ISSN:0273-2866
Box 701
Ames, Iowa 50010

April 1986
Vol. 6, No. 4
Pages 133-180
$6.00

Dairy and Food Sanitation®

A Publication of the International Association of Milk, Food and Environmental Sanitarians, Inc.

Characteristics and Efficiency of Milk Filters

Listeria Update

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Probing America's Worst *Salmonella* Outbreak

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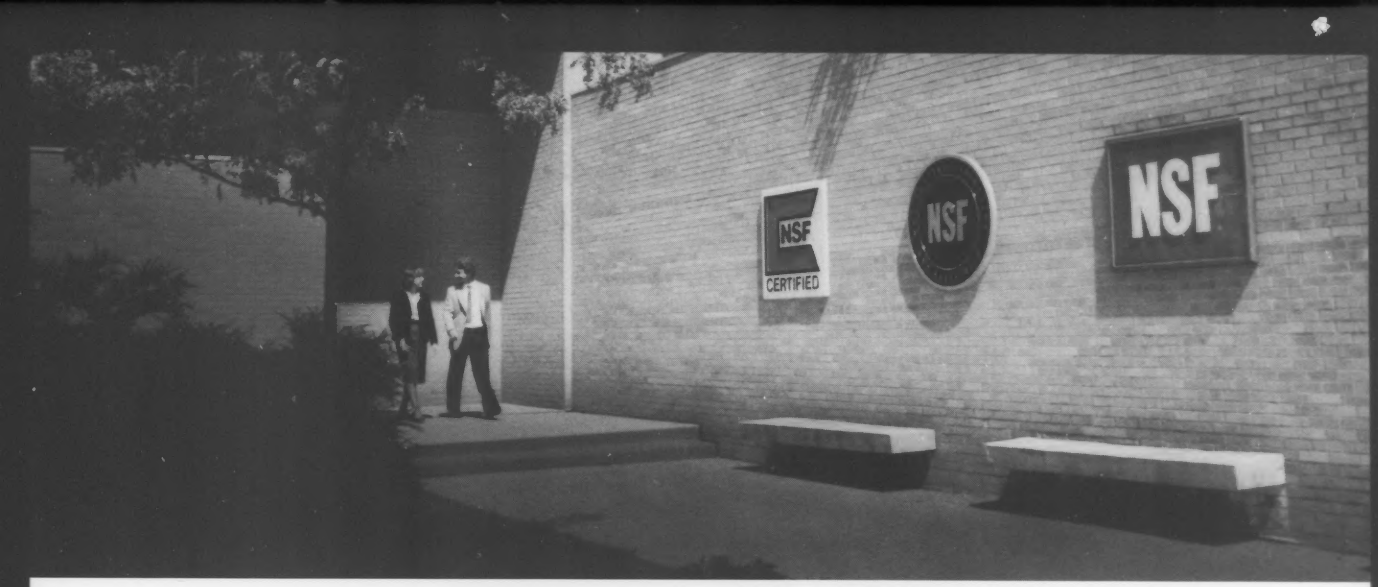

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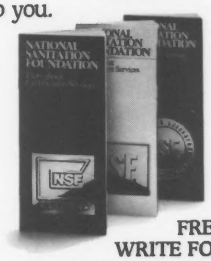

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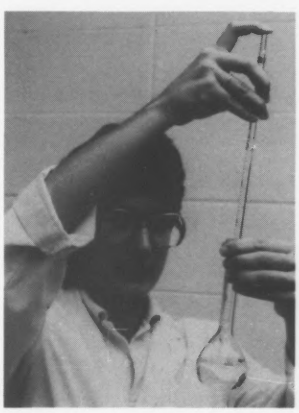

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Dairy and Food Sanitation (ISSN:0273-2866) is published monthly by the International Association of Milk, Food and Environmental Sanitarians, Inc., executive offices at PO Box 701, 502 E. Lincoln Way, Ames, IA 50010. Printed by Heuss Printing, Inc., 911 Second St., Ames, IA 50010. **Second-class postage paid at Ames, IA. Postmaster: Send address changes to IAMFES, 502 E. Lincoln Way, Ames, IA 50010-0701.**

Manuscripts: Correspondence regarding manuscripts and other reading material should be addressed to Kathy Hathaway, PO Box 701, Ames, IA 50010-0701. 515-232-6699.

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Dairy and Food Sanitation

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Of Microbes and Milk: Probing America's Worst Salmonella Outbreak

by Chris Lecos
reprinted from the February 1986 FDA Consumer

Large, refrigerated tanker trucks no longer rumble through the streets of Melrose Park, Illinois, to deliver their 40,000-to 50,000-pound loads of milk to the Hillfarm Dairy. The dairy at one time processed about 1.5 million pounds of milk a day, but not a drop has flowed through its maze of nearly five miles of stainless steel pipes for almost a year now. The huge silo-like storage tanks that rise about the plant's rooftop are readily visible to any casual passer-by, but they stand there today as empty monuments to the worst outbreak of *Salmonella* food poisoning in U.S. history.

Located in a thriving industrial area of this Chicago suburb, the dairy was the sole supplier of milk to 217 supermarkets operated by the Jewel Food Stores chain in Illinois, Indiana, Iowa and Michigan. The dairy, also owned by the Jewel company, had been producing milk there since 1968.

The outbreak that prompted the company to cease all dairy production on April 9, 1985, began with a scattered trickle of patients into Chicago-area hospitals and doctors' offices in late March. It ended with a torrent of sick men, women and children, all stricken by an organism identified as *Salmonella typhimurium*. One of its microbiological characteristics was its resistance to certain antibiotics.

At least 16,284 persons are known victims of the outbreak, all but 1,059 of them from Illinois. The others lived in Indiana, Iowa, Michigan, Minnesota and Wisconsin. That is the number of culture-confirmed cases, meaning the *Salmonella typhimurium* strain that was contaminating the milk they drank also was found in stool samples from the victims. Patricia J. Larsen, a spokeswoman for the Illinois Department of Public Health, said the organism "directly caused" the deaths of two persons and was a contributing factor in the deaths of four, possibly five, others. The latter were people with other conditions that "presumably were aggravated to some degree by the infection," she said.

Those are the official numbers, but most public health authorities agree that the actual totals are substantially higher. Many more people, it is believed, suffered diarrhea, fever, abdominal pain and cramps from drinking the milk but recovered quickly and never saw a doctor or reported their illness.

The Illinois outbreak triggered one of the most intensive investigations ever made of a milk-borne epidemic. What made it so frightening was the fact that thousands of people had become ill from drinking one of the most closely regulated products in the food supply. For years, milk has had the enviable record of being one of the nation's safest foods because it was a pasteurized product.

It's not uncommon for unpasteurized milk to contain *Salmonella* or other organisms. But about 99 percent of the 280 million glasses of milk Americans drink every day is pasteurized. At most dairies, that means heating the milk to at least 161 degrees Fahrenheit for at least 15 seconds and then quickly cooling it--thus destroying microorganisms that could contaminate the milk. Milk safety experts with the Food and Drug Administration point out that less than 1 percent of all outbreaks of food poisoning reported in the past decade were caused by milk. And over the past 30 years, about 95 percent of those milk-related food poisoning incidents that did occur involved unpasteurized milk.

At the Hillfarm Dairy it was pasteurized, 2 percent (low-fat) milk produced under two brand names--Bluebrook and Hillfarm--that caused so many to become ill with *Salmonella* poisoning.

But when the investigation into the poisonings began, there was no certainty that the outbreak was due solely to low-fat milk, although it was the one product that many of the victims said they had consumed.

As investigators began their probe to find the source of the contamination, countless questions begged for answers:

Where did this unusual strain of *Salmonella* come from? Did it originate at one of the dairy farms that supplied the milk to Hillfarm? Was it brought into the plant by an unsanitized truck? Was the milk originally so contaminated that enough bacteria survived the plant's pasteurization process to contaminate the

finished product? Was the contaminating organism resistant to heat treatment? Did someone purposely, or accidentally, introduce the organism into the plant?

The investigation determined that the same organism had caused at least three outbreaks of food poisoning in the spring of 1985 and other smaller, scattered outbreaks dating back to June 1984. Investigators believe an August 1984 outbreak, in which 200 people became ill, probably was related to consumption of Hillfarm products. However, later investigation failed to provide enough evidence for investigators to claim that the other 1984 incidents were similarly linked. Such reoccurrence, however, did raise the possibility that the organism had somehow persisted within the plant's environment for many months. What made it possible for this organism to intermittently -- but not regularly -- contaminate 2 percent milk but not whole or skim milk or any other products (chocolate milk, cottage cheese, ice cream, etc.) produced by Hillfarm?

These were just some of the questions tht confronted state and federal investigators, and later a special task force of experts, who swarmed all over this dairy last year searching for the cause of the outbreak.

Last year's outbreak had its beginning with the low-fat milk produced on March 20, a Wednesday. By the following weekend, small numbers of people were entering Chicago-area hospitals complaining of fever, cramps, stomach pains and diarrhea. Almost another week would elapse before it was apparent that a major outbreak was developing. Analysis of stool cultures, which takes several days to complete, confirmed that this scattering of victims had a common link: All were stricken by *Salmonella typhimurium*. The other common denominator, obtained by interviewing the victims, was the low-fat milk that many said they had drunk.

On April 1, the Illinois public health department issued its first warning that Bluebrook 2 percent milk produced on March 20 and bearing a shelf expiration date of March 29 posed a health hazard. By this time, there were at least 300 suspected *Salmonella* cases in five Chicago-area counties. As the number of victims swelled, it became apparent that two more outbreaks were developing among people who drank the dairy's other Hillfarm brand of 2 percent milk, that which was produced on March 30 and April 8. On April 9, the Jewel company ceased all dairy production.

When it became evident that the outbreak was getting more serious with each passing day, the investigation started by state public health authorities, assisted by their federal counterparts, was turned over to a 22-member task force appointed by Illinois Inspector General Jeremy D. Margolis. Formed April 19, 10 days after the plant's closing, the task force included scientists, engineers and other experts from FDA, the U.S. Centers for Disease Control, and the Illinois public health department, as well as consultants and specialists from the private sector, including key employees of the Hillfarm Dairy. Jerome J. Kozak, chief of FDA's Milk Safety Branch in Washington, D.C., was named to oversee the task force's day-to-day operations.

"The Jewel company literally turned over the entire plant to us," Kozak said. "Anything we wanted, any record, anything they could do to help find out what had occurred, we were given. We could go to the person responsible in the plant for an explanation of what occurred at specific times, dates and places. If there was any reticence by plant employees to talk to us, there were plant superiors there to assure the employees they could talk to us without fear of retribution."

Hillfarm had enjoyed the reputation of being a well-run dairy operation. Many of its processing functions were automatic and computer-controlled. The technology included an efficient CIP, or Clean-in-Place, system that, with the touch of the right buttons, sent cleaning and sanitizing solutions throughout the system. The 170,000 gallons of milk that it processed each day usually were delivered to Jewel's supermarkets within two days after production. All the finished milk products carried a shelf expiration date, or "pull date." That meant the milk had been produced nine days earlier -- a fact that enabled investigators to pinpoint the different batches and brands of contaminated milk.

The task force went to extraordinary lengths to find the cause of the outbreak during its five-month probe.

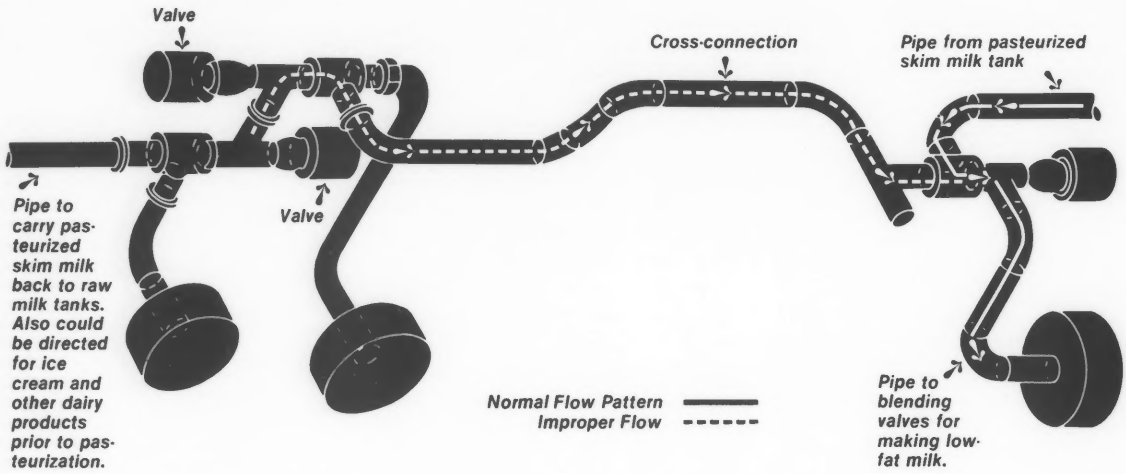
The group met in a "war room" in the plant and methodically set out to prove or disprove a wide array of theories that might account for the outbreak.

Company records were meticulously checked so that the task force could reconstruct, as closely as possible, the operating procedures of the plant. The plant's equipment was taken apart almost piece by piece. Its storage tanks for unpasteurized and pasteurized milk, pasteurizing equipment, pipelines, milk fillers, and other major pieces of equipment were examined for physical defects. In addition, thousands of samples were collected for laboratory analysis. Both physical and laboratory examinations were made of valves, pipes, gaskets, packaging materials, and even the ink on the packages. The plant's compressed air and water systems, conveyors, floors, sewers, and even its roof were examined. In effect, the entire plant environment was exposed to the scientific and engineering scrutiny of the investigators.

In addition, all of the plant's milk sources -- dairy farms in Wisconsin, Illinois and Michigan -- were checked to see if the *Salmonella typhimurium* strain could be found. It wasn't. Tank trucks -- which are tagged to show when they were last cleaned and sanitized - were selectively checked. Some were not tagged properly, and the task force noted that it could not exclude all the trucks, or some of the products shipped in them, as a possible means of bringing the organism into the plant.

Elaborate tests were done to uncover possible defects in equipment. For example, all the milk storage tanks were tested with colored dyes

This simplified diagram shows the cross-connection in the Hillfarm Dairy that could have caused skim milk to become mixed with milk contaminated with the bacteria that caused the food poisoning outbreak. Investigators found that unpasteurized milk could enter the cross-connection from the left side and remain there long enough for bacteria to multiply. Then, when pasteurized skim milk was pumped from its storage tank to be used in making low-fat milk (the type involved in the food poisoning cases), a suction was created that could draw the contaminated milk out of the cross-connection and into the skim milk line.



and checked for hairline cracks and pinholes that could serve as bacterial breeding grounds. The tanks are 15 to 55 feet high. The tests required the erection of scaffolding in the tank interiors. During the examination of the tank that held pasteurized skim milk, several suspicious areas were found about 20 feet up from the bottom. Four-inch holes were cut into the tank and foam insulation for any evidence of milk residue or moisture leakage. There was none.

