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55TH ANNUAL MEETING
August 19, 20, 21, 22, 1968
Chase Park Plaza Hotel
St. Louis, Missouri

NOTICE
Page I and II—
National Mastitis Council Meeting.

Official Publication

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

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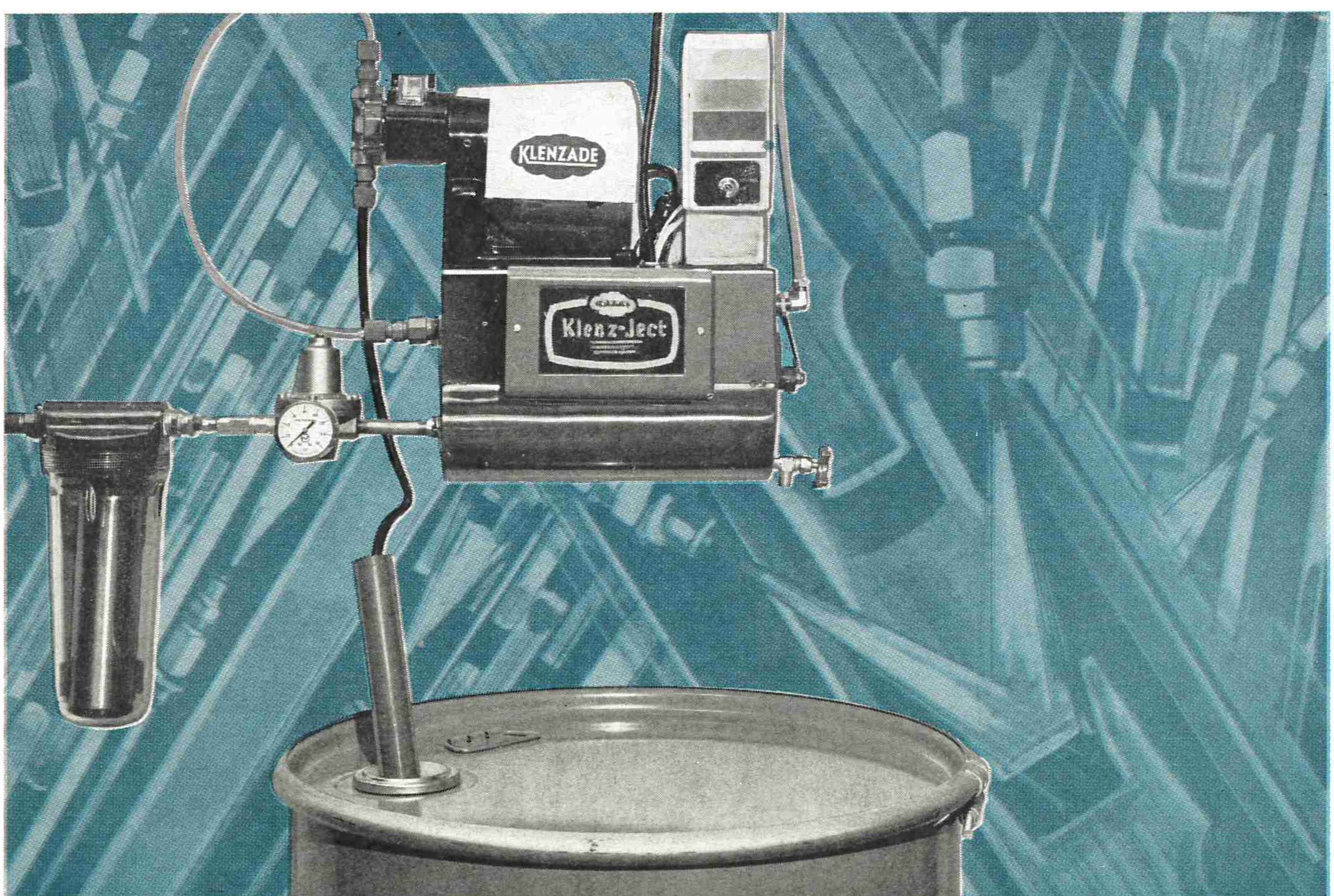

