justified on the basis of relative potential hazards in use. There are other additional stresses which are not revealed by the usual procedures of surveillance, which may be of greater hazard, such as pesticides and chemicals.

Grade A

There is reason to believe the understanding of programs for Grade A by consumers has lost its punch; consumers, including institutions, readily have taken to substitute products which are without the benefit of such surveillance. The taxpayer either has taken the Grade A effort for granted, or is not convinced of its usefulness. It is unrealistic to impose unequivalent procedures for milk and for certain imitation-type products. The role of Grade A needs to be made better known in the institutional trade which is the fastest growing segment in the food market.

The concern and need of regulatory agencies for improved systems of evaluation of manufactured dairy products in interstate trade needs attention. The National Conference on Interstate Milk Shipments has a basis of procedure in principle which could be applied to manufactured products to meet these needs.

Finally, the NCIMS is an efficient, economic, and successful method in extensive use by regulatory agencies across the nation. Its procedures should be directed by those who best use it for all the people. What would we do without it? The Conference can do well to investigate use of educational tools to advance its activities, and to make better known its functions and services.

REPORT OF COMMITTEE ON FOOD EQUIPMENT

(Continued from Page 254)

systems, automatic and manual, and to require an incoming water supply air gap on all such units. Vending machine with ice-making components are already equipped with air gaps, thereby protecting the community water supply from backflow of carbon dioxide (carbonated water) into copper lines outside of the machine.

Upon presentation of several alternatives, it was tentatively agreed by all parties concerned that vented systems and certain other "Fail Safe" options would be acceptable in lieu of tubing replacement and air gap installation.

Notwithstanding the presence of copper tubing in the upstream (from the back-flow device) parts of the water supply system, it was believed that the following valving arrangements would be considered "Fail Safe": *(a)* systems with an atmospherically vented 2-way or 3-way valve upstream from the checkvalves and carbonator; and *(b)* systems with a vented pump-actuated valve upstream from the checkvalves and carbonator.

Additionally, at least two other presently-used systems would be acceptable: *(a)* those in which no copper tubing is used from the incoming, air-gapped water reservior to the carbonator; and *(b)* those which use a non-toxic water precooler tank (rather than coils) into which backflow would be exhausted to the atmosphere without passing through toxic tubing.

Several vending and manual post-mix equipment manufacturers have eliminated all copper tubing (mostly 15-20 ft in the heat exchanger or precooler) in the "open" water supply system between the incoming air gap and the carbonator. Others who still rely on double checkvalves only have suggested that this method may solve their carbonation backflow problems, provided the minuscule amount of copper in

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AMENDMENT TO THE 3-A SANITARY STANDARDS FOR FARM MILK COOLING AND HOLDING TANKS–REVISED

Serial #1304

Formulated by
International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

The "3-A Sanitary Standards for Farm Milk Cooling and Holding Tanks–Revised, Serial #1301", are hereby further amended in the sections indicated below:

Substitute the following for subsection 1 of A.–MATERIAL

1. All portions and parts in contact with milk and all surfaces from which milk or condensate may drain or drop into the tank, except those identified in A.6 and A.7 (a) to (h) inclusive, shall consist of stainless steel of the AISI 300 series[1] or corresponding ACI[2] types (See Appendix, Section D), or metal that is non-toxic and non-absorbent and which under conditions of intended use is equally corrosion resistant to stainless steel of the foregoing types. The weld areas and the deposited weld material shall be substantially as corrosion-resistant as the parent metal.

Add a new Section D to the Appendix, to follow Section C, as follows:

D. Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of Section A.1 herein. Where welding is involved the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in A.1 sets forth the chemical ranges and limits of acceptable stainless steels of the 300 series. Cast grades of stainless steel equivalent to types 303, 304 and 316 are designated CF-16F, CF-8, and CF-8M, respectively. These cast grades are covered by ASTM[3] specifications A296-67 and A351-65.

This amendment is effective September 20, 1970.

[1]The data for this series are contained in the following reference: AISI Steel Products Manual, Stainless & Heat Resisting Steels, April, 1963, Table 2-1, pp. 16-17. Available from: American Iron & Steel Institute, 633 Third Ave., New York, NY 10017.

[2]Alloy Casting Institute, 300 Madison Ave., New York, NY 10017.

[3]Available from American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.