The task force also ruled out any possibility that the pasteurization system was overwhelmed by huge doses of *Salmonella*-contaminated milk. Only an enormous dose of *Salmonella* -- estimated at 1 trillion organisms per milliliter -- could theoretically enable a few organisms to survive the plant's pasteurization process. "In practice," the report said, "this level cannot be achieved. . ."

The investigators' concern that the strain may have been resistant to heat also was ruled out after tests by FDA and other microbiological experts. An employee could have been a chronic carrier of the *Salmonella* organism but, the task force concluded after testing the employees, this also was unlikely.

The investigation of the sabotage theory, which had received considerable publicity, also involved Illinois state police, who interviewed 129 plant employees and former employees. Many were given lie detector tests. The report noted that a person or persons with a culture of *Salmonella typhimurium* would need access to, as well as a thorough knowledge of, the plant and its operation and then be able to "commit a series of intentional acts" -- undetected -- in order to contaminate the milk on an intermittent basis on at least three production dates in 1985 as well as during the year before. No significant leads or evidence of sabotage were found.

In the end, the task force was unable to unearth any evidence within the plant of the existence of the same *Salmonella typhimurium* strain that was causing the food poisonings. Nor could it prove how the bacteria got into the plant in the first place to contaminate the low-fat milk.

A report released by the task force on Sept. 14 disclosed various defects in the plant's operation and equipment and, more importantly, what the investigators felt were the most likely causes of the outbreak. But while "potential problems" were identified in the plant, the task force was unable "to reconstruct an unbroken chain of probable events that led to intermittent contamination" of the dairy's low-fat milk products. A "contamination of defects" probably played a role in causing the outbreak, according to the report.

The task force concluded that the most likely source of the outbreak was a stainless steel pipe called a cross-connection. The pipe, about 10 feet long, was linked on one side to

piping that carried unpasteurized milk and on the other to pipes carrying pasteurized skim milk. (The connection is also called a skim milk transfer line.) Valves at each end were supposed to prevent unpasteurized milk from mixing with pasteurized products.

Investigators suspected the cross-connection early on, after it was discovered by Charles Price, the senior regional milk specialist from FDA's Chicago office, when he went to the plant on April 2. Price discovered that sometime in the past the Hillfarm Dairy had converted one of its raw milk storage tanks into a tank for storing pasteurized skim milk. Tracing the piping from the tank, he found the cross-connection.

The cross-connection was a "modification" to the plant's original engineering design and had been installed sometime between 1975 and 1979. It had several functions. It was used when the dairy wanted to route pasteurized skim milk from the storage tank for use with such products as ice cream. If there was contaminated skim milk in the line, it did not affect those products because they were pasteurized afterwards. The cross-connection also was used at the end of a day's production to remove for reprocesssing whatever milk was left over in the pasteurized skim milk tank.

"Just because it was there," Kozak pointed out, "did not mean it caused the contamination. There was still a question of figuring and demonstrating how contaminated milk could get through the cross-connection and then into the pasteurized skim milk line." Presumably, this was supposed to be prevented by appropriate shut-offs.

So another elaborate test was undertaken. Like other U.S. dairies, Hillfarm employed what is known as a post-pasteurization blending process to produce its low-fat (2 percent) milk -- the type linked to the outbreak of the illness. This involves blending already pasteurized whole milk (3.25 percent or more milk fat) with already pasteurized skim milk (0.5 percent of less milk fat). No further pasteurization was done since the process involved the mixing of already pasteurized products. Post-pasteurization blending is not uncommon; some dairies around the country have used the process for more than 20 years.

To test the blending system, thousands of gallons of colored water were pumped into a storage tank for unpasteurized milk. Clear water was used in the storage tank for pasteurized skim milk. When the pump for the blending system was activated, an inspection of the cross-connection revealed "a mixture of clear and colored water," thus indicating, the task force report said, that "products on the raw side of the valve cluster could be commingled with pasteurized skim milk in the skim milk transfer line," or cross-connection.

The test showed that small amounts of milk could collect in the cross-connection and remain there long enough for bacteria to multiply. Even a cupful, said one scientist, would be enough. But how did the milk, even though contaminated, get past the shut-off valves into the pasteurized skim milk lines?

Tests demonstrated that when the processing system for producing low-fat milk was activated, the pasteurized skim milk was pumped at such a high speed from the skim milk tank to the blending lines that it created a vacuum. According to Kozak:

"We were able to prove that when the pump was put into operation -- that is, when you started pulling product out of the pasteurized skim milk tank at a high volume -- it created such a tremendous suction that potentially contaminated product which was already in the cross-section, and just sat there, could then be sucked into the line for pasteurized skim milk during blending."

This was a possible explanation for the outbreaks that occurred from milk produced on March 20 and March 30. But it did not necessarily account for the contaminated milk found in the April 8 production, for the investigators knew that the cross-connection, upon its discovery April 2, had been disconnected the following day. A plant employee told the task force that the transfer line was reconnected on the evening of April 7 by a worker who did not know it was supposed to remain disconnected. However, another plant employee said he discovered the reconnected pipe and again disconnected it -- before any low-fat milk was produced on April 8.

But another avenue for contaminated milk to get into the cross-connection was found by the task force. This route involved the plant's reclaiming milk that, for various reasons was unsuitable for delivery to stores and was not supposed to leave the plant. This milk was salvaged for use with such plant products as ice cream. (However, it was Hillfarm's policy, the report said, not to reclaim any milk that was unsold and returned from the supermarkets.)

On a typical day, the Hillfarm Dairy would take the packaged milk that had been produced, load it onto pallets, and move it to coolers where it would remain until it was trucked to the supermarkets. When a forklift would raise a pallet load of milk, it was not uncommon for cartons to tip over, fall on the floor, or suffer other damage. That made it possible for carton exteriors to become contaminated. Rather than selectively remove the undeliverable cartons, it was easier for the dairy to move the entire pallet to a section of the cooler for later salvaging. Milk in damaged cartons was disposed of, but the milk in other cartons involved in such incidents was reprocessed.

When it came time to reprocess this milk, the cartons would be opened and the contents dumped into a vat. FDA officials were critical of the employee's practice of emptying cartons by opening them by hand and banging them on the side of the vat.

All reclaimed milk was supposed to be repasteurized, but another test demonstrated that it was possible for some reclaimed milk to bypass the pasteurizing units and get into the cross-connection, where it would sit until it was drawn into the pasteurized skim milk piping during the

blending for low-fat milk. However, for this to happen, the report stressed, two plug valves would have to have been turned to an "improper position." Some task force members believe that valves might have been unintentionally left in the wrong position after cleaning and sanitizing operations were completed and production was resumed.

Plant inventory records disclosed that a large volume of milk was reclaimed on March 19. This was milk that had accumulated during a week when the floor of the cooler was being ripped up to replace a sewer drain. The report notes that "some stacks of cases were reportedly tipped onto and into this construction area," and that it is "highly probable" that Bluebrook low-fat milk processed on March 20 and Hillfarm low-fat milk processed on March 30 "were brought back from the cooler to the production floor and reprocessed before it was known that these products were contaminated." Milk was being reclaimed until the plant ceased operations. So this was another possible means of contamination within the plant's environment and could have accounted for the contaminated production of April 8.

Yet another potential source of contamination existed.

In general, the plant's Clean-in-Place system was effective in cleaning and sanitizing the equipment, piping and other critical areas of the dairy operation. One exception was a T-shaped pipe connection leading from the pasteurized skim milk tank to the skim milk transfer line. It was still attached even after the cross-connection pipe had been disconnected. Tests showed that small amounts of milk could collect in the T-connection long enough for populations of *Salmonella* to multiply.

The T-conection had threaded caps, and interviews with plant employees disclosed that a contaminated thread cap to an unpasteurized milk line could have been removed and placed on a pasteurized milk line. Plant employees admitted "they were not aware. . .that it was necessary to remove the end cap of the valve and manually clean" the removed caps.

As the final report stressed, the task force's conclusions are theories that were backed by the findings of close physical examination of the plant and by a wide array of tests. Describing the task force's effort as "the most comprehensive dairy investigation ever undertaken," Illinois Inspector General Margolis noted in releasing the report last fall:

"This wasn't sabotage, this wasn't a superbug, this wasn't a failure of the pasteurization process. It was a unique microbiological engineering phenomenon."

Dairy and Food Sanitation, Vol. 6, No. 4, Pages 136-140 (April 1986)

Characteristics and Efficiency of Milk Filters[1]

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INTRODUCTION

The Milk Ordinance and Code *(1)* states that all milk will be free of extraneous material. The efficiency of removal of extraneous matter is subject to periodic question, whenever upon sediment analysis, a dirty disc is produced.

In early work Jacobsen and Olson *(6)* determined that milk filtration would reduce the somatic cell count and the efficiency was directly related to milk temperature at filtration. Clarifiers have been used classically to remove additional extraneous material from milk so that sediment would not appear in homogenized fluid milk *(4, 8, 9)*.

Little recent information could be found that details filtering characteristics of fabrics currently in use in the United States and Canada. It is interesting that in Bulgaria, a standard indicates the technical requirements for milk filters. These requirements include width, weight, thread density, tensile strength and elasticity needed in cotton fiber *(2)*. Also Bertozzi *(3)* stated that no significant changes in bacterial populations in filtered versus unfiltered milk occurred using nylon filters with porosities as small as 70 nm. This fact of no significant change in microbial populations was proved by Dahlberg and Marquardt *(4)* much earlier using cloth filters with pores of 312 nm^2.

The objective of this research was to compare milk filters currently in use with prototypes developed for raw milk as well as other applications.

MATERIALS AND METHODS

All filters used were of two styles; a sock sealed at one end with the measurement of 5.7 x 61.0 cm (2.25 x 24 inches), and a sleeve 12.3 x 43.2 cm (4.83 x 17 inches). These two styles represent the configurations used in modern milk handling systems where milk is pumped from the vacuum breaker container to the milk tank. Gravity flow systems were not considered.

Two farms were used in this trial. The University of Wisconsin Dairy Cattle Center in Madison (using sock filters) and the University of Wisconsin Arlington Research Farm (using sleeve filters). Each filter was evaluated for two weeks at each farm with microbiological and compositional data collected from milk sampled at each pick-up and delivery to the University of Wisconsin Dairy.

Microbiological Evaluation of Milk Samples

Bacteria in milk samples were enumerated by the Standard Plate Count (SPC) method as given in Standard Methods for the Examination of Dairy Products, 14th edition (SMEDP) *(7)*. Pour plates were prepared with Tryptone Glucose Yeast Extract Agar, and the appropriate dilution of milk then incubated at 32°C for 48 hours before counting. Mean population over the study period for each brand of filter as well as the range is given in Table 1.

Somatic cells were counted using the direct microscopic technique (DMSCC) given in SMEDP *(7)*. Mean count over the study period for each filter and the range is given in Table 1.

Sediment retention was assayed on each lot of milk received at the University of Wisconsin Dairy Plant. The procedure followed was in SMEDP *(7)*.

Physical Evaluation of Filter Materials

Performance characteristics of each filter fabric were examined according to the following procedures. Results are given in Table 2.

1. Fabric thickness was measured with a micrometer having a .16 x 2.5 cm (.06 x 1.0 inches) contact surface area. Each filter, both sock and sleeve, was measured at several points excluding that area within .5 cm (.2 inches) of the edge.

[1] *Research supported by the College of Agricultural and Life Sciences, University of Wisconsin-Madison.*

2. Fabric weight was determined to four decimal places on an analytical balance. Pieces of fabric were cut to be 15.2 x 30.5 cm (6 x 12 inches) from sleeve filters and weighed. Duplicate weighings were averaged and multiplied by the correct factor to give data in ounces per yard^2.

3. Flow rates were measured at two different temperatures. Use of 10°C (50°F) is characteristic of dairy processing conditions while 40°C (104°F) considers milk directly from the dairy cow, i.e., a farm pumping situation. In these trials two stainless steel processing vats were used to hold milk at the appropriate temperature. A centrifugal pump rated at 0.5 horsepower turning at 1750 rpm pushed milk through the sleeve filter mounted at the discharge of the pump. Milk volume in the tank was measured after each trial and readjusted to 100 gallons. After each 100 gallon pump over, a new filter was mounted on the perforated stainless steel sleeve. Timing of flow was from pump turn on until air suck into the delivery line. Each filter brand was tested four times and results averaged.

4. Sediment retention was assessed using charcoal suspended in milk then drawing the milk through the filter section mounted in a standard sediment apparatus giving 3.2 cm (1.25 inch) area for residue collection. The mixed sample procedure used was as described in SMEDP. Preparation of the sediment discs was a modification of the procedure given by the Association of Official Analytical Chemists (AOAC) *(5)*, for preparation of a fine sediment standard. All filter sections were dried at 100°C overnight and weighed before use.

In one series of trials enough dried Norite charcoal

Table 1. Effect of filter use on standard plate and somatic cell counts in milk from two University farms.