THIS IS YOUR *Invitation* TO ATTEND THE *Annual Meeting*

NATIONAL MASTITIS COUNCIL

RSVP

The seventh annual meeting of the National Mastitis Council is scheduled to be held at the Sherman House, February 15 and 16, 1968. Everyone interested in the many aspects of mastitis prevention and control is cordially invited to attend. Our program committee has been hard at work arranging for speakers to make this the best meeting yet. Here is a brief account of some of the topics you can look forward to hearing discussed.

From New York, Dr. L.E. Field will report on the follow-up of 200 high cell count herds. There is enough data from case histories to show what can be done in some herds to effect permanent improvement. From California, Dr. O.W. Schalm will talk to us about the progress of an inflammatory reaction in a quarter, with emphasis on variations in the normal level of leucocytes. From the Southwest Milk Producers, Dan Noorlander will share his experiences with 7,000 dairy farmers from that area.

We expect to have a discussion of a currently operating mastitis control program and we have asked Roy Olsen to describe the Spokane city health department's successful operation. From Vermont, Dick Dodge will discuss who does what about mastitis from the view point of an extension dairyman. The relationship of the milking machine and mastitis and problems in providing effective drug products for the treatment of mastitis that will pass FDA standards are other subjects to be discussed.

At the request of many of you that attended last year's meeting, we are setting up some informal discussion group sessions Thursday evening. We are planning one group on milking machine problems and another on screening tests. These group sessions will provide an opportunity for everyone to take part and get their questions answered or discussed because the discussion will depend on the desires of those in attendance.

Make your plans now to attend this meeting. It will start at 9 A.M. February 15 and adjourn at noon February 16. Fill in the registration form and return it today to the National Mastitis Council, Inc., 910 17th Street N.W., Washington, D.C. 20006. It will save time for you and the NMC if you send the registration fee with the form.

Registration Form

NATIONAL MASTITIS COUNCIL ANNUAL MEETING

Sherman House — Chicago, Illinois
February 15-16, 1968

PLEASE TYPE OR PRINT *BOTH* SECTIONS OF THIS FORM

The top half will be used for preparation of badges and mailing of proceedings after the meeting. The lower half will be forwarded by NMC to the Sherman House.

Register the following person(s). (Fee of $15.00 per person includes registration, February 15 luncheon, milk and coffee breaks, and proceedings.) Checks are payable to: National Mastitis Council, Inc.

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STAPHYLOCOCCI SHED IN MILK OF FRESHENED HEIFERS FOLLOWING THE USE OF MILKING MACHINES

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(Received for publication July 24, 1967)

Abstract

The transmission of staphylococcal strains prevalent in the milk of 3 dairy herds to their respective, freshened heifers following the use of the milking machine was traced by phage typing. The introduction of new cows to 1 herd provided 1 staphylococcal strain that predominated in the herd. Some heifers acquired staphylococcal strains identical to those found in the herd within 1 wk following the use of the milking machine.

The shedding of staphylococci into the milk from cows and freshened heifers has been recognized and documented for some time *(4)*. Some strains of staphylococci are carried in the udders or teat canals as part of the normal flora with no apparent adverse effects, whereas other strains pose a definite pathological condition for the animal involved *(2)*. There is evidence of individual differences among milk cows toward being carriers of various staphylococcal strains as well as differences in susceptibility to staphylococcal mastitis *(3)*.

The purpose of this study was to ascertain the influence that milking machines may have on the strains of staphylococci shed in milk of freshened heifers and the association that these strains may have to their respective dairy herds.