AMENDMENT TO RESCIND AMENDMENT TO 3-A SANITARY STANDARDS FOR STAINLESS STEEL AUTOMOTIVE MILK TRANSPORTATION TANKS FOR BULK DELIVERY AND/OR FARM PICK-UP SERVICE, SERIAL #0507*

Serial #0508

Formulated by
International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

In accordance with the action of the 3-A Sanitary Standards Committees as recorded in Section V of the minutes of the meeting held May 5, 6 and 7, 1970, the "Amendment to 3-A Sanitary Standards for Stainless Steel Automotive Milk Transportation Tanks for Bulk Delivery and/or Farm Pick-Up Service, Serial #0507", is hereby rescinded, effective May 20, 1970. Subsequent to this date the "Amendment to 3-A Sanitary Standards for Stainless Steel Automotive Transportation Tanks for Bulk Delivery and/or Farm Pick-Up Service, Serial #0507", will become null and void. Notice of this rescinding amendment is hereby published in the Journal of Milk and Food Technology in accordance with the provisions of the 3-A Standard Operating Procedure.

This amendment is effective May 20, 1970.

*Published in Journal of Milk and Food Technology for April 1970, (Vol. 33, No. 4, P. 132).

AMENDMENT TO 3-A SANITARY STANDARDS FOR STORAGE TANKS FOR MILK AND MILK PRODUCTS

Serial #0103

Formulated by
International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

The "3-A Sanitary Standards for Storage Tanks for Milk and Milk Products" dated November 9, 1955, Serial #0101, are hereby further amended in the sections set forth below:

In subsections B.(1), B.(4), B.(6), B.(8), B.(10), B.(11) and B.(12) where the following expressions occur

"—shall be of 18-8 stainless steel with a carbon content of not more than 0.12 per cent."

"—shall be of 18-8 stainless steel."

"—shall be made of 18-8 stainless steel."

the following shall be substituted:

shall be of stainless steel of the AISI 300 series[1] or corresponding ACI[2] types (See Appendix, Section C.), or metal that is non-toxic and non-absorbent and which under conditions of intended use is equally corrosion resistant to stainless steel of the foregoing types.

Add a new subsection C to the Appendix as follows:

C. *STAINLESS STEEL MATERIALS*

Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of subsections B.(1), B.(4), B.(6), B.(8), B.(10), B.(11) and B.(12) herein. Where welding is involved the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in the subsections listed above sets forth the chemical ranges and limits of acceptable stainless steels of the 300 series.

Cast grades of stainless steel equivalent to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. These cast grades are covered by ASTM[3] specification A296 and A351.

This amendment is effective September 20, 1970.

[1]The data for this series are contained in the following reference: AISI Steel Products Manual, Stainless & Heat Resisting Steels, April 1963, Table 2-1, pp. 16-17. Available American Iron & Steel Institute, 150 E. 42nd St., New York, New York, 10017.

[2]Alloy Casting Institute, 300 Madison Avenue, New York, NY 10017.

[3]Available from American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.

REPORT OF COMMITTEE ON FOOD EQUIPMENT

(Continued from Page 258)

brass carbonator pump housings is not a hazard.

To help answer some of these questions, the NAMA had toxicological studies on used (brass) vending machine pumps conducted to determine the ppm of copper formed after 72 hr exposure in solutions with an initial pH of 3.0, 4.0, 5.0, and 6.0. Indiana's toxicologists verified the results. After 72 hr, one sample showed about 9 ppm of copper. The other ranged between 1.0 and 2.5 ppm. Drinking water standards permit 1.0 ppm and human blood contains about 1.4 ppm.

The purpose of this preliminary study by NAMA was to provide guidance to manufacturers who have gone to copperless systems (except for the pump) and similar guidance for several who indicate that they might phase out copper precooler coils, if the pump does not constitute a hazard.

Other educational materials. An informative and interesting piece of literature developed by the NAMA should prove of interest to the general public and to the members of industry and public health. This publication, *A Manual on Microwave Oven Safety,* which is intended to aid the vending industry in complying with the Electronic Products Radiation Control Act may also be obtained from NAMA.

Recommendations

1. The Association reaffirm its support of the National Sanitation Foundation and the National Automatic Merchandising Association and continue to work with these two organizations in developing acceptable standards and educational materials for the food industry and public health.