Filter Manufacturer	Test periods	Farm	Direct Microscopic Somatic Cell Count X	Direct Microscopic Somatic Cell Count range	Standard Plate Count X	Standard Plate Count range
		MSN	200,000	120,000/280,000	6,700	1,900/17,000
A_1	Nov. 28-Dec. 11	Arl	160,000	120,000/220,000	4,600	1,400/ 8,400
	Dec. 12-Jan. 8	MSN	230,000	92,000/360,000	3,800	900/21,000
A_2	Feb. 20-Mar. 12	Arl	170,000	83,000/250,000	3,400	1,200/ 7,400
	Jan. 9-Jan. 23	MSN	190,000	140,000/410,000	5,900	1,200/19,000
A_3	Jan. 31-Feb. 19	Arl	160,000	70,000/210,000	2,300	1,000/ 3,800
		MSN	220,000	140,000/270,000	5,100	2,300/ 7,700
B	Nov. 14-27	Arl	270,000	230,000/320,000	5,200	1,800/15,000
	Oct. 31-Nov. 13	MSN	260,000	200,000/330,000	5,600	1,600/14,000
C	Mar. 13-Mar. 26	Arl	150,000	110,000/190,000	6,600	4,600/12,000
		MSN	250,000	140,000/490,000	2,600	900/ 4,500
D	Apr. 24-May 7	Arl	130,000	100,000/180,000	17,000	1,800/110,000
		MSN	170,000	140,000/290,000	2,500	1,200/ 4,700
E	Apr. 10-Apr. 23	Arl	130,000	110,000/180,000	3,400	1,900/ 6,100
		MSN	280,000	200,000/370,000	2,900	1,700/ 5,800
F	May 27-Apr. 9	Arl	160,000	110,000/250,000	6,500	2,000/30,000
Blind control- No Test	Dec. 12-Jan 8	Arl	160,000	89,000/230,000	12,000	1,500/39,000
	Jan. 9-Jan 23	Arl	170,000	79,000/240,000	2,600	1,000/ 3,500

[a]MSN=U.W. Dairy Cattle Center at Madison [b]Arl=U.W. Experimental Farm at Arlington

Table 2. Physical data showing performance and featur

Filter Manufacturer	Thickness, inches	Weight, ounces/yard^2	Flow Rate[a]/100 gal (3.6% milk)		Fine sediment Retention (%)	Sediment Retention (%)	Tensile strengt			
			Time with milk at 10°C (min/sec)	Time with milk at 39°C (min/sec)			dry filter		wet	wat
							MD[b]	CD[c]	MD	
A_1	0.0120	1.64	2/11	2/29	78	48	11.8	18.3	14.6	
A_2	0.0113	1.97	2/24	2/34	57	51	14.5	24.6	22.6	
A_3	0.0135	2.11	2/29	2/29	85	68	18.7	18.7	15.8	
B	0.0220	3.01	2/27	2/33	36	43	50.6	29.2	29.0	
C	0.0218	4.20	2/16	2/34	16	52	93.9	17.1	34.8	
D	0.0079	1.38	2/16	2/31	58	33	22.9	23.2	22.0	
E	0.0274	1.78	2/28	2/34	17	30	53.4	60.0	15.6	
F	0.0221	3.30	---	---	34	33	52.8	29.7	27.7	

[a]97.6 inches^2 of surface area used on sleeve filter

[b]MD=machine direction
[c]CD=cross direction

d features of filters used in this study.

strength, pounds/inch^2				Tear strength, pounds					
water		milk				water		milk	
wet	filter	wet	filter	dry filter		wet	filter	wet	filter
MD	CD	MD	CD	MD	CD	MD	CD	MD	CD
14.6	21.4	15.0	19.1	1.5	2.3	1.8	2.7	1.9	2.4
22.6	25.9	16.5	25.1	1.8	3.1	2.8	3.2	2.1	3.1
15.8	30.6	19.6	29.9	2.3	3.7	2.0	3.8	2.5	3.7
29.0	18.9	31.0	17.7	5.9	3.5	3.4	2.4	3.8	1.9
34.8	7.1	34.4	6.4	11.8	2.1	4.3	0.9	4.3	0.8
22.0	17.9	23.6	21.2	2.9	2.9	2.75	2.2	3.0	2.6
15.6	19.7	18.0	21.5	6.7	7.5	1.9	2.5	2.3	2.7
27.7	16.4	29.1	18.1	6.6	3.7	3.5	2.1	3.6	2.3

n

powder was weighed into milk to give 20 mg charcoal in 100 ml of milk. The milk was heated to disperse the charcoal. Each filter section mounted in the sediment tester had 200 ml of milk passed through it with the water aspirator on full. Then each filter was rinsed twice with 200 ml of warm tap water.

In another series of trials, only that dried norite charcoal that passed through a #230 standard sieve (.0025 inches nominal opening), was used. Enough of this dried charcoal was added to milk to give 20 mg charcoal in the 100 ml of milk.

Following removal from the sediment tester each filter section was dried overnight at 100°C and reweighed. The difference in weight was calculated as the efficiency of the filter or the percentage retention.

5. Tear and tensile strength was measured on filter sections, 5.1 x 20.3 cm (2" x 4"), dry, wet with water, and wet with milk using an Instron model 1132 load elongation apparatus (Instron Corp., Canton, MA). Filter sections were assayed both in the machine direction and the cross direction. All wet tests involved submersion of the filter section for two minutes in either water or milk, then shaking to remove excess fluid. Data shown are the average of two trials with each filter section. The Instron was fitted with a 2511-301 reversible load cell (100 lb., 45.4 kg) and was operated with a crosshead speed of 5.1 cm/min. Data are recorded on a X-Y recorder (F.L. Mosely Co., Pasedena, CA; model 135) operated at 26.1 cm/min.

Microscopic Differences in Filters

A scanning electron microscope was used to detect differences in each type of filter (Japan Electron Optics Laboratory, Tokyo, Japan; model JSM-U3). Small sections of each type of filter were mounted on metal caps then subjected to vacuum deposition of a gold paladium mixture. After observing a typical pattern at 20 KV acceleration voltage in the microscope a polaroid picture was taken at 100 x magnification. Following, the microscope was adjusted to 300 x magnification and, with slight adjustment, another photograph was taken.

Composition of Filters

Since filters under study were not all natural fabric, each was evaluated for the percentage of resin or bonding material and its identity, as well as the percentage of fiber and its identity. These data are given in Table 3.

RESULTS AND DISCUSSION

Bacteria and Composition

The analysis of milk for bacteria as SPC and for somatic cells showed no measurable change as a result of the filter in the milk line at the time (Table 1). Occasionally, a high bacteria count was assayed, however, this was not an indication of filter problem. The development of hydrolytic rancidity in milk collected during this study suggested that no increase in acid degree value would result from routine use of any of the listed filters to filter milk. Average pounds of milk passed through the filters at U.W. Dairy Cattle Center ranged from 1700 to 2300 per milking while at U.W. Arlington Research Center 2500 to 3700 pounds were filtered per milking.

During the course of these experiments no tests were in progress during two intervals. However, compositional and microbiological data were collected. These results (Table 1) are consistent with other values for SPC and DMSSC when filters were on trial and served as blind controls.

Furthermore, sediment discs examined showed at the most slight residue and ranged in value from 6 to 8 by the official USDA scoring system.

Physical Data

All rayon and part rayon filters were thicker than the all polyester filter and polypropylene filters (Table 2). Thickness provides a degree of rigidity which simplifies installation, however, thickness does increase the bulk of the filters when packaged. If the coil spring over which the filter is placed is wet, rigidity would definitely aid in installation. There is a close direct relationship between thickness and weight per square yard of filter material. However, filter E was too thick and provided problems with folding during installation.

Flow rates of 100 gallon lots of milk through each filter shows close similarity regardless of temperature. Resistance to flow in these trials was not enough to cause a measurable increase in development of hydrolytic rancidity. Rancidity may develop when the centrifugal pump moving milk from the vacuum collection chamber through the filter to the storage tank has to work too hard. This increases the likelihood of the impeller disrupting the fat globule membrane and allowing subsequent reaction of lipase on unprotected fat globules.

Polypropylene and 100% polyester filters showed a great affinity to retain fine sediment. All other filters in this study showed similar or less retention of fine particulates compared to non-sieved sediment. All rayon filters retained fine sediment poorly, while those filters with supplemental polyester added showed intermediate retention of fine particulates.

In other studies, using the AOAC method to prepare a standard fine sediment disc, two factors were illustrated: 1) all filters in this study have greater filtering efficiency than the standard filter disc used for sediment assay by the procedure in SMEDP and 2) the sediment test for routine evaluation of milk is virtually meaningless particularly when a good to excellent filter is used in the milk line.

Tensile strength indicated one exceptional characteristic for all filters from A manufacturer in this study. None broke but only stretched or elongated. The filter with 100% polyester broke on test. Further, polypropylene and

polyester fabrics lose little strength when wetted with water or milk.

The factor of no rupture is important in quality milk production. In the event of a clogged filter from debris or mastitic milk, good management would want to keep this material out of the bulk tank. The milk flow should stop, causing a back-up of product within the system until it overflows into the vacuum trap. The farmer can then change the filter. Filters that rupture may do so under stress, causing much of the entrapped material and subsequent material to pass into the bulk tank. This is an unacceptable result.

Composition of all filters used in this study is shown in Table 3.

Microscopy

Great detail can be observed from pictures taken at 300X with the scanning electron microscope. The reasons for the greater retentive ability of polypropylene and polyester filters is clear. These filters have a denser fiber network and smaller openings between fibers. The filter from D manufacturer (all polyester) is quite thin and shows the backing material clearly through the filter.

Moreover, all A filters are denser than all others used in this study. This is indicated by the electronic streaking across all pictures of filters A_1, A_2 and A_3. During the process of preparing sections of filters for electron microscopic evaluation, a gold palladium mixture is vacuum deposited on the fibers. If the matrix is too dense, incomplete deposition results, thus when subjected to electron microscopic evaluation, electron streaking occurs as a result of the uncoated fibers. The evidence of electron streaking would therefore suggest a highly efficient filter compared to others given similar preparatory treatments where no streaking is visible.

Moreover, resins used to bond filter material where rayon is involved appears to partially block passage of

Table 3. Composition of filters in this study

	Composition %				
Filter identity	Rayon	Polyester	Polypropylene	Binder and identity	
A_1, A_2 & A_3	--	--	100	--	
B	56	19	--	25	styrene acrylonitrile acrylate
C	63	--	--	37	acrylomitrile acrylate with trace of styrene
D	--	86	--	14	aliphatic aromatic ester
E	78	--	--	22	ethylacrylate
F	53	31	--	16	styrene acrylonitrile acrylate

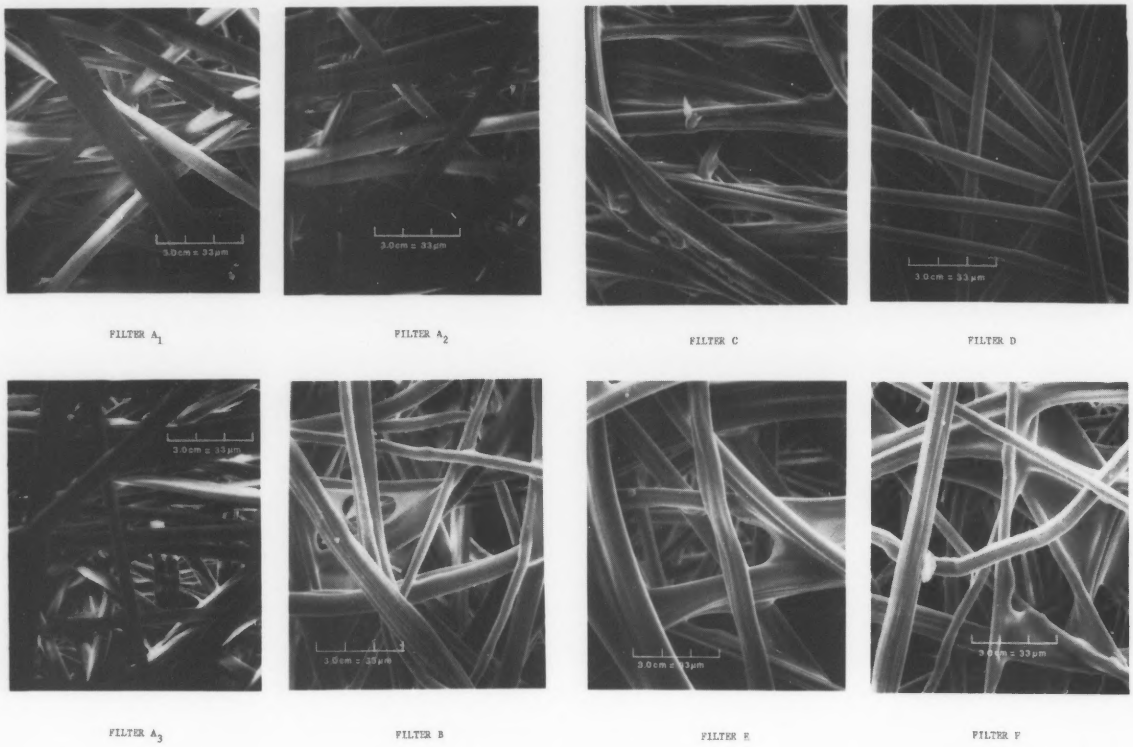

Figure 1. *Scanning electron microscope photographs of milk filters, 300X. Identification letters correspond to manufacturers listed on Tables.*

fluid and the entrapment of particulates. Much of the rigidity of these filters is attributed to resin. It is also interesting to note the apparent loose resin in some pictures.

CONCLUSIONS

1. All polypropylene filters were superior to rayon, rayon-polyester and all polyester filters.
2. Scanning electron microscope pictures at 300 x magnification illustrate clearly the density of fibers, the size of openings and the size of the fibers.
3. No polypropylene filter ruptured during assay of tensile and tear strength. The polypropylene fibers only elongated. This factor could be considered a "safety valve" where high quality filtration results are needed.

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TENTATIVE PROGRAM
Seventy-Third Annual Meeting
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In Cooperation with the
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August 3-6, 1986

Radisson South **Minneapolis, MN**

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Sunday, August 3 - 12:00 Noon - 5:00 PM
Monday, August 4 - 7:00 AM - 5:00 PM
Tuesday, August 5 - 7:00 AM - 5:00 PM
Wednesday, August 6 - 7:00 AM - 5:00 PM

ADVANCE REGISTRATION FEES

	Member	Companion(s) Each	Student	Non Member
Registration	___$30	___$10	___Free	___$40
Early Bird Reception*	___Free	___Free	___Free	___Free
Zoo and Pig Roast	___$19	___$19**	___$19	___$19
Banquet and Reception	___$20	___$20	___$20	___$20
*National Mastitis Council	___Free	___Free	___Free	___Free

*Indicate attendance
**Children 16 and under $5 each. No. _____

NOTE, all prices at the door will be at least 20% higher. Advance register before July 1 and SAVE. Refundable if canceled prior to June 30, 1986.

EXHIBIT HOURS

Set-up	Sunday, August 3	1-3 pm
Open	Sunday, August 3	3-5 pm
	Monday, August 4	2-4 pm
	Tuesday, August 5	11 am-1 pm 7-9 pm
	Wednesday, August 6	12-2 pm
Take-Down	Wednesday, August 6	2:30 pm

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SATURDAY - AUGUST 2, 1986

12:00 - 5:00 PM — Local Arrangements Committee

1:00 PM - 5:00 PM — IAMFES Board Meeting

SUNDAY - AUGUST 3, 1986
Afternoon

Committees meet on Sunday afternoon and Monday morning. You need NOT be a committee member in order to attend a committee meeting.

12:00 - 5:00 PM — Registration - Foyer Area
12:00 - 5:00 PM — IAMFES Board Meeting

Evening

6:00 PM - 8:00 PM — Early Bird Reception - Pool Area

MONDAY - AUGUST 4, 1986
Morning

7:00 AM - 1:00 PM — Committee Meetings

8:00 AM - 5:00 PM — Companion Hospitality
See Companion Activites at back of this program

MONDAY - AUGUST 4, 1986
Afternoon
General Session - Roy E. Ginn, Presiding

1:15 PM — DOOR PRIZE

1:20 PM — INVOCATION - Ivan Parkin, Westbrook, CT.