Experimental Methods

Staphylococci were isolated from the milk of individual cows comprising 3 dairy herds by aseptically sampling the milk taken from each quarter of every milking cow and spreading a 0.1 ml aliquot from each sample over the surface of a staphylococcus medium #110 agar plate. After incubation of the agar plates, 10 typical staphylococcal colonies were picked from each plate for phage typing by the procedure of Blair and Williams *(1)*. Each staphylococcal isolate was checked for coagulase production by the tube test and the positive strains were typed with 24 phages including the basic phages recommended by the Subcommittee on Phage Typing of *Staphylococcus* of the Nomenclature Committee of the International Association of Microbiological Societies. These phages and their propagating strains were obtained from a commercial source. Propagation and standardization of titers followed the recommended procedures of Blair and Williams *(1)*. The specific phages used were: Group I – 29, 52, 52A, 79, 80; Group II – 3A, 3B, 3C, 55, 71; Group III – 6, 7, 42E, 47, 53, 54, 75, 77; Group IV – 42D; miscellaneous – 81, 187, 83, 44A, 73. Typing was carried out at the routine test dilution (RTD). Staphylococcal cultures showing no lysis at the RTD were regarded as non-typable. Those lytic reactions showing more than 50 plaques to confluent lysis were considered as strong reactions. The "phage pattern" or "type" of the strain under study was based only on those phages showing a strong reaction. Two strains were considered different if 1 was strongly lysed by at least 2 phages which showed no lysis with the other strain. This same procedure was applied to milk from freshened heifers prior to and after the use of milking machines. The 3 dairy herds used in this study were selected on the basis of the availability of freshened heifers coming into the herd and the history of the herd.

Results and Discussion

The dairy herd designated No. 1 had been in production for several yr and was continually plagued with chronic mastitis that flared up into a high incidence of clinical cases during adverse weather conditions of the winter months. Table 1 shows the presence of 5 staphylococcal phage type strains carried by the cows in this herd. Three of the strains, 29, 52, 42E, 53, 77, 83; 3A, 3C, 55, 47, 54, 83, 81 and 3A, 3C, 55, 6, 7, 42E, 47, 54, 83, 81 were carried by 11, 8, and 7 cows, respectively, whereas strain 6, 7, 42E, 47, 54, 75, 77, 81 was part of the microflora in the milk of 3 cows and 6, 187 was found in the milk of only 1 cow. A freshened heifer was shedding only coagulase-negative staphylococci in her milk prior to the use of the milking machine but after 2 wk of machine milking, her milk contained 2 of the 5 strains found in the herd.

The second dairy herd was newly formed around a nucleus of 3 older cows consisting of 2 Holsteins and 1 Guernsey and 7 freshened heifers (Table 2). The only typable staphylococcal strain was carried by the Guernsey. One of the other cows carried a staphylococcal strain that was not lysed by the phages employed, whereas the remaining cow had no staphylococci in her milk. Four of the 7 freshened heifers had staphylococci that were not typable by the 24 phage strains. The other 3 freshened heifers showed no demonstrable staphylococci in their milk. Following 1 mo on the milking machines, a check of the entire milking herd revealed that 1 of the

TABLE 1. STAPHYLOCCAL PHAGE TYPES OF INDIVIDUAL COWS IN A MILKING HERD (DAIRY HERD NO. 1)