2. The Association urge all sanitarians to obtain a complete set of the National Sanitation Foundation's Food Equipment Standards and Criteria and a copy of the National Automatic Merchandising Association—Automatic Merchandising Health-Industry Council's Vending Machine Evaluation Manual; to evaluate each piece of food equipment and vending machine in the field to determine compliance with the applicable sanitation guidelines; and to let this Committee and the appropriate evaluation agency know of any manufacturer, installer, or operator failing to comply with

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AMENDMENT TO 3-A SANITARY STANDARDS FOR STAINLESS STEEL AUTOMOTIVE MILK TRANSPORTATION TANKS FOR BULK DELIVERY AND/OR FARM PICK-UP SERVICE

Serial #0509

Formulated by
International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

The 3-A "Sanitary Standards for Stainless Steel Automotive Milk Transportation Tanks for Bulk Delivery and/or Farm Pick-Up Service, Amended April 28, 1954", Serial #0501 are hereby further amended in the sections indicated below:

In subsections A 1., A 5. and A.8 where the following expressions occur

"—shall be of 18-8 stainless steel with a carbon content of not more than 0.12%."
"—shall be of 18-8 stainless steel."

the following shall be substituted:

shall be of stainless steel of the AISI 300 series[1] or corresponding ACI[2] types (See Appendix, Section C.), or metal that is non-toxic and non-absorbent and which under conditions of intended use is equally corrosion resistant to stainless steel of the foregoing types.

In subparagraph D.1 delete the words "stainless steel".

Add a new subsection C to the Appendix as follows:

C. *STAINLESS STEEL MATERIALS*

Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of subsections A 1., A 5. and A8. herein. Where welding is involved the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in A 1., A 5., and A8. sets forth the chemical ranges and limits of acceptable stainless steels of the 300 series.

Cast grades of stainless steel equivalent to types 303, 304, and 316 are designated CF-16F, CF-8 and CF-8M, respectively. These cast grades are covered by ASTM[3] specifications A296 and A351.

This amendment is effective September 20, 1970.

[1]The data for this series are contained in the following reference: AISI Steel Products Manual, Stainless & Heat Resisting Steels, April 1963, Table 2-1, pp. 16-17. Available from American Iron & Steel Institute, 150 E. 52nd St., New York, NY 10017.

[2]Alloy Casting Institute, 300 Madison Avenue, New York, NY 10017.

[3]Available from American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.

REPORT OF COMMITTEE ON FOOD EQUIPMENT

(Continued from Page 260)

these guidelines.

3. The Association urge all sanitarians and regulatory agencies to support the work of the Association's Committee, and subscribe, by law or administrative policy, to the principles represented by the Standards, Criteria, and Evaluation Manual for Food Equipment and Vending Machines.

This report of the Committee on Food Equipment Sanitary Standards respectfully submitted by:

KARL K. JONES, *Chairman*, Purdue University, West Lafayette, Indiana.

IRVING L. BELL, State Department of Health, Frankfort, Kentucky.

GLENN BRAUNER, National Canners Association, Washington, D.C.

CARL HENDERSON, New Mexico Department of Public Health, Santa Fe, New Mexico.

LLOYD W. REGIER, Fisheries Research Board, Halifax, Nova Scotia, Canada.

JEROME SCHOENBERGER, City Department of Health, New York, New York.

HAROLD WAINESS, Harold Wainess and Associates, Chicago, Illinois.

PROGRAM

FIFTY-SEVENTH ANNUAL MEETING

INTERNATIONAL ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC.

In Cooperation with

THE IOWA ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC.

AUGUST 16-20, 1970

Roosevelt Motor Hotel — **Cedar Rapids, Iowa**

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Monday, August 17—1:00 P.M.-5:00 P.M.
Tuesday, August 18—8:00 A.M.-6:00 P.M.
Registration Fee $10.00

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SUNDAY, AUGUST 16, 1970

1:30 P.M.-5:30 P.M.—Executive Board — French Room (215)

8:00 P.M.-11:00 P.M.—Executive Board — French Room (215)

MONDAY, AUGUST 17, 1970

1:00 P.M.-5:00 P.M.—Registration—2nd Floor Foyer

COMMITTEE MEETINGS

Check Bulletin Board

SPECIAL MEETINGS:

8:00 A.M.-12:00 Noon—Executive Board—French Room (215)

1. Report on Local Arrangements
2. Report of Executive Secretary
3. Report of Sanitarians Joint Council

1:30 P.M.-5:00 P.M.—Executive Board — French Room (215)

1. Report of Journal Management Committee
2. Regular Agenda (Presidents Agenda)

MONDAY, AUGUST 17

1:30 P.M.-5:00 P.M.—Individual Committee Meetings (See Bulletin Board)

7:00 P.M.-8:30 P.M.—Affiliate Council—East Room

7:00 P.M.-10:00 P.M.—Executive Board—French Room (215)