WELCOME - Dr. Michael M. Pullen, University of Minnesota, St. Paul, MN

PRESIDENTIAL ADDRESS - Sidney E. Barnard, Pennsylvania State University, University Park, PA

2:30 PM — KEY-NOTE ADDRESS - IVAN PARKIN LECTURESHIP - Better Today Than Yesterday? - But What About Tomorrow? - J. C. Olson, Jr., Sun City Center, FL

3:10 PM — REFRESHMENT BREAK

3:25 PM — DOOR PRIZE

3:30 PM — BUSINESS MEETING

MONDAY - AUGUST 4, 1986
Evening

5:00 PM - 9:30 PM — PIG ROAST AT THE MINNESOTA ZOO

TUESDAY - AUGUST 5, 1986
Morning - Food Protection Session
Archie C. Holliday, Chairperson

8:30 AM — GUIDELINES FOR UNIFORMITY IN FACILITIES PLANNING AND PLAN REVIEW

9:00 AM — CONSUMER RESPONSE TO FOOD IRRADIATION - Christine M. Bruhn*, H. G. Schutz, R. Sommer, Univ. of California, Davis, CA.

9:20 AM — EFFECTS OF POTASSIUM SORBATE ON THE MICROBIAL CONTENT AND KEEPING QUALITY OF A RESTAURANT - MEXICAN HOT SAUCE - Lutgarda S. Palomar, Lisa M. Flores, Peggy A. Roh and Lloyd B. Bullerman*, University of Nebraska-Lincoln, Lincoln, NE

9:40 AM — GROWTH AND ENTEROTOXIN PRODUCTION BY *STAPHYLOCOCCUS AUREUS* IN CREAMS WITH VARIOUS AMOUNTS OF MILKFAT - Margaret I. Halpin*, and Elmer H. Marth, University of Wisconsin-Madison, Madison, WI

10:00 AM — REFRESHMENT BREAK

10:15 AM — DOOR PRIZE

10:20 AM — MOLD GROWTH AND MYCOTOXIN PRODUCTION IN BINAGOL, A PHILIPPINE DESSERT PRODUCT - Lutgarda S. Palomar and Lloyd B. Bullerman*, University of Nebraska-Lincoln, NE

10:40 AM — AFLATOXIN PRODUCTION BY AND GROWTH OF *ASPERGILLUS PARASITICUS* IN A MEDIUM CONTAINING POTASSIUM CHLORIDE OR A MIXTURE OF POTASSIUM CHLORIDE AND SODIUM CHLORIDE - Gulam Rusul, Fathy El-Gassar* and Elmer H. Marth, University of Wisconsin, Madison, WI

11:00 AM — BIOTECHNOLOGY - IMPLICATIONS FOR THE DAIRY INDUSTRY - Susan K. Harlender, University of Minnesota, St. Paul, MN

11:30 AM — SULFITES IN FOOD - Steven L. Taylor, University of Wisconsin, Madison, WI

TUESDAY - AUGUST 5, 1986
Morning - Milk Sanitation Session
Sidney E. Barnard, Chairperson

8:25 AM — DOOR PRIZE

8:30 AM — PI STUDY REPORT - Robert L. Sanders, FDA, Washington, D.C.

9:00 AM — GROWTH PATTERNS OF *LISTERIA MONOCYTOGENES* IN SKIM, WHOLE AND CHOCOLATE MILK AND IN WHIPPING CREAM AT 4, 13 AND 35 DEGREES C - Eileen M. Rosenow* and Elmer H. Marth, University of Wisconsin-Madison, Madison, WI

9:20 AM — SUITABILITY OF UHT MILK TO MONITOR CALIBRATION OF INFRARED TESTING EQUIPMENT - Ruth G. Fuqua* and William E. Thompson, Dairymen, Inc., Louisville, KY

9:40 AM — AN ELISA METHOD FOR THE DETECTION OF *LISTERIA MONOCYTOGENES* IN RAW MILK - J.M. Farber* and J.I. Speirs, Sir Frederick Banting Research Centre Tunney's Pasture, Ottawa, Ontario

10:00 AM — REFRESHMENT BREAK

10:15 AM — DOOR PRIZE

10:20 AM — BEHAVIOR OF *LISTERIA MONOCYTOGENES* DURING THE MANUFACTURE AND RIPENING OF CHEDDAR CHEESE - Elliot T. Ryser* and Elmer H. Marth, University of Wisconsin-Madison, Madison, WI

10:40 AM — ANALYSIS OF RAW MILK FOR THE EPIDEMIC SERO-

TYPE OF *L. MONOCYTOGENES* LINKED TO AN OUTBREAK OF LISTERIOSIS IN CALIFORNIA - C.W. Donnelly*, E. H. Briggs, and G. J. Baigent, University of Vermont, Burlington, VT

11:00 AM — LACTOSE INTOLERANCE AND FERMENTED DAIRY FOODS - Dennis A. Savianno, University of Minnesota, St. Paul, MN

11:30 AM — FDA'S NEW MILK AND DAIRY INITIATIVES - Jerome J Kozak, FDA, Washington, D.C.

TUESDAY - AUGUST 5, 1986
Morning - Salmonella Symposium
Donald J. Pusch and Edmund A. Zottola, Co-Moderators

8:25 AM — DOOR PRIZE

8:30 AM — SALMONELLOSIS - THE PROBLEM - Edmund A. Zottola, University of Minnesota, St. Paul, MN

9:15 AM — METHODS FOR THE ISOLATION AND IDENTIFICATION OF *SALMONELLA* FROM FOOD WITH EMPHASIS ON NEW METHODS - Russell S. Flowers, Silliker Laboratories, Chicago Heights, IL

10:00 AM — REFRESHMENT BREAK

10:15 AM — *SALMONELLA* INFECTIONS AND THE MEAT INDUSTRIES - R. Ashley Robinson, University of Minnesota, St. Paul, MN

10:45 AM — THE ILLINOIS MILKBORNE SALMONELLOSIS OUTBREAK - Damien A. Gabis, Silliker Laboratories, Chicago, IL

11:15 AM — *SALMONELLA* IN CHEDDAR CHEESE; RECENT EXPERIENCES IN CANADA - David Collins-Thompson, University of Guelph, Ontario, Canada

TUESDAY - AUGUST 5, 1986
Afternoon - Food Protection Session
Robert B. Gravani, Chairperson

1:25 PM — DOOR PRIZE

1:30 PM — PANEL DISCUSSION - ACTION TAKEN BY INDUSTRY, STATE AND FEDERAL AGENCIES IN A FOOD SAFETY SITUATION - Moderator: Robert B. Gravani, Cornell University, Ithaca, NY. Panelists: Jerome J. Kozak, FDA, Washington, D.C.; Carl A. Smith, Pillsbury Co., Minneapolis, MN; Lewis W. Schultz, Illinois Department of Public Health, Springfield, IL; Lawrence R. Crowell, NYS Department of Agriculture and Markets, Albany, NY

3:15 PM — REFRESHMENT BREAK

3:30 PM — DOOR PRIZE

3:35 PM — *LISTERIA MONOCYTOGENES* IN GROUND BEEF - Jennifer Johnson*, M. P. Doyle, R. G. Cassens, University of Wisconsin, Madison, WI

3:55 PM — LACTASE - TREATED SKIM MILK AS A SUBSTRATE FOR GROWTH AND ACID PRODUCTION BY MUTANTS OF LACTIC STREPTOCOCCI – Kamal M. Kamaly* and Elmer H. Marth.

4:15 PM — QUALITY ASSURANCE IN THE FOOD INDUSTRY - Warren Schweke, General Mills, Inc., Minneapolis, MN

4:45 PM — BACTERIOLOGIC AND PARASITIC STUDIES ON NASAL SWABS AND FECAL SPECIMENS OF FOODHANDLERS IN A NIGERIAN UNIVERSITY - A. A. Adesiyun*, O. J. Ajannusi, S. J. Akpa, and J. A. Egamana, Admadu Bello University, Zaria, Nigeria.

TUESDAY - AUGUST 5, 1986
Afternoon - Milk Sanitation Session
Ronald H. Case, Chairperson

1:25 PM — DOOR PRIZE

1:30 PM — BACTERIAL ATTACHMENT; IT'S IMPORTANCE IN CLEAN-

ING AND SANITIZING - Edmund A. Zottola, University of Minnesota, St. Paul, MN

2:00 PM — A NEW METHOD OF PREDICTING SHELF LIFE OF FLUID MILK - Sita R. Tatini, University of Minnesota, St. Paul, MN

2:30 PM — PREVALENCE OF MILK CONTAMINATION BY CERTAIN ANTIBIOTICS AS DETECTED BY AN IMMUNOSSAY METHOD - Joseph W. Amshey*, Laurel Samoiloff, Vita S. Theriault, Angenics, Inc., Cambridge, MA

2:50 PM — REFRESHMENT BREAK

3:05 PM — DOOR PRIZE

3:10 PM — ASSURING INTEGRITY OF PASTEURIZED PRODUCT VIA PROCESS AND PIPING SYSTEM DESIGN - Dale A. Sieberling, Sieberling Associates, Inc., Roscoe, IL

3:40 PM — DAIRY PLANT INSPECTION BY USDA - Robert Semerad, USDA, Washington, D.C.

4:10 PM — SURVEILLANCE OF SOFT AND SEMI-SOFT CHEESE FOR *LISTERIA* - M. A. Johnston*, A. Loit, U. Purvis, J. Farber, Health and Welfare Canada, Ottawa, Ontario

4:30 PM — VITAMIN ADDITIONS TO MILK - ARE THEY REALLY THERE? - H. Michael Wehr, Oregon Department of Agriculture, Salem, OR

TUESDAY, AUGUST 5, 1986
Evening - Food Protection Session
Cracker Barrel
Robert B. Gravani, Moderator

7:30 PM — THE SAFETY OF AIRLINE FOODS-CURRENT CONCERNS AND INITIATIVES - Panel Discussion. Panelists: John Taylor, US FDA, Washington, D.C., Ulfert Esen, United Airlines, Flushing, NY, Jeffrey M. Spykerman, US FDA, Minneapolis, MN, W. Joel Simpson, Dobbs Houses, Inc., Memphis, TN

TUESDAY, AUGUST 5, 1986
Evening

7:00 - 9:00 PM — Exhibits

WEDNESDAY - AUGUST 6, 1986
Morning - Food Protection Session
Leon Townsend, Chairperson

8:25 AM — DOOR PRIZE

8:30 AM — NEW CONCEPTS IN FOOD PACKAGING - Curtis L. Larson, 3M Company, St. Paul, MN

9:00 AM — FATE OF *LISTERIA MONOCYTOGENES* DURING THE MANUFACTURE AND RIPENING OF CAMEMBERT CHEESE - Elliot T. Ryser* and Elmer H. Marth, University of Wisconsin-Madison, Madison, WI

9:20 AM — IDENTIFICATION, DISINFECTION AND QUALITY CONTROL INTERVENTION OF *SALMONELLA TYPHIMURIUM* IN THE INDUSTRY - Melvin N. Kramer, Environmental Health Associates Ltd., Baltimore, MD

9:40 AM — INCREASING THE CALCIUM: SODIUM RATIO IN COTTAGE CHEESE - B. J. Demott, The University of Tennessee, Knoxville, TN

10:00 AM — REFRESHMENT BREAK

10:15 AM — DOOR PRIZE

10:20 AM — A RAPID AND EASY-TO-USE TEST FOR THE DETECTION OF *SALMONELLA* IN MILK AND FOOD - N. Robert Ward*, Johon P. DesRosier and Jay Stemmler, BioControl Systems, Inc., Kent, WA

10:40 AM — QUANTITATION OF GROWTH OF MOLD ON CHEESE - Ahmed E. Yousef* and Elmer H. Marth, University of Wisconsin-Madison, Madison, WI

11:00 AM SEAFOOD POISONING - Marleen M. Wekell, US FDA, Seattle, WA

11:30 AM SEAFOOD QUALITY AND SAFETY - Ranzell Nickelson II, Applied Microbiological Services, Inc., College Station, TX

WEDNESDAY - AUGUST 6, 1986

Morning - Milk Sanitation Session
Philip Hermsen, Chairperson

8:25 AM DOOR PRIZE

8:30 AM CHOLESTEROL OXIDES - RECENT FINDINGS - Paul B. Addis, University of Minnesota, St. Paul, MN

9:00 AM EVALUATING MICROBIAL QUALITY OF RAW MILK - R. B. Maxcy*, R. J. Paul, University of Nebraska, Lincoln, NE

9:20 AM USE OF TEMPERATURE SENSITIVE GEL FOR CONCENTRATION OF BACTERIA OF MILK - S. Maheshkumar, Richard Peterson, and Sagar M. Goyal*, University of Minnesota, St. Paul, MN

9:40 AM NUTRITIONAL AND MICROBIOLOGICAL QUALITIES OF RAW AND PASTEURIZED GOATS' MILK - J.A. Zee*, P. Tirard-Colelt, C. Lavigne, R.E. Simard, Université Laval, Ste-Foy, Quebec

10:00 AM REFRESHMENT BREAK

10:15 AM DOOR PRIZE

10:20 AM DETECTION OF ANTIBIOTIC RESIDUES IN MILK BY A RAPID TEST STRIP ASSAY - D. M. Bleile*, C. D. Gallup, A. J. DeLizza, J. E. Dyck, G. T. Barnard, W. C. Hsu, S. N. Hanjan, R. Varro, D. J. Litman, and P. Khanna, Syntex Diagnostics Division, Palo Alto, CA

10:40 AM DETECTION OF GRAM NEGATIVE BACTERIA IN COTTAGE CHEESE BY AN IMPEDANCE TECHNIQUE - Nora Tsang*, Ruth Firstenberg-Eden and Joseph Zindulis, Bactomatic, Inc., Princeton, NJ

11:00 AM COMPUTERIZATION OF DHIA LABS - George E. Grammling, National Dairy Herd Improvement, Columbus, OH

11:30 AM CURRENT STATUS OF NEW BIOTECHNOLOGIES THAT AFFECT THE DAIRY INDUSTRY - Alan G. Hunter, University of Minnesota, St. Paul, MN

WEDNESDAY - AUGUST 6, 1986
Afternoon - Dairy Field Representative Session
Vernal S. Packard, Chairperson

1:25 PM DOOR PRIZE

1:30 PM BUTTERFAT/TOTAL SOLIDS STANDARDS - Paul G. Christ, Land O'Lakes, Inc., Minneapolis, MN