Old Cows (Initially)					
#1	29, 52, 42E, 53, 77, 83		3A, 3C, 55, 47, 54, 83, 81		3A, 3C, 55, 6, 7, 42E, 47, 54, 83, 81
#2	29, 52, 42E, 53, 77, 83		3A, 3C, 55, 47, 54, 83, 81		
#3	29, 52, 42E, 53, 77, 83				
#4	29, 52, 42E, 53, 77, 83		3A, 3C, 55, 47, 54, 83, 81		
#5	29, 52, 42E, 53, 77, 83				3A, 3C, 55, 6, 7, 42E, 47, 54, 83, 81
#6	29, 52, 42E, 53, 77, 83				3A, 3C, 55, 6, 7, 42E, 47, 54, 83, 81
#7			3A, 3C, 55, 47, 54, 83, 81		3A, 3C, 55, 6, 7, 42E, 47, 54, 83, 81
#8		6, 7, 42E, 47, 54, 75, 77, 81			
#9	29, 52, 42E, 53, 77, 83		3A, 3C, 55, 47, 54, 83, 81		
#10		6, 7, 42E, 47, 54, 75, 77, 81		6, 187	
#11			3A, 3C, 55, 47, 54, 83, 81		
#12	29, 52, 42E, 53, 77, 83				3A, 3C, 55, 6, 7, 42E, 47, 54, 83, 81
#13			3A, 3C, 55, 47, 54, 83, 81		3A, 3C, 55, 6, 7, 42E, 47, 54, 83, 81
#14	29, 52, 42E, 53, 77, 83				3A, 3C, 55, 6, 7, 42E, 47, 54, 83, 81
#15	29, 52, 42E, 53, 77, 83	6, 7, 42E, 47, 54, 75, 77, 81	3A, 3C, 55, 47, 54, 83, 81		
#16	29, 52, 42E, 53, 77, 83				
Heifer (Before use of milking machine)					(2 wk after use of milking machine)
#1	Coag. neg.				29, 52, 42E, 53, 77, 83 6, 7, 42E, 47, 54, 75, 77, 81

TABLE 2. STAPHYLOCOCCAL PHAGE TYPES OF INDIVIDUAL COWS IN A MILKING HERD (DAIRY HERD NO. 2)

Old Cows	Initially	After 1 mo	After 4 mo
Guernsey	29, 52, 77, 81+[a]	29, 52, 77, 81+[b]	29, 52, 77, 81+[a]
Holstein #1	Coag.-Pos.; Neg. lysis	Coag.-Pos.; Neg. lysis	Coag. Pos.; Neg. lysis
Holstein #2	—	—	—
Additions to milking herd:			
	Purchased cow (5 yr old)		42D, 44A+[c]
	Holstein #3	42D+[b]	42D+[b]
		Purchased cow (4 yr old)	42D, 44A+[c]
		Holstein #4	42D+[b]
		Freshened cow (7 yr. old)	
		Holstein #5	42D+[b]

Heifers	Before use of milking machine	1 mo after use of milking machine	4 mo after use of milking machine
#1	—	—	Coag-neg.
#2	Coag.-Pos.; Neg. lysis	Coag.-Pos.; Neg. lysis	42D+[b]
#3	—	—	—
#4	Coag.-Pos.; Neg. lysis	42D+[b]	42D+[b]
#5	Coag.-Pos.; Neg. lysis	Coag.-Pos.; Neg. lysis	Coag. Pos.; Neg. lysis
#6	—	—	Coag-neg.
#7	Coag.-Pos.; Neg. lysis	Coag.-Pos.; Neg. lysis	42D+[b]
Additions to milking herd:			
Freshened Heifer #8 (on milking machine 1 wk)			42D+[b]
Freshened Heifer #9 (on milking machine 2 wk)			Coag.-neg.

[a]+ Indicates weak lytic reactions with phages 71, 6, 7, 42E, 47, 53, 54, 73.
[b]+Indicates weak lytic reactions with phages 29, 52, 3C, 6, 7, 47, 53, 54, 75, 77, 73, 81, 83.
[c]+ Indicates weak lytic reactions with phages 6, 42E, 47, 75, 77, 81, 83.

TABLE 3. STAPHYLOCOCCAL PHAGE TYPES OF INDIVIDUAL COWS IN A MILKING HERD (DAIRY HERD NO. 3)