1. Committee Chairmen
2. Meet with Past Presidents
3. Report of Affiliate Council Chairman

6:00 P.M.-7:30 P.M.—Reception—Gov. Lowe Room

TUESDAY, AUGUST 18, 1970

8:00 A.M.-5:00 P.M.—REGISTRATION—2nd Floor Foyer

MORNING—GENERAL SESSION NORTH ROOM

DICK B. WHITEHEAD, *President-Elect*, Presiding

9:30—INVOCATION
REVEREND A. L. ZACHAR

9:35—ADDRESS OF WELCOME
GOVERNOR ROBERT RAY

9:50—PRESIDENTIAL ADDRESS
MILTON E. HELD, *President*

10:15—A RESPONSE TO THE ENVIRONMENTAL CHALLENGE
NORMAN MYRICK

11:00—ENVIRONMENTAL TOXICOLOGY AND NATIONAL POLICY
JOHN L. BUCKLEY

11:45—NOMINATIONS 1970

TUESDAY, AUGUST 18

AFTERNOON—MILK SANITATION SECTION

ELMER E. KIHLSTRUM, *Presiding*

1:30—DOOR PRIZE DRAWING

1:45—TESTING FOR CLEANLINESS OF MILK PRODUCTION
MICHAEL H. ROMAN

2:30—IS BACTERIOLOGICAL TESTING OF RAW MILK AND DAIRY PRODUCTS STILL ADEQUATE?
GEORGE W. REINBOLD

3:15—BREAK

3:30—RECRUITING PERSONNEL FOR A DYNAMIC INDUSTRY IN THE SOARING SEVENTIES
C. BRONSON LANE

4:15—THE FIELDMAN 1970 MODEL
JOE P. JOHNSON

TUESDAY, AUGUST 18

AFTERNOON—FOOD & ENVIRONMENTAL SANITATION SECTION

ALFRED M. AHERN, *Presiding*

1:30—DOOR PRIZE DRAWING

1:45—FUTURE OF ENVIRONMENTAL HEALTH IN HEALTH CARE FACILITIES
DAROLD W. TAYLOR

2:30—FOOD PROTECTION RESEARCH AT THE FOOD RESEARCH INSTITUTE
J. M. GOEPFERT

3:15—BREAK

3:30—TRAINING AND ENFORCEMENT PROCEDURE FOR THE FAST FOOD SERVICE DRIVE IN TYPE OPERATION
RICHARD G. WALTHER

4:15—THE PROBLEM OF RODENTS IN OUR MODERN ENVIRONMENT
L. A. PENN

TUESDAY EVENING AUGUST 18

7:30-9:30–EVENING DISCUSSION GROUPS

These discussion groups are for the benefit of our members who have special questions or problems which they wish to discuss informally with others. Selected individuals have agreed to answer questions and otherwise assist in discussions.

7:30–FOOD SANITATION
Gov. Lowe Room
EATON E. SMITH, *Moderator*
J. M. GOEPFERT
R. WALTHER
JACK FRITZ

7:30–MILK
North Room
ROY E. GINN, *Moderator*
M. M. JEFFERSON
W. A. "BILL" BALL
WILLIAM ARLEDGE

7:30–ENVIRONMENTAL SANITATION
East Room
WILLIE GREEN, *Moderator*
JACK CLEMENS
L. A. PENN
DANIEL STOUT

WEDNESDAY, AUGUST 19

MORNING—GENERAL SESSION
NORTH ROOM

A. N. MYHR, *Presiding*

8:30–DOOR PRIZE DRAWING

8:45–(TO BE ANNOUNCED)

9:30–BREAK

9:45–DOOR PRIZE DRAWING

10:00–ANNUAL BUSINESS MEETING

1. Report of Executive Secretary
2. Report of Secretary-Treasurer
3. Committee Reports
4. 3A Symbol Council Report
5. Report of Resolutions Committee
6. Report of the Committee on Inter-Association Cooperation
7. Report of Affiliate Council
8. Old Business
9. New Business
10. Election of Officers
Announcements