2:00 PM DESIGNING PIPELINE SYSTEMS FOR CLEANING - Steven B. Spencer, PA State University, University Park, PA

2:30 PM DAIRY EQUIPMENT CLEANING AND SANITIZING UPDATE - Dennis Birchard, H. B. Fuller Co., St. Paul, MN

3:00 PM REFRESHMENT BREAK

3:15 PM DOOR PRIZE

3:20 PM TOTAL SOLIDS COMPOSITION OF REGULAR HOMOGENIZED MILK - Sidney E. Barnard*, Edward D. Glass, Jr., Daniel D. Phelps, Gregory J. Desautels, Louise M. Moir, and Debra L. Daum, The Pennsylvania State University, University Park, PA

3:40 PM PANEL DISCUSSION - MILK QUALITY PREMIUMS - Thomas C. Everson, Wisconsin Dairies, Inc., Baraboo, WI; Richard Bender, Mountain Empire Dairymen Association, Thornton, CO; David L. Parrish, Mid America Dairymen, Inc., St. Paul, MN

WEDNESDAY - AUGUST 6, 1986
Afternoon - Environmental Protection Session
Helene Uhlman, Chairperson

1:25 PM — DOOR PRIZE

1:30 PM — EPA/INDUSTRIAL WASTEWATER - George W. Laraway, Jr., Zionsville, IN

2:00 PM — GROUND WATER CONTAMINATION: THE ROSEMOUNT STORY - Fay M. Thompson, University of Minnesota, St. Paul, MN

2:30 PM — THE ROLE OF INCINERATION IN HAZARDOUS WASTE MANAGEMENT - George Vander Velde, Chemical Waste Management, Inc., Oakbrook, IL

3:00 PM — REFRESHMENT BREAK

3:15 PM — DOOR PRIZE

3:20 PM — CONTROL OF MOLD AND INDOOR AIR QUALITY - Andrew J. Streifel, University of Minnesota, St. Paul, MN

3:40 PM — THE MICROBIOLOGICAL EVALUATION OF HAND WASHING PRACTICES FOR FOOD SERVICE PERSONNEL - Donald Vesley, University of Minnesota, St. Paul, MN

4:00 PM — HIGH QUALITY WATER SYSTEM DISINFECTION - Andrew J. Streifel, University of Minnesota, Minneapolis, MN

WEDNESDAY - AUGUST 6, 1986
Afternoon - Dairy and Food Protection Session
Symposium on Listeriosis
Joseph A. O'Donnell, William W. Coleman II, Co-Moderators

1:25 PM — DOOR PRIZE

1:30 PM — COMPARISON OF METHODS FOR DETECTING *LISTERIA MONOCYTOGENES* IN MILK - Michael Doyle, University of Wisconsin, Madison, WI

1:55 PM — USE OF MODIFIED FLUORESCENT ANTIBODY PROCEDURE FOR RAPID DETECTION OF *LISTERIA MONOCYTOGENES* IN DAIRY PRODUCTS - Catherine W. Donnelly, University of Vermont, Burlington, VT

2:20 PM — EPIDIMIOLOGY OF *LISTERIA MONOCYTOGENES* IN THE UNITED STATES - Claire V. Broome, CDC, Atlanta, GA

2:45 PM — REFRESHMENT BREAK

3:00 PM — BEHAVIOR OF *LISTERIA MONOCYTOGENES* IN MILK AND CHEESE - Elmer H. Marth, University of Wisconsin, Madison, WI

3:25 PM — THERMAL RESISTANCE CHARACTERISTICS OF *LISTERIA MONOCYTOGENES* - Robert M. Twedt, FDA, Cincinnati, OH

WEDNESDAY - AUGUST 6, 1986
Evening

6:00 - 7:00 PM — Reception

7:00 PM — Annual Awards Banquet, entertainment by Edgewatt Productions, a nationally known group of singers and musicians specializing in variety production.

COMPANION ACTIVITES

MONDAY - AUGUST 4, 1986

9:30 AM - 2:30 PM — Guided tour of Ard Godfrey House, Lady of Lourdes church, shopping and browsing at redeveloped riverfront area. Lunch - own expense. Cost $11/person. (Min. of 30 people)

TUESDAY - AUGUST 5, 1986

9:00 AM - 4:00 PM — Spend a fun-filled day at Valley Fair, an outdoor entertainment center featuring carnival rides, games, exhibits, etc. Included in price is admission, transportation, lunch, Day Tours Hostess/Guide and an adult escort. (No one under 10 unless accompanied by

an adult) Cost $20/person. (Min of 30 people)

9:30 AM - 3:30 PM — Comprehensive tour of the Twin Cities including such attractions as Guthrie Theater, St. Paul's Cathedral, St. Anthony Falls, Landmark Center, Minneapolis lakes and much more. Also included is lunch at Forepaugh's, a haunted Victorian Mansion. Cost (including lunch) $26/person. (Min of 30 people)

WEDNESDAY - AUGUST 5, 19868

9:30 AM - 2:30 PM — Minibus service to Southdale Shopping Center. Transporation provided free.

C.E. Rogers Company Awarded AMPI Contract

The C.E. Rogers Company, design engineers of evaporators and spray dryers for the dairy and food industries, was recently awarded a contract to supply Associated Milk Producers Inc. of New Ulm, Minnesota, a 100,000 lb. an hour multiple effect MVR evaporator for installation in their Blair, Wisconsin plant.

The evaporator will process sweet whey with a water evaporation rate of 88,461 lbs. per hour. Final concentrate discharge solids are 52%.

Estimated completion date of the project, fall 1986.

For more information contact: C.E. Rogers Company, P.O. Box 118, Mora, MN 55051. 612-679-2172.

Consumers State Concerns About Food/Beverage Packaging

"When it comes to food and beverage packaging, today's shopper is a lot more concerned with safety, health and economic considerations, than with annoyances like containers which are hard to open, reclose or store," says Lorna Opatow, president of Opatow Associates, a New York marketing research firm, speaking at the North American Food Packaging Expo '86, in Harmon Cove, NJ.

A featured speaker at this conference and exposition for the food industry, she points out that "consumers view your package as an integral part of the product. To them, the product and package are one - unless the package doesn't function properly." Industry knows stale taste, broken crackers, poor carbonation, etc. are due to deficiencies in protective packaging. "But consumers usually consider these product, rather than packaging failures," she says.

Highlighting the importance of package copy, she reports that a high proportion of people interviewed in her company's surveys now cite packages as their major source of product information. Describing the power of words, she says that "with another name, irradiation would simply be a method for extending shelf life. By using a word people associate with cancer, its developers impeded public acceptance of the process." Lorna Opatow told her audience that their buyers are changing, and some of the differences should be of special concern to package developers:

"Older customers are increasing. They need more legible type, smaller sizes and packages which are easier to use." "Family composition is changing, with more males, teenagers and working women doing the grocery shopping, all of whom are time and convenience oriented."

"Ethnic diversity and the economic strength of minorities is increasing. Package developers should be sensitive to their need to be considered when choosing illustrations and, for some of them, special language requirements."

"Our social climate is more open, encouraging consumers to speak up and take action about products and packages which don't measure up."

For more than 20 years, her company has specialized in studies for marketing, communications, consumer affairs and design. "Our recent surveys show that many of the product problems consumers report are actually packaging failures, and the percent varies by company and product. We'll have overall figures in July, when first results of our Consumer Satisfaction Index® are released." CSI is a continuing survey of the buying public which tracks changes in brand satisfaction, satisfaction with the company's consumer response function, and buying patterns related to both.

Additional information is available from Opatow Associates, 919 Third Avenue, New York, NY 10022. 212-421-4837.

Better Process Control School to be Held in April

"Better Process Control School" will be held on the UC Davis campus, April 21-24. This FDA-approved school is being held in conjunction with the California Cannery Inspection Authority, and the Food and Drug Administration. Technical instruction in the school will be given by staff members of the University of California, the National Food Processors Institute and selected industry experts and will be offered only one time at UC Davis during 1986.

Lectures, discussions and examinations will cover the following subjects: Microbiology of Canning; Food Container Handling; Food Plant Sanitation; Records for Product Protection; Principles of Thermal Processing; Process Room Instrumentation, Equipment and Operation; Still Retorts: 1. Pressure Processing in Steam, 2. Processing in Water with Overpressure; Agitating Processing Systems: 1. Continuous Container Handling, 2. Discontinuous Container Handling; Hydrostatic Processing Systems; Aseptic Processing and Packaging Systems; Acidified Foods; Container Closure Evaluation: 1. Closures for Metal Containers, 2. Closures for Glass Containers. Certificates will be awarded to those who satisfactorily complete the

course of instruction.

The enrollment fee of $250 includes all course materials and four lunches. To enroll or for more information call 916-752-6021.

Recent Study Shows Calcium May Lower Cancer Risk

Calcium reduced the risk of colon cancer in humans genetically predisposed to the disease in a recent Memorial Sloan-Kettering Cancer Center study. After only two or three months, 1,250 milligrams of calcium per day slowed colon cell growth in ten subjects known to be at high risk for colon cancer. In the lining of the colon, the nutrient reestablish normal cell development which is usually accelerated in cancer patients, according to Martin Lipkin, M.D., principal researcher in the study.

Since its November 1985 publication in the *New England Journal of Medicine,* the research received wide coverage in vehicles such as *Time* magazine, *The New York Times* and *Chicago Tribune*. Broadcast exposure included major television and radio networks throughout the country.

In past animal studies, researchers found calcium to inhibit the formation of toxic substances in the colon. With the substances unable to circulate, the chance of colon cancer in rodents, for example, lessened.

University of California-San Diego researcher Cedric Garland and his co-workers also found dietary calcium and vitamin D may be associated with a lower incidence of colorectal cancer in nearly 2000 men. The February 1985 epidemiological study published in *The Lancet* explained that fat intake and cigarette smoking did not affect the results.

"Dairy foods supply 74 percent of the calcium in our nation's food supply," adds Elwood W. Speckmann, Ph.D., president of National Dairy Council. One glass of whole milk, and one one-half ounce of cheese, or one cup of yogurt supplies about one third of the adult Recommended Dietary Allowance of the nutrient.

"Recent studies also indicate calcium may be instrumental in lowering high blood pressure or in helping to prevent other diseases such as osteoporosis," Speckmann said.

National Dairy Council is the nutrition research and nutrition education arm of the dairy industry. United Dairy Industry Association, through the efforts of American Dairy Association, Dairy Research Inc., and National Dairy Council, conducts a total dairy product promotion program representing 95 percent of the nation's dairy farmers and 86 percent of milk marketed.

Researchers Unravel Some of Listeria's *Mysteries*

Raw fruits and vegetables are good for you. They're full of vitamins, minerals and fiber. Raw milk can kill you. It's full of germs.

People drink raw milk and usually get away with it. But unpasteurized dairy products can harbor all sorts of nasty organisms.

One of these organisms, the bacterium *Listeria monocytogenes,* was blamed for the recent spate of deaths from Mexican cheese in California. "Very little is known about *Listeria* in the cheesemaking process, or foods in general," says Elmer Marth, University of Wisconsin-Madison food scientist and bacteriologist. He has been investigating *Listeria* and its behavior in dairy products for the last 18 months.

"*Listeria* is widespread in the environment - it's found in plants, soils, animals, and human and animal milk," Marth continues. When the Food and Drug Administration took raw milk samples from bulk cooling tanks around Cincinnati, they found *Listeria*-like organisms in 10 percent of the samples, and confirmed disease-causing *Listeria* bacteria in 5 percent of the milk they tested, he says.

Listeria poses no health threat in properly pasteurized milk or milk products that remain uncontaminated after pasteurization, according to the FDA.

Listeria-caused disease, or listeriosis, can have several forms in humans. Healthy adults usually experience mild, flu-like symptoms, from which they recover. Immunocompromised adults, such as those receiving some forms of chemotherapy, have greater chances of getting meningitis, a sometimes-fatal inflammation of the brain and spinal cord.

Listeriosis can be deadly to newborn infants. The disease usually causes abortions or stillbirths during the second half of pregnancy. Infected infants born alive are usually quite ill with perinatal septicemia (blood poisoning), Marth says. Infants surviving this often suffer meningitis, brain damage and mental retardation.

"All this means don't drink raw milk," he says.

The California outbreak probably occurred because part of the milk made into cheese was raw. An outbreak in Massachusetts in 1983 involved pasteurized milk, which was somehow contaminated before reaching consumers. These outbreaks prompted Marth and Michael Doyle, a food microbiologist with the UW's Food Research Institute to investigate *Listeria's* behavior during the manufacture of cottage cheese and nonfat dry milk.

"We had pasteurized milk in Massachusetts that had *Listeria* of unknown origin in it," Marth notes. "We wondered - could we manufacture it into something useful rather than tossing all that milk, and will the manufacturing process kill off the bac-

teria?"

Not usually. The researchers made cottage cheese in pilot-plant vats, using processes similar to commercial cheesemaking. They added two strains of *Listeria,* both obtained from the Massachusetts outbreak. One strain was obtained from milk, the other from humans. Both strains survived the manufacturing process, although the milk strain appeared to be the hardier of the two.

They also made nonfat dry milk from skim milk inoculated with *Listeria*. Both strains survived - in reduced numbers - the heat processing and spray drying. When the milk was tested after 12 weeks of storage, viable *Listeria* had disappeared.

"We found you can't use those manufacturing processes and be assured of freedom from *Listeria,* except possibly if you store nonfat dry milk for more than three months at room temperatures," Marth says.

The studies also showed that *Listeria* can and does grow at refrigerator temperatures - one more reason to avoid unpasteurized milk or milk products.

He points out an unsettling sidelight to both the Massachusetts and California outbreaks. All 49 of the Massachusetts victims wound up at Massachusetts General Hospital. In California, most people went to the USC Medical Center.

"So, people were concentrated in both places. If they'd been spread all over, possibly nobody would have noticed. At USC, one nurse noted the problem and alerted other agencies. The cases had been going on for four months before that nurse alerted public health authorities.

"Had authorities not been notified, work would not have been done to pinpoint the problem," he says. The result could have been even more deaths if stores had continued to sell the contaminated cheese.

Keeping track of *Listeria* is difficult. "Under current regulations, listeriosis is not reportable. It probably should be," Marth says. The national Centers for Disease Control currently doesn't have much data on the incidence of the disease. The CDC is considering studying a 30-million person area for listeriosis in hospitals.

New Product News

The products included herein are not necessarily endorsed by Dairy and Food Sanitation.

Dyna-Dish Weighing Accessory System

Dyna-Dish Weighing Accessory System Introduced

• Dyn-A-Med Products proudly introduces "The Dyna-Dish Weighing Accessory System." Now you can order all of your supply items used for sample weighing, including microwaveable dishes, from one source.