		Initially		After 4 Mo
Old Cows				
	#1	(29, 6, 7, 42E, 47, 53, 54, 75, 77, 73, 81)[a]		(29, 6, 7, 42E, 47, 53, 54, 75, 77, 73, 81)
	#2	29, 6, 7, 42E, 47, 53, 54, 75, 77, 73, 81		Discontinued milking
	#3	(29, 6, 7, 42E, 47, 53, 54, 75, 77, 73, 81)		Discontinued milking
	#4	(29, 6, 7, 42E, 47, 53, 54, 75, 77, 73, 81)		(29, 6, 7, 42E, 47, 53, 54, 75, 77, 73, 81)
	#5	(29, 6, 7, 42E, 47, 53, 54, 75, 77, 73, 81)		Discontinued milking
			#6	(29, 6, 7, 42E, 47, 53, 54, 75, 77, 73, 81)
		Additions to milking herd	#7	Coag.-neg.
		by freshening:	#8	29, 6, 7, 42E, 47, 53, 54, 75, 77, 73, 81
Heifers		Before use of milking machine		4 mo after use of milking machines
	#1	Coag.-neg.		(29, 6, 7, 42E, 47, 53, 54, 75, 77, 73, 81)
	#2	Coag.-neg.		Coag.-pos.; neg. lysis
	#3	Coag.-neg.		Coag.-pos.; neg. lysis
	#4	Coag.-neg.		Coag.-pos.; neg. lysis
		Addition to milking herd:		
		Freshened Heifer #5		Coag.-neg.

[a]( ) Indicates a weak lytic pattern.

heifers was now carrying a 42D strain, the same as a milking cow that had been introduced into the herd since the initial phage typing of prevalent staphylococci. By the fourth month, 2 more older cows, 1 by purchase and the other by freshening, were added to the milking herd along with 2 more freshened heifers. The purchased cow was shedding 2 staphylococcal strains, 42D, 44A+ and 42D+, into her milk and the freshened cow 1 strain, 42D+. Strains 42D+ and 42D, 44A+ were considered different because of differences in 8 weak reactions even though they differed by only 1 strong reaction. Meanwhile, the purchased cow that originally demonstrated the presence of strain 42D+ after 1 month, also carried strain 42D, 44A+ at this time. Besides introducing the 42D strain into the herd, this cow also acquired the 42D, 44A+ strain from another cow that constituted a later addition to the herd. At this period, 3 of the original seven heifers were shedding strain 42D+ as was one of the 2 most recently added heifers.

The third dairy herd was made up of 5 older cows and 4 freshened heifers ready for the milking machines (Table 3). All of the older cows carried 1 typable strain of staphylococcus, 29, 6, 7, 42E, 47, 53, 54, 75, 77, 73, 81. None of the 4 freshened heifers carried any strains that would be considered for phage typing. By the end of 4 mo, one of the original 4 heifers was shedding the above mentioned staphylococcal strain found in the milk from the older cows. The other 3 heifers now had coagulase-positive staphylococci that did not lyse with any of the 24 phages. In the interim, a fifth freshened heifer was added to the milking herd but only coagulase-negative staphylococci were found in the milk from her 4 quarters.

These results do not exclusively implicate the milking machine as the sole fomite for transmitting the staphylococci prevalent in a dairy herd to freshened heifers. However, the act of milking definitely perpetuates and disseminates the strains that are endemic to the herd as well as those that are introduced by other animals.

The use of phages for bovine strains of staphylococci could have possibly added to the number of typable strains. Nevertheless, the 24 phages used in this study effectively demonstrated the transmission of staphylococci from herds and individual cows of a herd to the incoming, freshened heifers.

Tables 1 and 2 show a difference in transmissibility among staphylococcal strains. In Table 1, the incoming heifer readily picked up 2 of the 5 strains found in the herd, and Table 2 shows strain 42D, which was introduced to the herd by the addition of an older cow, becoming the predominant strain. This older cow also acquired strain 42D, 44A from another older cow added to the milking herd subsequent to the last sampling. It is not known whether this latter cow was also carrying strain 42D or if she acquired it following the use of the milking machines. Then, again, a few animals remained free of any staphylococci while others acquired non-typable strains (Tables 2 and 3). The herd listed in Table 1 that exhibited a chronic mastitic condition had no animal shedding less than two strains in their milk.

As little as 1 wk was sufficient time after the use of the milking machines for 1 heifer in dairy herd No. 2 (Table 2) to acquire the strain identified with the herd. The heifer in dairy herd No. 1 (Table 1) had 2 of the 5 strains in the herd within 2 wk while dairy herd No. 3 had only 1 heifer out of 4 which shed the herd strain in her milk following 4 mo on the milking machines.