WEDNESDAY, AUGUST 19

AFTERNOON—MILK SANITATION SECTION
NORTH ROOM

ORLOWE OSTEN, *Presiding*

1:30–DOOR PRIZE DRAWING

1:45–MILK FLAVOR, THE TRUE TEST OF QUALITY
DAVID K. BANDLER

2:15–"STERILIZED" DAIRY AND IMITATION PRODUCTS
ERNEST GLASER

3:00–BREAK

3:15–PROGRAM FOR PLANT (FINISHED PRODUCT) QUALITY ASSURANCE
EDWARD L. SING

4:00–MANURE DISPOSAL SYSTEMS AND ENVIRONMENTAL CONTROL FOR CONFINED DAIRY HOUSING
D. W. BATES

AFTERNOON—FOOD AND ENVIRONMENTAL SANITATION SECTION
GOV. LOWE ROOM

RAY BELKNAP, *Presiding*

1:15–DOOR PRIZE DRAWING

1:30–HARMFUL ORGANISMS FOUND ON FLIES ON DAIRY FARMS
BLANTON WHITMIRE

2:15–ROLE OF ENZYMES IN THE DAIRY AND FOOD INDUSTRY
KHEM M. SHAHANI

3:00–BREAK

3:15–SANITARY ASPECTS & PROBLEMS OF MASS MEAL TRANSPORTATION OF PREPARED FOOD
O. G. SHEPARD

4:00–SOME APPROACHES TO WATER POLLUTION CONTROL
C. M. WIDMER

WEDNESDAY, AUGUST 19

AFTERNOON—FOOD INDUSTRY SANITATION SECTION
CONSERVATORY ROOM

LOUIS A. KING, *Presiding*

1:30–DOOR PRIZE DRAWING

1:45–"THE NEW COOPERATIVE STATE AND FEDERAL RED MEAT PROGRAM
WM. D. O'MARA

2:15–INSPECTION OF FLOUR SHIPMENTS
KENNETH V. NYBERG

3:00–BREAK

3:15–MICROBIOLOGY OF POULTRY PRODUCTS
A. A. KRAFT

4:00–SANITATION BY DESIGN
DARRELL F. JONES

WEDNESDAY EVENING, AUGUST 19

6:30-7:30–RECEPTION
Gov. Lowe Room and Conservatory

7:30–ANNUAL AWARDS BANQUET
North Room

MILTON E. HELD, *Presiding*

INVOCATION
IVAN E. PARKIN

INTRODUCTIONS

MASTER OF CEREMONIES
EARL O. WRIGHT

PRESENTATIONS OF AWARDS
AL N. MYHR, *Chairman*

1. Past President's Award
2. Citation Award
3. Honorary Life Membership
4. Sanitarian's Award

The Sanitarian's Award is sponsored jointly by the Diversey Corporation, Klenzade Products, Inc., and Pennwalt Chemicals, Inc.; and is administered by the Internationala Association of Milk, Food and Environmental Sanitarians.

INSTALLATION OF OFFICERS
MILTON E. HELD

9:30–ENTERTAINMENT
North Room and East Room

THURSDAY, AUGUST 20

MORNING—GENERAL SESSION NORTH ROOM

MILTON E. HELD, *Presiding*

9:00–DOOR PRIZE DRAWING

9:15–FOOD PRESERVATION
NINO F. INSALATA

10:00–SUBJECT TENTATIVE
WILLIE GREEN

10:45–SOLID WASTE A CONCERN FOR OUR ENVIRONMENT
JACK CLEMENS

ENTERTAINMENT MEN AND WOMEN

MONDAY, AUGUST 17

6:00 P.M.-7:30 P.M.–RECEPTION
Gov. Lowe Room

WEDNESDAY, AUGUST 19

6:30 P.M.–COCKTAIL HOUR
Gov. Lowe Room

7:30 P.M.–BANQUET
North Room

9:30 P.M.–ENTERTAINMENT
North Room

THURSDAY, AUGUST 20

12:00 Noon-4:00 P.M.–SHRINER HORSE SHOW & PICNIC

ENTERTAINMENT FOR THE LADIES

TUESDAY, AUGUST 18
Amana Colonies
10:00 A.M.-3:30 P.M.

WEDNESDAY, AUGUST 19
Tea at Art Gallery
2:00-3:30 P.M.

PROGRAM PARTICIPANTS

AHREN, ALFRED M.–Linn County Health Dept., Cedar Rapids, Iowa

ARLEDGE, WILLIAM L.–Dairymen Inc., P. O. Box 1099, Bristol, Va.

BALL, WILLIAM A.–Associated Milk Producers, Inc., 35th & Taylor, Little Rock, Arkansas

BANDLER, DAVID K.–Extension Specialist, Dairy Science, 10 Stocking Hall, Cornell University, Ithaca, N. Y.

BATES, DONALD W.–Agric. Extension Engr., U. of Minn., 212 Agric. Eng. Bldg., St. Paul, Minn.

BELKNAP, RAY–79 Locust, Lakeside Park, Ft. Mitchell, Ky.

BUCKLEY, JOHN *L.*–Office of Science & Technology, Executive Office of the President, Washington, D.C.