This product line is suitable for any laboratory utilizing any make of electronic top load balance or microwave balance. Areas of application include: Agriculture, Bulk Counting, Checkweighing, Chemical Q.C. Testing, Dairy Research, Environmental Testing, General Manufacturing, Laboratory Weighing, Moisture Determination Testing, Fat Determination Testing in Meat Processing, Petroleum Research, Quality Control Testing, Toxicology, University Science and Research, and Wastewater Treatment.

"The Dyna-Dish Weighing Accessory System" offers a variety of disposable product lines. Literature and generic pricing information are available upon customer request.

For more information contact: Dyn-A-Med Products, 255 Bluff Court, Barrington, IL 60010. 312-382-5195.

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Telatemp Freeze Temperature Indicators

Sanitary Wedgewire Strainer Available

• Lewis Engineering's Wedgewire Strainer offers sanitary construction, with all contact parts fabricated from T-316 stainless steel. Strainer housings are available in 1", 1-1/2", 2", 2-1/2", 3", 4" inlets/outlets; with Cherry-Burrell "S-Line", "I-Line", "Q-Line" and Bevel Seat sanitary connections. NPT and Kamlock fittings can also be provided.

The wedgewire strainer element features a triangular wire spiraled around, and welded to, longitudinal support ribs. This design creates high strength and rigidity, and does not require the use of an overscreen. Slot widths between the spirals of the outer wire can be varied to obtain different partical retentions. Slot openings range from .001" up to .157" (approximately 400 mesh up to 5 mesh). Slot openings widen towards the center of the element reducing back pressure and resistance to flow.

The strainer is designed so the wedgewire screen can be removed for cleaning while the strainer is in place. Quick disconnect fittings on the housing facilitate easy access to the wedgewire screen. The strainer screen can also be cleaned by back flushing.

Strainer screens are standardized and readily interchangeable. Maximum operating pressure @70 degrees Fahrenheit is 150 P.S.I. Maximum operating temperature is 250 degrees Fahrenheit and flow rates of up to 325 G.P.M. can be obtained.

For more information contact: Lewis Engineering Co., Inc., 616 East St. Charles Road, Lombard, IL 60148. 312-620-5554.

Please circle No. 244
on your Reader Service Page

New Freeze Indicators Monitor Temperature

• New Telatemp freeze temperature indicators monitor food, chemicals, and pharmaceuticals to visibly show if they have been exposed to damaging cold and freezing temperatures of 26°F, 32°F or 41°F during processing, storage or in transit for quality control. After exposure to the rated cold temperature, a visible liquid filled bulb turns permanently and irreversibly from clear to a solid violet color. To use simply peel off self-adhesive backing and apply to a package, container or area to be monitored. The plastic housed sensor mounting surface is 3-3/16" long x 11/16" wide. Price: $2.10 each for quantity of 100.

For FREE EVALUATION SAMPLE and literature write Telatemp Corp., P.O. Box 5160, Fullerton, CA 92635. Telephone toll free 1-800-321-5160, except CA: 714-879-2901.

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New Concentrate for Juice Industry

• A new Cranberry Concentrate has been developed by Creative Cranberry Products, Inc. of Hanover, Massachusetts that is many times stronger than the standard 50 brix cranberry concentrate presently on the market. The new product is best used in blending with other juice concentrates, as well as 50 brix cranberry concentrate to produce a cranberry juice cocktail. The results are a 25% to 30% reduction in total ingredient costs as well as a high quality finished product.

For samples and formulations contact: A. J. DeGutis, Jr., President, Creative Cranberry Products, Inc., National Headquarters, 1206 Hanover Street, W. Hanover, Massachusetts 02339. 617-878-1313.

Please circle No. 246
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Brochure Describes Energy Conservation And Other User Benefits

• A new 4-page brochure describes energy conservation and other user benefits of Mars Air Doors. Easily mounted over entranceways of receiving/warehouse doors up to 16 feet high.

1. In cold weather they reduce the load on heating systems by drawing warm air down to floor level where it is needed, as 60% of wasted heated air is trapped under ceilings. Stratified air is mixed and circulated with building heat and heat given off by lights and machinery, etc.
2. Deflect wind and reduce heat loss through open doors.
3. During warm weather, they direct a stream of unheated air downward to keep insects, dust and fumes from entering open doors.
4. If air conditioning exists in the building during warm weather, the air doors can be used to prevent loss of conditioned air.
5. Use of Mars Air Doors allows personnel and cargo to pass freely from one area to another with an unobstructed view through open doors or passageways, eliminating doorway accidents.

Mars Air Doors are the only air doors with National Sanitation Foundation and U.L. listing.

A model selection chart with performance specifications is included in the brochure. Free copies are available from Mars Air Doors, 17920 South Figueroa Street, Cardena, California 90248. 213-770-1555.

Please circle No. 247
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Food Science Facts
For The Sanitarian

Dr. Robert B. Gravani
Cornell University
Ithaca, NY

FOOD QUALITY

The production of high quality food products has been an important goal ever since our early ancestors first began to preserve foods. The food industry is very aware of the consumers image of food quality and strives to produce "quality" products.

What is a high quality food? The word quality has been described in many ways and means different things to different people. According to Webster's Dictionary, quality is "a characteristic or attribute". The degree of excellence that something possesses is another common definition of quality. The quality of a food consists of many characteristics, factors or attributes. Each is important in determining the overall quality (good or bad) and consumer acceptance of a product. Quality is not a fixed thing, but varies greatly among people and products.

To most consumers, the quality of food depends on personal preferences and people often use terms such as good, bad, excellent or fantastic to indicate their like or dislike of a product.

What quality factors do consumers look for? To most consumers, quality food products are wholesome and safe, appetizing, tasty, and appealing, packaged properly, labeled fairly and accurately, attractively merchandized and are sold at a price they can afford. The importance of each of these quality factors fluctuates with consumer attitudes, tradition, ethnic background, education, lifestyle, income, and for many other reasons.

A more detailed look at the quality factors that most consumers want in food products are outlined below:

• *Wholesomeness and Safety* - These two factors relate to human health and are very important to everyone. Consumers want to know that the foods they buy are free from adulterants and harmful microorganisms and that additives and chemical residues are controlled to safe levels. Since consumers can't evaluate these factors, they must have confidence and trust in the foods they buy. The food industry and government are jointly responsible for maintaining public confidence in the wholesomeness and safety of foods.

• *Nutrition* - Nutrition has become increasingly important to consumers. Consumers want to buy foods that contain sufficient quantities of the essential nutrients (vitamins, minerals, proteins, fats and carbohydrates) that are needed to satisfy their bodies' requirements for growth, maintenance, repair of tissues, and good health.

• *Appearance* - The appearance of a food product is evaluated with the eye and is the first to be noticed by consumers in the supermarket. It is usually that first impression gained from the appearance of the product which causes consumers to purchase it or to leave it behind. Since this decision is sometimes made before consumers have prepared the food for consumption, the appearance of the product is most important in the case of the first purchase of an item. The appearance of foods is enhanced when attractive packaging materials are combined with eye-catching labels.

• *Texture and Flavor* - The texture and flavor of foods are characteristics that consumers evaluate mainly with their sense of touch, taste and smell. These sensory impressions, along with cultural backgrounds, food habits, and many other factors, affect the consumers' acceptance of food products.

• *Trust and Confidence* - These two words indicate the attitudes consumers want to have toward the types of food they buy. They want to trust the food company to provide a safe and wholesome product. They also want to be confident that the label, instructions for preparation, accompanying information and advertising claims about the product are honest, fair and accurate. Popularly accepted brands have established consumers' trust and confidence because the companies have consistently manufactured products to satisfy these requirements.

• *Marketability* - The marketability of a particular food product is judged by the price the consumer is willing to pay for it. Whenever any work is performed to improve the quality of a food item, the cost of the product goes up. It must be determined whether the consumer is willing to pay this additional cost.

These quality factors are closely related and are very important in the purchase of food products today. Consumers don't consciously "add up" each quality character-

istic of an item, but they evaluate all of the characteristics together and then choose a food product. The choice is based on personal preference and on what a person likes best.

The food industry looks at quality a bit differently than most consumers. Quality is considered a measure of the safety, purity, color, size, shape, maturity, texture, viscosity, mouthfeel, flavor or other special characteristic of the food.

Food quality is usually discussed in terms of some characteristic or standard that can be easily measured. To help ensure food quality, many quality standards have been developed. Some of the standards that are used to evaluate food quality are described below.

• *Government Standards* - These quality standards are established by federal, state and local regulatory agencies and are set through specific regulations. They are usually mandatory and specify minimum standards of quality relating to freedom from adulteration (such as harmful bacteria, yeasts, molds, foreign matter, insects, rodents, pesticides, etc.).

• *Company Standards* - These voluntary quality standards are established by individual companies for their products. These quality standards are used to generate consumer interest in, and loyalty to certain brands of foods.

• *Industry Standards* - These voluntary standards are often developed by the members of a specialized segment of the food industry and are used to assure minimum acceptable quality. Examples are standards for certain fruits, peanut butter and some frozen foods.

• *Grade Standards* - These federal grade standards are voluntary and provide a common language for producers, wholesalers, retailers and consumers. Examples are the USDA Grade standards for meat, dairy, poultry, fruits and vegetables, and the U.S. Department of Commerce grades for fishery products.

Every food processing establishment, food retailer and food service operation should have a corporate policy or philosophy concerning the quality of foods that they process, sell, or prepare. This policy statement can be used to make both employees and customers aware of the companies commitment to quality. The production of quality food products should be the goal of every food industry employee.

The next issue of Food Science Facts will discuss controlling and assuring the quality of foods.

Wyoming Public Health Association Highlights

Officers of the Wyoming Public Health Sanitarians Association are: front row left to right: Sandra Palmer — Treasurer, and Sandra Knop — Secretary. Back row left to right: Tyrone Welty — President-Elect and Gary Hickman — President.

Kate Wachtel of IAMFES is shown presenting Gary Hickman, President of the Wyoming Public Health Sanitarians Association, with their official charter as a new affiliate.

Gary Hickman, left, is shown presenting Tyrone Welty with the Outstanding Sanitarian Award at the Wyoming Public Health Associations annual educational conference.

Killing an Organization

Several ways of killing your organization are listed below. As you read these, please ask yourself if you are a party to this murder.

Just pretend everyone knows of your organization and what it has to offer.

Tell yourself you just don't have time to become involved with projects.

Convince yourself that your organization has been around so long that it will draw members automatically.

Forget that your counterparts have the same problems you have and if brought before your organizational meetings it would be a place to exchange views on these issues.

Just pretend that your headquarters' office can function without your interest or suggestions.

Tell yourself that your counterparts are "carrying the ball" and you are not needed.

Tell yourself that replies are not needed to letters and questionnaires sent to you for comments from your chairman or others trying to make your organization worthwhile to you.

Follow these steps, and you'll never have to worry about your organization again - it will no longer exist.

New Members

California

Miles O. Bennett
Armour Processed Meat Co.
So. San Francisco

Connecticut

Paul E. Gotthelf
Ct. Dept. of Agriculture
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Increasing the Calcium:Sodium Ratio in Cottage Cheese, *B. J. Demott,* The University of Tennessee, P.O. Box 1071, Knoxville, Tennessee. 37901.

With the objective to increase the nutritive value of cottage cheese, the incorporation of calcium into cream to be used for dressing was investigated. Cream containing one of 16 different combinations of $CaCl_2 \cdot 2H_2O$ and/or NaCl was added to cottage cheese curd. The Ca concentrations were 50 to 106 mg/100g and the Na concentrations were 278 to 348 mg/100g cheese. Samples containing 106 mg Ca/100g cheese had like-moderately flavors, but samples having 106 mg Ca/100g cheese had dislike-slightly flavors. Statistical analyses showed Ca concentration to have both linear and quadratic effects, and Na concentrations to have a quadratic effect upon flavor scores. Best flavors were on those samples containing 60 to 77 mg Ca/100g and 295 to 330 mg Na/100g cheese. However a like-moderately flavor was still present on those samples containing 89 mg Ca and 312 mg Na/100g cheese. This is a Ca:Na ratio of .28, nearly double the 0.15 found in commercial cheese. Consumer panel data indicated that the concentration of Ca can be increased from a normal of about 60 mg/100g to at least 89 mg/100g without influencing the flavor.

Suitability of UHT Milk to Monitor Calibration of Infrared Testing Equipment, *Ruth G. Fuqua* and William E. Thompson,* Dairymen, Inc., 10140 Linn Station Road, Louisville, KY 40223.

With the advent of infrared testing equipment for dairy products to rapidly analyze samples for fat protein and lactose, a need arose for stable check samples to monitor the calibration of the equipment. The suitability of UHT milk as calibration check samples was determined using a Foss Milko Scan 104 in several laboratories. All laboratories utilized in-house calibration testing for fat and outside reference samples for protein and lactose calibrations. Stability of whole and 2% UHT milk was analyzed by determining the repeatability of samples within a lot over a period of months. Results were also compared to indicate accuracy of calibration among the laboratories. UHT milk remained stable for fat protein and lactose at the level of accuracy for the equipment and indicated when recalibration of the Milko Scan 104 was required. Additionally results indicated that UHT milk can be used for analysis of error between laboratories.

MIXING OF CLEANING COMPOUNDS SENDS EMPLOYEES TO HOSPITAL

On November 21, 1984, at 9:30 a.m. the Cheyenne Fire Department contacted the Cheyenne-Laramie County Health Department, Division of Environmental Health, requesting assistance at a local eating establishment. Sandi Palmer arrived at approximately 9:50 a.m. to find the situation as follows:

At approximately 8:45 a.m., the dishwasher took a five-gallon bucket with a bleach and water solution in it (about 1/3 full) and began adding a phosphoric acid product to it. The dishwasher stated that she smelled the liquid in the bucket and the "lime remover" container and thought they had the same odor. That was why she had began combining the two products. The bucket was located in the dish-machine area. An immediate chemical reaction resulted, causing gas fumes to go through the kitchen area and into the dining area. The Fire Department was called; the establishment was immediately evacuated and closed. The bucket was taken outside the building.

Eight restaurant employees were sent to the hospital emergency room. Doctors took x-rays and some blood samples. Those with headaches were given Tylenol. None were hospitalized. And they were told to go home to shower and change clothes to prevent skin burns.

The Fire Department requested the Crime Lab from the Hathaway Building to get samples of the liquid. The samples showed extremely high pH and the resulting product was chlorine gas.