CLEMENS, JACK E.—Chief Sanitary Engineer, State Dept. of Health, Lucas Office Bldg., Des Moines, Iowa

FRITZ, JOHN H.—Assistant Director, Division Sanitation Control, Food & Drug Administration, 1090 Tusculum Ave., Cincinnati, Ohio

GLASIER, ERNEST—Vice-President, Avoset Food Corp., 80 Grand Ave., Oakland, California

GINN, ROY E.—Manager, Quality Control Committee Laboratory, 2274 Coma Ave., West, St. Paul, Minnesota

GOEPFERT, J. M.—Professor, Food Sesearch Institute, 2115 Herrick Dr., University of Wisconsin, Madison, Wisconsin

GREEN, WILLIE—Department of Public Health, University of Minnesota, Minneapolis, Minn.

HELD, MILTON E.—910 Upper Lupin Way, San Carlos, California

INSALATA, NINO F.—Post Microbiological Research, General Food Corp., 275 Cliff St., Battle Creek, Mich.

JEFFERSON, MELVIN M.—Va. Dept. of Agriculture & Commerce, 1444 West Main St., Richmond, Viginia

JOHNSON, JOE P.—Associated Milk Producers, Inc., Arlington, Texas

JONES, DARRELL F.—Corporate Sanitation Inspector Quality Control Dept., General Mills, Inc., 9200 Wayzata Blvd., Minneapolis, Minnesota

KRAFT, A. A.—Dept. of Food Technology, Iowa State University, Ames, Iowa

KIHLSTRUM, ELMER E.—616-54th Place, Western Springs, Illinois

KING, LOUIS A. JR.—400 E. Ontario St., Dept. of Bakery Sanitation, American Institute of Baking, Chicago, Illinois

LANE, C. BRONSON—Assistant Extension Professor, Dairy Technology, University of Kentucky, 104 Dairy Products Bldg., Lexington, Kentucky

MYRICK, NORMAN—International Paper Co., 220 East 42nd St., New York, N. Y.

MYHR, AL N.—Dept. of Dairy Science, University of Guelph, Guelph, Ontario, Canada

O'MARA, WILLIAM D.—Federal-State Cooperation Officer, 471 Federal Bldg., Second & Walnut Sts., Des Moines, Iowa

NYBERG, KENNETH V.—Field Sanitarian, Dept. of Sanitation Education, American Institute of Baking, 400 East Ontario St., Chicago, Ill.

OSTEN, ORLOWE M.—Minnesota Dept. of Agri., 517 State Office Bldg., St. Paul, Minnesota

PARKIN, IVAN E.—Rt. 1, Box 630, Westbrook, Connecticut

PENN, L. A.—Technical Service Division, Milwaukee Health Dept., Room 105, 841 N. Broadway, Milwaukee, Wisconsin

RAY, ROBERT—Governor, Des Moines, Iowa

ROMAN, MICHAEL H.—18 Eugene St., Lowville, N. Y.

REINBOLD, GEORGE W.—Dept. of Food Technology, Iowa State University, Ames, Iowa

SHAHANI, KHEM M.—Dept. of Food Science, University of Nebraska, Lincoln, Nebraska

SHEPARD, O. G.—Transportation Division, Marriott Corporation, 5200 Addison Rd., N.E., Beaver Heights, Maryland

SING, EDWARD L.—Ex. Director, Moseley Laboratories, 3862 East Washington St., Indianapolis, Indiana

SMITH, EATON E.—Dir. Food & Drugs, Dept. of Consumer Protection, State Office Bldg., Hartford, Connecticut

STOUT, DANIEL—Research Entomologist, Whitmire Laboratories, Inc., St. Louis, Missouri

TAYLOR, DAROLD W.—Chief Health Facilities, Services Improvement Program, Commissioner Health Services, USPHS, Washington, D. C.

WALTHER, RICHARD G.—McDonald's Corp., 221 N. LaSalle St., Chicago, Illinois

WIDMER, C. M.—Vice-Pres. Engineering, Penick & Ford Ltd., Cedar Rapids, Iowa

WHITEHEAD, DICK B.—Diversey Corporation, 212 W. Monroe St., Chicago, Illinois

WHITMIRE, BLANTON—Whitmire Research Laboratories, Inc., 339 South Vandeventer Ave., St. Louis, Missouri

WRIGHT, EARL O.—Food Technologist, Iowa State University, Ames, Iowa

ZACHAR, A. L.—Pastor of St. Ludmilas Church, Cedar Rapids, Iowa

NEWS AND EVENTS

NORTON COMPANY DEDICATED EXPANDED CHAMBERLAIN LABORATORIES IN OHIO

Norton Company's expanded Chamberlain Laboratories, more than doubled in size to 77,000 square feet, were dedicated June 8, 1970 at ceremonies attended by over 200 leaders of science, industry, government and education. Included in the day's events were conducted tours of the laboratories and brief speeches by Milton P. Higgins, chairman of the board of Norton Company, John Jeppson, Norton president, and Robert C. Hunter, Norton vice president and general manager of the Akron based Norton divisions.

Centered in the Laboratories are all research and development activities of Norton's Chemical Process Products Division, Plastics & Synethetics Division and Bio-Medical Products group. These divisions made up the internationally-known U. S. Stoneware Company prior to its acquisition by Norton Company four years ago.

Norton's Plastics and Synthetics Division produces the well-known Tygon(R) and Transflow(R) plastic tubings. Certain Tygon formulations designed for handling sensitive solution meet Food and Drug Administration (FDA) requirements and are widely used in the food and beverage industries. Other types of Tygon Tubing are used in laboratories, the chemical processing industries, the surgical, pharmaceutical and hospital fields as well as in general industry. Transflow clear plastic tubing which fulfills the requirements of both the FDA and the dairy industry's 3-A groups, has long been the standard for dairy farmers and milk haulers in the handling of raw milk. Transflow clear plastic inflations and shells were developed to provide see-through milking and to eliminate over-milking. The Plastics & Synthetics Division also manufactures laboratory equipment and aircraft radomes, as well as custom made parts of plastic and rubber.

The Bio-Medical Products group custom-produces plastic and rubber components for original equipment manufactures marketing to the health-care field.

Norton's Chemical Process Products Division is the world's leading manufacturer of tower packings and internals, for the chemical, petrochemical, and refinery industries. The division also makes air pollution control equipment, catalysts and adsorbents, and a complete line of grinding, mixing and blending equipment.

Completely climate-controlled, Chamberlain Laboratories is of structural steel frame, masonry and curtain wall construction. Among highlights of its design is a 1,600 square foot bay, 40 feet high, which accommodates the full size absorption and distillation towers used to develop mass transfer data for the chemical process industries.

Situated on 10 attractively-landscaped acres in Stow, Ohio, the structure houses the firm's Plastics & Synthetics, Ceramics, Catalysts & Adsorbents, Mass Transfer and Analytical Laboratories.

The Laboratories are dedicated to James M. Wills, John J. Chamberlain and James M. W. Chamberlain, three men who guided U. S. Stoneware during its century of existence from its beginning as a small, backyard pottery to a position of respect and leadership in the chemical processing, ceramics and plastics industries.

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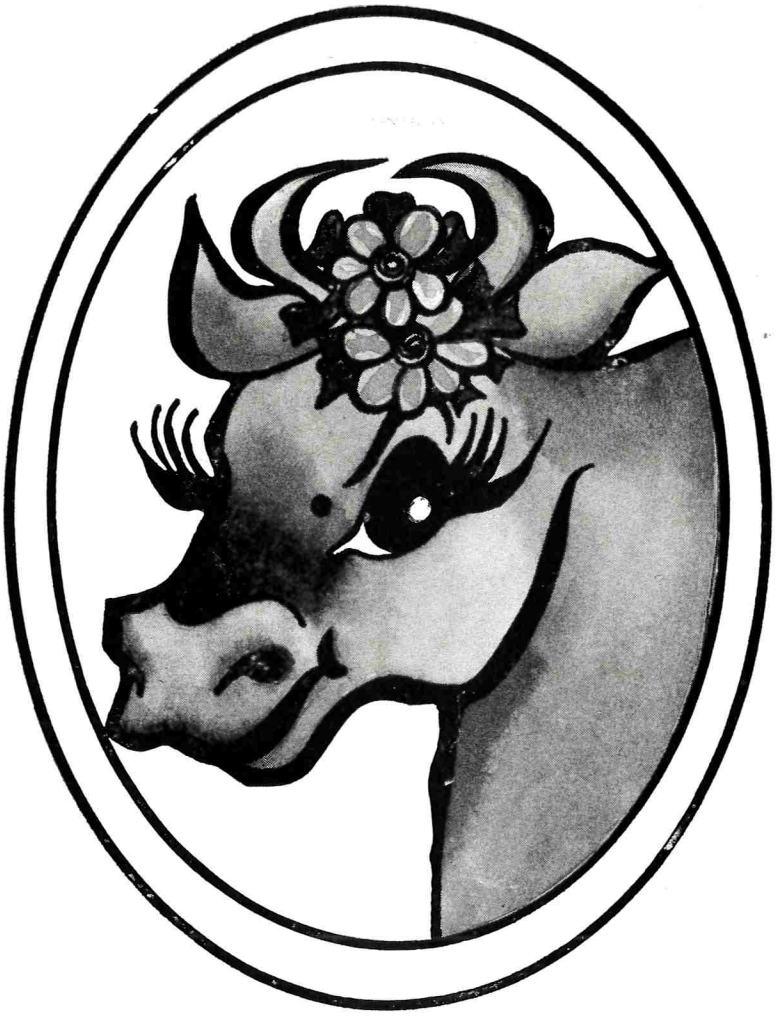