For two hours, Gus Lopez and Sandi Palmer from the Health Department monitored the cleanup procedures. All open and exposed containers of food were discarded. All utensils were washed and exposed counters and prep areas were cleaned of any possible residues. The Fire Department brought in baking soda to neutralize the bucket of solution.

About 1:15 p.m., OSHA met Mr. Lopez at the location, and the air was tested for chlorine gas. Two tube tests were done in the kitchen and one in the dining room. All had 0 readings.

The establishment was reopened at about 2:00 p.m. that day. The "downtime" cost was approximately $9,000-$10,000.
(Winter 1985, Wyoming - THE SANITATOR)

FOODBORNE BOTULISM ILLINOIS

From October 15 to October 21, 1983, 28 cases of foodborne botulism occurred in Peoria, Illinois. All 28 persons had eaten at the same restaurant from October 14 to October 16; all were hospitalized. Twelve patients required ventilatory support, and no deaths have been reported. Botulinal type A toxin was detected in serum and/or stool specimens in 13 patients. The epidemiologic investigation implicated sauteed onions served on a patty-melt sandwich as the source of botulinal toxin.

The patients were 20-72 years of age, and 20 were female. Detailed food histories were obtained from the patients and from groups of well persons who had consumed food at the restaurant during the same 3-day period. Each of these comparisons showed a highly significant association between eating a patty-melt sandwich and developing botulism ($p < 0.001$). Of the 28 patients, 24 recalled eating the patti-melt, which consisted of toasted rye bread, sliced American cheese, one-half or one-third pound hamburger patty and sauteed onions. The remaining four patients recalled eating a variety of food items, none of which were implicated by epidemiologic data. Review of the serving practices in the restaurant indicated that the same utensils were used in serving multiple food items, including the patty-melt.

An additional case-control study was conducted to determine which items on the patty-melt were associated with illness. Eighteen persons who had eaten the patty-melt during the 3-day period and remained well were identified through repeated news media announcements. These 18 controls, plus the 24 patients who ate patty-melts, represented 42 of the estimated maximum of 45 patty-melts served over the 3-day period. All 24 patients, but only 10 of 18 controls, reported eating the sauteed onions ($p = 0.0004$). The onions were said to have been prepared daily with fresh whole onions, margarine, paprika, garlic salt, and a chicken-base powder; they were held uncovered in a pan with a large volume of melted margarine on a warm stove (below 60°C [140°F,] and were not reheated before serving).

The original batch of sauteed onions was not available for culture or toxin testing, but type A botulinal toxin was detected in an extract made from washings of a discarded foil wrapper used by one of the patients to take a patty-melt home. Type A botulinal spores were cultured from five of 75 skins of whole onions taken from the restaurant. No other ingredients of the sauteed onions contained botulinal toxin or spores. Additional laboratory tests are pending.

Editorial Note: This is the third largest foodborne botulism outbreak reported in the United States since 1899. The two larger outbreaks occurred in 1977 in Michigan, when 58 people became ill after eating home-canned peppers at a restaurant, and in 1978 in New Mexico, when 34 people became ill after eating potato salad or bean salad at a restaurant. Botulism outbreaks are usually isolated incidents involving small numbers of people who have consumed improperly preserved home-canned or home processed foods.

Epidemiologic evidence implicated the sauteed onions as the source of this outbreak. Recent investigations of pot pies and baked potatoes have demonstrated the ability of C. botulinum to grow and produce toxin in cooked foods held at temperatures below 60 C (140°F). Sauteed onions have never before been associated with botulism. *MMWR 1/20/84*

UNUSUAL BOTULISM CASES-CALIFORNIA

Two unusual outbreaks of botulism were reported in California in 1984, both from fresh foods as opposed to canned.

The first outbreak was apparently due to mishandling of a meatloaf-like dish prepared from turkey, cereal, onion and green pepper. The turkey loaf was inadvertently left in an oven after being cooked for almost 24 hours heated only by a pilot light (oven temperature = 98°F). Upon discovering the meatloaf, a 61 year-old woman tasted it, decided that it was still good and reheated it at 300°F for about 20 minutes. Three other members of her household ate the reheated turkey loaf. After 36 hours, the woman and her 13-year old granddaughter developed symptoms of botulism. Both recovered completely.

The second outbreak was linked to consumption of stew that was left unheated on the stove top for 16 hours after cooking. The victim merely tasted the stew and complained of a bad taste. His roommate confirmed the "sour" taste and immediately spit out the stew and rinsed his mouth out. The stew was then discarded. Forty hours later the man who tasted the stew and

did not spit it out developed botulism. He recovered after an extended hospital stay requiring mechanical respiratory assistance. *From: California Morbidity, No. 4, February 1, 1985).*

SUSPECT VIRAL GASTROENTERITIS OUTBREAK-DUTCHESS COUNTY

The Dutchess County Health Department investigated an outbreak of gastroenteritis apparently resulting from a common source meal at a Poughkeepsie restaurant. Two separate groups of patrons of the restaurant reported illness after New Year's Eve dinners. Symptoms consisted of nausea, vomiting, cramps, diarrhea, fever, headache, and dizziness with onset 36 to 48 hours after the meals. Employee interviews revealed that several waitresses and other employees who prepared green salads were ill immediately prior to or during the dinners. Follow-up interviews of ill patrons showed a significant number of secondary cases among their family members who had not attended the dinner. No food item was implicated by the food specific attack rate table.

Of particular interest and epidemiological significance, the epi curve (onset [date and time] vs. number of cases) showed a few cases in employees occurring one incubation period (36-48 hours) before the event, several cases in employees during the event, and many cases in patrons one incubation period after the event. Secondary infections continued in decreasing numbers for several incubation periods after the main outbreak indicating person-to-person transmission. This type of curve is typical of viral gastroenteritis outbreaks seen on outbreak reports from the State Surveillance System.

An inspection of the restaurant showed inadequate and infrequently used handwash facilities in addition to excessive hand contact with food (particularly) with green salads.

Editor's Note: This Dutchess county outbreak was the first report received this year in an ever increasing number of reports of suspected viral gastroenteritis outbreaks. Through March 1985, most of the reported outbreaks appear to be viral in nature. On occasion, a food item usually served cold, is clearly implicated. For the most part though, a specific food is not implicated, while eating the meal is significantly associated with illness.

While emphasis is currently being placed on prevention of diseases of bacterial origin with the HACCP program, the viral foodborne disease cases must not be neglected. Simply put, prevention of these outbreaks involves but two "critical control points": 1) proper handwashing and 2) exclusion of ill employees from food handling.

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Abstracts of papers in the April Journal of Food Protection

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Evaluation of Inorganic Phosphate on Growth and Lactose Metabolism of Lactic Streptococci in Batch and Continuous Culture, R. P. Sinha, Food Research Institute, Research Branch, Agriculture Canada, Ottawa, Ontario, Canada K1A 0C6

J. Food Prot. 49:260-264

Addition of 1.9% inorganic phosphates (K_2HPO_4,1.33% + KH_2PO_4, 0.57% wt/vol) in place of 1.9% disodium β-glycerophosphate (GP) in M17 medium (M17P) resulted in increased buffering capacity. Even at equimolar concentration (88 m*M*), Na_2HPO_4 (M17P1) or K_2HPO_4 (M17P2) showed higher buffering than GP(M17). Cultures consistently showed lower cell density in M17P2 than in other buffered media after 7 h of growth at 32°C, suggesting that buffering media with Na_2HPO_4 is better than buffering with K_2HPO_4 for cultivation of lactic streptococci. The effect of buffering media with Na_2HPO_4 on culture growth and appearance of lactose-negative (Lac^-) variants was also tested under continuous culture growth conditions in a chemostat. Growth of *Streptococcus lactis* C2 continuously at pH 6.8 for 168 h in M17P1, and M17 broths at 32°C failed to yield any lac^- strains. Results showed that successful propagation of lactic streptococci in continuous culture growth can be achieved without enriching for cells with undesirable metabolic characteristics.

Occurrence of Phthalate Esters in Italian Packaged Foods, Renata Amodio Cocchieri, Hygiene and Preventive Medicine Institute, IInd University Hospital, Naples, Italy

J. Food Prot. 49:265-266

Two hundred samples of Italian plastic-packaged food products were examined for the presence and concentration of phthalic plasticizers. Di-n-butylphthalate (DBP) was detected in 97, 80, 95, 100 and 49% of cheese, salted meat, vegetable soup, potato chips and milk samples, respectively. No DBP was recovered from jams and baby food. The mean levels of contamination with DBP varied from 0.07 to 2.80 μg/g. Di-2-ethylhexyl-phthalate (DEHP) was determined in 80, 71, 94 and 52% of salted meat, jam, baby food and milk samples, respectively, and in all the cheese and vegetable soup samples. The mean DEHP values ranged between 0.21 and 2.38 μg/g.

Production and Characterization of Antibody Against 3′-OH-T-2 Toxin, Ru-Dong Wei, William Bischoff and Fun Sun Chu, Food Research Institute and Department of Food Microbiology and Toxicology, University of Wisconsin, 1925 Willow Drive, Madison, Wisconsin 53706

J. Food Prot. 49:267-271

Antibody raised against T-2 toxin cross-reacted poorly with 3′-OH-T-2 toxin. A new immunogen was prepared by conjugation of hemisuccinate (HS) of 3′-OH–T-2 toxin to bovine serum albumin (BSA). Antibodies against 3′-OH–T-2 toxin were demonstrated by a radioimmunoassay 10 wk after immunization of rabbits with this new immunogen using tritiated 3′-OH–T-2 toxin as the testing ligand. Highest titers (1:6,000) were obtained 17 wk after immunization and two booster injections. The antibodies had good cross-reactivity with T-2 toxin, acetyl-T-2 toxin and 3′-OH–acetyl-T-2 toxin. The relative cross-reactivity of this antibody with 3′-OH-T-2, acetyl-T-2, T-2, 3′-OH-acetyl-T-2, 3′-OH-T-2-HS, T-2 isomer, HT-2 and 3′-OH–HT-2 was 1, 3, 4, 5, 15, 30, 45 and 175, respectively. No cross-reaction was found when 3′-OH-T-2 triol, T-2-triol, T-2-tetraol, DAS and DON at a concentration of 1 μg per assay was tested. The detection limit for 3′-OH-T-2 toxin by the RIA was about 0.1 ng per assay.

Potato-Like Odor of Retail Beef Cuts Associated with Species of *Psuedomonas*, R. L. Daise, E. A. Zottola and R. J. Epley, Department of Food Science and Nutrition, University of Minnesota, St. Paul, Minnesota 55108

J. Food Prot. 49:272-273

Retail cuts of beef and hamburger packages from a North Dakota meat processor were examined due to consumer complaints of a strong potato-like or musty odor associated with the meat. Examination for total numbers of aerobic bacteria on plate count agar and for gram-negative psychrotrophic bacteria on crystal violet tetrazolium agar revealed numbers in excess of 10^8 CFU/g. Numbers of coliform bacteria on violet red bile agar were in excess of 10^6 CFU/g. Gram-negative rods were isolated and identified. The isolates were characterized by a positive catalase reaction, oxidase production, an oxidative O/F reaction, nonutilization of lactose, liquification of nutrient gelatin, slight motility, production of acid in litmus milk with decoloration and clotting, nonproduction of indole, and nonreduction of nitrate. The isolate was tentatively identified as a *Pseudomonas* of undetermined species, probably a variant of either *Pseudomonas taetrolens* or *Pseudomonas perolens*.

Evaluation of Inositol Brilliant Green Bile Salts and Plesiomonas Agars for Recovery of *Plesiomonas shigelloides* from Aquatic Samples in a Seasonal Survey of the Suwannee River Estuary, Mary L. Miller and John S. Koburger, Food Science and Human Nutrition Department, University of Florida, Gainesville, Florida 32611

J. Food Prot. 49:274-277

Two plating media, inositol brilliant green bile salts (IBB) and plesiomonas (PL) agars, were compared using surface plating procedures for the recovery of *Plesiomonas shigelloides*. IBB was more effective in both the percentage of positive samples recovered and the percentage of isolates confirmed as *P. shigelloides*. Pure culture studies of heat- and cold-injured cells, however, showed that IBB agar failed to recover many of these organisms. Samples examined were from the Suwannee River estuary and included water, sediment, fish, crabs and mollusks. This survey found a high incidence (58.7%) of *Plesiomonas* in environmental samples. Counts of *P. shigelloides* per gram of sample differed among the various types of samples, ranging from 10^1 CFU/g in water and oysters to 10^6 CFU/g in bream.

Use of Fast Green FCF with Tryptic Soy Agar for Aerobic Plate Count by the Hydrophobic Grid Membrane Filter, Phyllis Entis and Peter Boleszczuk, QA Laboratories Limited, 135 The West Mall, Toronto, Ontario, Canada M9C 1C2

J. Food Prot. 49:278-279

A hydrophobic grid membrane filter (HGMF) method for aerobic plate count using Tryptic Soy Agar with fast green FCF was evaluated against a conventional pour plate method on 250 food samples, representing 25 product categories. The HGMF method yielded counts equivalent to or significantly higher than the pour plate method for 24 of the 25 product categories (t-test for paired data).

Evaluation of Summer Sausage Manufactured Using Mixed *Lactobacillus* and *Leuconostoc* Starter Culture, O. J. Burrowes, F. H. Schmidt, K. L. Smith and J. V. Chambers, Food Science and Human Nutrition Department, University of Florida, Gainesville, Florida 32611

J. Food Prot. 49:280-281

A 1:1 mixture of *Leuconostoc* and *Lactobacillus plantarum* and of *L. plantarum* alone were used as starter-cultures in making two batches of summer sausage. Sausage samples were evaluated for volatile flavor compounds and by sensory evaluation. Ethanol was the primary volatile flavor compound in the sausage from mixed culture while acetaldehyde predominated in the single culture sausage. Sensory evaluation indicated a significant difference ($p \leq 0.01$) between the two types of sausages with 66% of the panelists preferring sausage prepared with *L. plantarum* alone.

Occurrence of *Salmonella* in Iraqi Milk Products, Wafa J. Al-Rajab, Wail Y. Al-Dabbagh and Soad M. Al-Zahawi, Department of Biology, College of Science, University of Mosul, Mosul, Iraq

J. Food Prot. 49:282-284

Thirty-two (8%) of 400 samples of locally produced milk products were found to contain *Salmonella*. Positive samples included ice cream (10.9%), Kishfa (10%), Gaymer (7.5%), cheese (6.6%) and yogurt (1.6%). A total of 15 serotypes were identified from these samples, where *Salmonella typhimurium* and *Salmonella infantis* occurred with the highest frequency.