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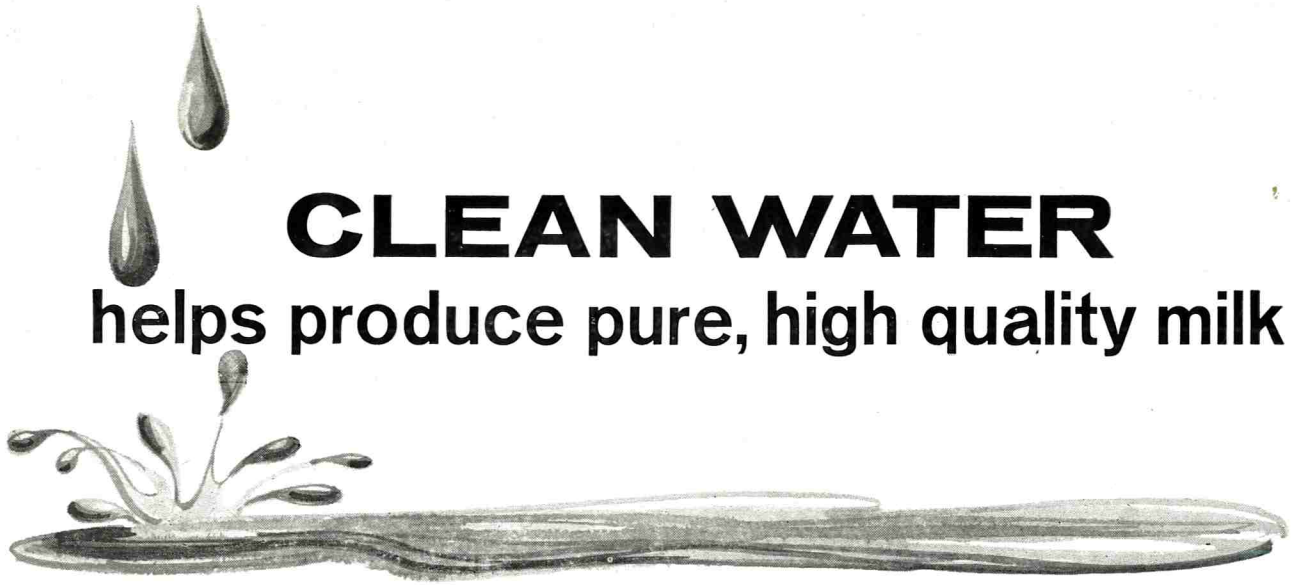

CLEAN WATER

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The minerals calcium and magnesium in water cause it to be hard. The greater the concentration of these minerals the *harder* the water. They combine with soaps to form scum and with milk residue in milking machines and bulk tanks to form milkstone deposits. These deposits in the pipeline offer a breeding ground for bacteria. Also, hard water can cloud and deposit mineral film on equipment surfaces, causing stains which are difficult to remove. Hard water greatly affects the cleaning efficiency of detergents, causing increased usage and higher costs.

Dairymen know that iron in the water causes rust and results in a metallic taste. Manganese is another metallic element responsible for similar water problems. Both of these elements must be held in suspension or eliminated to obtain proper balance of water and detergents for efficient cleaning.

Many dairymen do not know the condition of their water. It may look clean, but unless the water supply is analyzed, the problems it causes in daily clean-up cannot be properly dealt with.

The Surge dealer is equipped with a water analyzer kit that enables him to make most of the primary checks on water quality. He can give on-the-spot answers on hardness, iron content, chloride content, sulfate content, and information on Calcium, Manganese, Chlorine and PH. He can detect mineral, protein and fat deposits which are not apparent to the naked eye, with special "black-light" detection equipment.

Bacteriological readings on water require a more complete laboratory testing. Knowing specific water problems is necessary before the dairyman can properly deal with them. One prime solution to consider is the use of a Water Conditioner. It will filter, refine and soften the water supply in one operation.

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