Molar Ratio of Sodium and Chloride in Sweet-Type Whey and Inability to Determine Sodium Concentrations from Chloride Measurements, Antone G. Gregory, Associated Milk Producers, Inc., North Central Region, P.O. Box 455, New Ulm, Minnesota 46073-0455

J. Food Prot. 49:285-289

Sodium levels in sweet-type whey must be determined by direct measurement of sodium. The chloride assays, commonly used in the dairy industry, use silver to measure chloride and the results are interpreted as a measure of sodium chloride. This interpretation is in error due to the molar excess of chloride relative to sodium in whey. This was demonstrated by testing samples of sweet-type dry whey for sodium and chloride. Also, a material balance for sodium and chloride was performed throughout the cheesemaking process, demonstrating that this excess of chloride is introduced into the process with the whole milk. These natural milk salts remain predominantly in the whey, maintaining the molar excess of chloride relative to sodium.

Incidence of *Campylobacter jejuni* and *Campylobacter coli* Serogroups in a Chicken Processing Factory, B. J. Juven and M. Rogol, Department of Food Science, Agricultural Research Organization, The Volcani Center, P.O. Box 6, Bet Dagan 50250, Israel and National Center for Campylobacter, Central Laboratories, Ministry of Health, Jerusalem 91060, Israel

J. Food Prot. 49:290-292

Chicken carcasses and water samples were tested for contamination with *Campylobacter jejuni* or *Campylobacter coli* at a water-immersion stage in a kosher poultry processing factory. Among the wide variety of serogroups found on carcasses and water samples, only serogroups #2, #11 and #12 ranked among those most frequently isolated in Israel from humans.

A Retrospective Assessment of Human Health Protection Benefits from Removal of Tuberculous Beef, Tanya Roberts, Economic Research Service, U.S. Department of Agriculture, 1301 New York Avenue N.W., Room 932, Washington, D.C. 20005-4788

J. Food Prot. 49:293-298

In the early 1900s, government agencies instituted two programs, Federal slaughterhouse inspection and on-farm tuberculin testing, to control the spread of bovine tuberculosis (TB). From this historical perspective, the economic benefits of these programs are estimated using four parameters: (*a*) an estimation of how many cattle would have had bovine TB without the programs, (*b*) the likelihood of those infected cattle causing human illness through aerosol contamination, penetration of the skin via cuts and nicks, cross-contamination of other foods in the home, and consumption of meat and meat products, (*c*) current costs of treating human cases of TB, and (*d*) the evaluation of the benefits of preventing the death of some individuals. Based on these four parameters, the TB control programs have possible estimated economic benefits which range from $30 to $300 million annually.

A Review of Immunoassays and Their Application to Salmonellae Detection in Foods, George F. Ibrahim, Hawkesbury Agricultural Research Unit, New South Wales Department of Agriculture, Richmond, N.S.W., 2753, Australia

J. Food Prot. 49:299-310

Immunoassays have been established over the years as powerful tools for the detection of a wide range of antigens. This review brings together published work in relation to principles of immunoassays utilizing radioisotopes and enzymes, methods of amplifying the sensitivity of immunoassays, the immunochemistry of certain *Salmonella* antigens and detection of salmonellae by immunoassays.

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April 14-15, ADVANCED PEST CONTROL SEMINAR. For more information contact: Shirley Grunder, Sanitation Education Department, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

April 14-18, STATISTICAL QUALITY CONTROL SHORT COURSES, Statistical Methods Applied to Productivity Improvement and Quality Control - For the Food Processing Industry, to be held at the University of California, Davis, CA. For more information contact: Robert C. Pearl, Food Science & Technology Dept., University of California, Davis, CA 95616. 916-752-0980.

April 14-18, FRUIT AND FRUIT TECHNOLOGY RESEARCH INSTITUTE INTERNATIONAL CONFERENCE to be held at the CSIR Conference Centre, South Africa. For more information contact: Symposium Secretariat S.341, CSIR, P.O. Box 395, Pretoria 0001, South Africa. Telephone: 012 869211 x 2063. Telex: 3-630 SA.

April 15-17, FLAVOR WORKSHOP II. For more information contact: Gary Reineccius, University of Minnesota, Dept of Food Science, 1334 Eckles Ave., St. Paul, MN 55108. 612-373-1438.

April 21-23, FOOD ANTIOXIDANTS SYMPOSIUM: INTERNATIONAL PERSPECTIVES to be held at the Loew L'Enfant Plaza Hotel, Washington, D.C. Preregistration deadline: March 14, 1986. For more information contact: Ms. Elaine Auld, International Life Sciences Institute - Nutrition Foundation, 1126 Sixteenth Street, N.W. Suite 111, Washington, DC. 20036. 202-659-0074/872-0778.

April 21-May 2, REFRIGERATION TECHNOLOGY. For more information contact: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

April 22-23, FLORIDA ASSOCIATION OF MILK, FOOD & ENVIRONMENTAL SANITARIANS MEETING, to be held at the International Inn, Orlando, FL. For more information contact: Dr. Franklin Barber, 1584 Cumberland Ct., Fort Myers, FL 33907.

April 23, SANITATION WORKSHOP FOR THE FOOD PROCESSING AND FOOD SERVICE INDUSTRIES, to be held at Inn at the Park, Anaheim, CA. For more information contact: Kathryn Boor, Food Science and Technology, University of California, Davis, CA 95616. 916-752-1478.

April 27-30, AOAC SPRING TRAINING WORKSHOP, to be held at the Stouffer Madison Hotel, Seattle, WA. For more information contact: Mike Wehr, Oregon Dept. of Agriculture. 503-378-3793.

April 28-29, MOLD MONITORING AND CONTROL SEMINAR. For more information contact: Shirley Grunder, Sanitation Education Department, 1213 Bakers Way, Manhattan, KS 66502.

April 28-30, FOOD INDUSTRY CERTIFICATION/RECERTIFICATION PESTICIDE UPDATE WORKSHOP & EXPOSITION for all midwestern states, Matteson, Illinois. For more information contact: Harold Rowe at 813-586-5710 or write: Jean Day, Registrar, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540.

April 28-30, PIZZA TECHNOLOGY. For more information contact: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

April 29-May 1, WORKSHOP ON TRACE ANALYSIS OF FOODS. For more information contact: G. Reineccius, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108. 612-373-1438.

April 30-May 2, SOUTH DAKOTA ENVIRONMENTAL HEALTH ASSOCIATION ANNUAL MEETING. For more information contact: Stanley A. Swagoshi, South Dakota Department of Health, 1320 So. Minnesota, Suite A, Sioux Falls, SD 57105. 605-339-7113.

April 30-May 2, PIZZA TECHNOLOGY LAB. For more information contact: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

May 4-9, FOOD SANITATION EXECUTIVE LEADERSHIP INSTITUTE, University of Illinois, Champaign, Illinois. For more information contact: Harold Rowe at 813-586-5710 or write: Jean Day, Registrar, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540.

May 5-7, 6TH INTERNATIONAL FOOD & WINE SHOW, to be held at the Civic Auditorium and Brooks Hall, San Francisco, CA. For more information contact: Sandra Call, National Fairs Inc., 1902 Van Ness Avenue, San Francisco, CA 94109. 415-474-2300.

May 12-15, ASEPTIC PROCESSING AND PACKAGING WORKSHOP, to be held at Purdue University, West Lafayette, IN. For more information contact: James V. Chambers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN 47907. 317-494-8279.

May 12-15, 3-A SANITARY STANDARDS COMMITTEE ANNUAL MEETING, to be held in Kansas City, MO. For more information contact: Lisa M. Devery, Dairy and Food Industries Supply Association, Inc., 6245 Executive Boulevard, Rockville MA 20852. 301-984-1444.

May 12-14, PENNSYLVANIA DAIRY SANITARIANS ASSOCIATION MEETING, to be held at Pennsylvania State University. For more information contact: Sidney Barnard, Pennsylvania State University, 8 Borland Lab, University Park, PA 16802. 814-863-3915.

May 12-16, APPLICATION AND TROUBLESHOOTING MICROPROCESSOR CONTROL CIRCUITS. For more information contact: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

May 26-31, 2ND WORLD CONGRESS FOODBORNE INFECTIONS AND INTOXICATIONS will take place in Berlin (West) at the International Congress Centre (ICC). For more information contact: FAO/WHO Collaborating Centre for Research and Training in Food Hygiene and Zoonoses, Institute of Veterinary Medicine (Robert von Ostertag-Institute), Thielallee 88-92, D-1000 Berlin 33.

June 2-3, TEXAS ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL PROTECTION ANNUAL MEETING, to be held at the Executive Plaza, Austin, TX. For more information contact: Kirmon Smith, Texas Department of Health, 1100 W. 49th, Austin, TX 78756. 512-458-7111.

June 9-20, COOKIE TECHNOLOGY. For more information contact: Bev Martin, Research Department, American Institute of Baking, 1213 Bakers Way, Manhattan KS 66502.

June 13-14, WATER ACTIVITY: THEORY AND APPLICATIONS, 10TH BASIC SYMPOSIUM, to be held at the Grenelefe Hotel, Dallas, TX. For more information contact: Miss Marlene Myszkowski, Institute of Food Technologists, 221 North LaSalle Street, Suite 300, Chicago, IL 60601. 312-782-8424.

June 16-19, BASIC FOOD PLANT MICROBIOLOGY. For more information contact: Shirley Grunder, Sanitation Education Department, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

June 23-27, CRACKER TECHNOLOGY. For more information contact: Bev Martin, Research Department, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

June 29-July 2, 29TH CONFERENCE OF THE CANADIAN INSTITUTE OF FOOD SCIENCE AND TECHNOLOGY, to be held in Calgary, Alberta, Canada. For more information contact: Terry Smyrl, Ph.D., Alberta Horticultural Research Center, Brooks, Alberta, Canada, T0J 0J0. 403-362-3391.

June 30-July 3, SPECIALITY INGREDIENT AND PROCESSING (COOKIE). For more information contact: Bev Martin, Research Department, American Institute of Baking, 1213 Bakers Way, Manhattan KS 66502.

July 12-19, SIXTH INTERNATIONAL WORKSHOP ON RAPID METHODS AND AUTOMATION IN MICROBIOLOGY, to be held at Kansas State University. For more information concerning Program contents contact: Daniel Y.C. Fung, Call Hall, Kansas State University, Manhattan, KS. 66506. 913-532-5654. For registration information contact: Joe Pittle, Conference Center, Wareham building, Anderson Avenue, Manhattan, KS 66502. 913-532-5575.

July 14-18, TECHNOLOGIA DE PRODUCTION DE PAN (BREAD PRODUCTION FOR SPANISH SPEAKING BAKERS). For more information contact: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

July 14-18, IN-STORE BAKERY TRAINING-FROZEN DOUGH OPERATIONS. For more information contact: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

July 15-19, PURDUE CANNERS TECHNICIANS MOLD COUNT SCHOOL. For more information contact: Dr. James V. Chambers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN 47907. 317-494-8279.

July 21-25, PRINCIPLES OF BAKERY PRODUCTION-BREAD OR CAKE. For more information contact: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

AUGUST 3-7, IAMFES ANNUAL MEETING to be held at the Radisson South, Minneapolis, MN. For more information contact: Kathy R. Hathaway, IAMFES, Inc., P.O. Box 701, Ames, IA 50010. 515-232-6699.

AUGUST 10-15, 1986 ANNUAL MEETING OF THE SOCIETY FOR INDUSTRIAL MICROBIOLOGY to be held at the Sheraton-Palace Hotel, San Francisco, CA. For more information contact: Mrs. Ann Kulback - SIM Business Secretary, SIM Headquarters, P.O. Box 12534, Arlington, VA 22209. 703-941-5373.

September 23-25, WYOMING PUBLIC HEALTH SANITARIANS ASSOCIATION ANNUAL MEETING, to be held at the Holiday Inn, Thermopolis, WY 82443. For more information contact: William George, 118 1/2 N. 11th, Worland, WY 82401. 307-347-2617.

October 21-22, CALIFORNIA ASSOCIATION OF DAIRY AND MILK SANITARIANS ANNUAL MEETING, to be held at Holiday Inn Downtown, Fresno, CA. For more information contact: Richard C. Harrell, 1554 West 120th St., Los Angeles, CA 90047. 213-757-9719.

November 1-6, FOOD SANITATION 29TH ANNUAL NATIONAL EDUCATIONAL CONFERENCE & EXPOSITION, Scottsdale, Arizona. For more information contact: Harold Rowe at 813-586-5710 or write: Jean Day, Registrar, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540.

1987

AUGUST 2-6, IAMFES ANNUAL MEETING to be held at the Disneyland Hotel, Anaheim, CA. For more information contact: Kathy R. Hathaway, IAMFES, Inc., P.O. Box 701, Ames, IA 50010. 515-232-6699

September 26-30, DFISA's FOOD & DAIRY EXPO '87, to be held at McCormick Place, Chicago, IL. For more information contact: DFISA, 6245 Executive Boulevard, Rockville, MA 20852. 301-984-1444.

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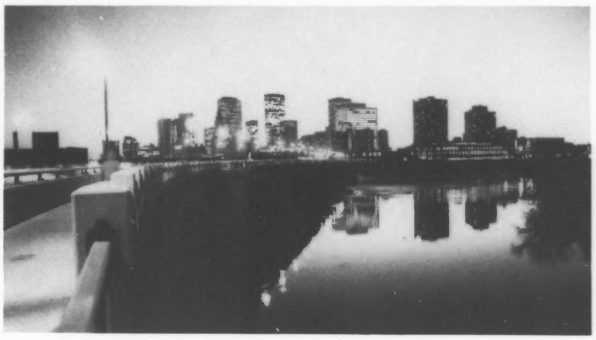

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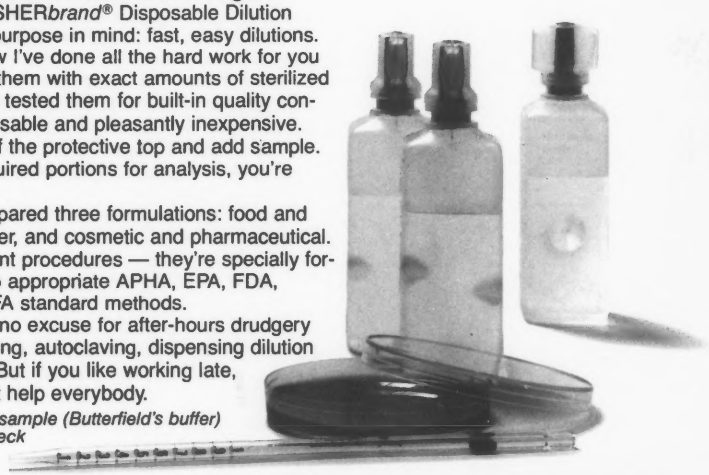

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