ACKNOWLEDGMENT

The authors express appreciation to Lester Barkman for establishing the necessary liaison with the producers' dairy herds.

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THE POTENTIAL AND PROBLEMS OF FOOD HARVEST FROM THE OCEANS[1]

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Abstract

There is a rich potential source of food in the sea to help supply protein to the world's needs. The problems associated with the fishing industry are many and complex. Problems of preservation of the fisherman's catch are directly connected to proper sanitation practices and the control of microorganisms. To solve these problems for the trawl fisherman, several projects are underway at the Gloucester Technological Laboratory which consider industrial sanitation type improvements and steps to govern microbial outgrowth by use of antimicrobial agents.

These projects are concerned with the application of gamma irradiation by different types of colbalt-60 irradiators, the improvement of vessel and shore handling procedures, the use of antimicrobial agents, and even by special innovations in shipping containers and principles. These projects are discussed with their special aspects of sanitation and microbial control.

The fishing industry is learning from the experience of other food industries and hopes to greatly extend the shelf-life of fishery products by application of improved industrial sanitary practices and by the control of microorganisms.

There is a rich source of food in the sea for the rapidly increasing world population. Seafoods have a great potential, not only for the world's basic food supply, but also as the choice of many consumers in this affluent America. The problems associated with the fishing industry are many and varied—as with any industry. The solutions to these problems could be of great benefit to the developing nations of the world as well as to a vital American industry. This discussion will consider the problems primarily associated with the North Atlantic trawl fish industry. In particular, some of these problems with a sanitation or microbiological aspect have been singled out and the approaches to these problems used by the Bureau of Commercial Fisheries Technological Laboratory in Gloucester, Massachusetts will be described.

The oceans of the world, which cover about 70% of its surface, support a fishing industry that harvested nearly 8 million tons of protein food in 1906 and approximately 58 million tons in 1966. Despite this large increase in landings of fish, only about 2% of the world's total food supply is procured from the oceans.

Man has been continuously reaping harvests from this great food resource and is currently deeply involved in investigations to increase his harvests from the sea, to improve upon the efficiency of his harvesting operations and to safeguard the product from source to consumer.

Almost two-thirds of the people of the world live in the developing nations. In many of these countries, the per capita diets are deficient in both quantity and nutritional value. The nutrient most commonly lacking in these diets is animal protein. Fish could supply an inexpensive, yet nutritionally complete animal protein. At present and increasingly in the near future, the world needs to fully utilize all its marine and fresh water food resources.

Seafoods are an excellent source of high quality protein complete in all the essential amino acids needed in man's diet. They are low in cartilaginous material, rich in vitamins, especially the B vitamins, and a good source of minerals. In many seafoods, such as cod or haddock, the fat content is very low and that which is present is highly unsaturated. Fish flesh is low in fiber and is an excellent choice for many special diets.

The North American countries are among the developed nations of this world and, as a whole, have available many rich sources of animal protein. As a result, fish must compete on the open market with the other sources for consumer preference, which is often based on both quality and cost. Seafoods offer the American an excellent opportunity to vary his diet; to help him, the Bureau of Commercial Fisheries has developed a series of recipes for the preparation of fish, thus making available a wide variety of seafood dishes.

However, to take full advantage of this market, the American fisherman has yet to solve many problems in his industry. The Bureau of Commercial Fisheries is endeavoring to help the American fisherman as well as making technical information available to the developing nations of the world.

The fishing industry is many-segmented, and each segment of the industry has problems of preservation;

[1]Presented at the 54th Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, Inc., Miami Beach, Florida, August 14-17, 1967.

some of these are unique to a particular species of fish, whereas other problems are common throughout the industry. The fisherman harvests a product which is extremely susceptible to spoilage and thus requires special handling for preservation. From the moment of catch, this protein food already has a natural complement of psychrophilic microorganisms, primarily the pseudomonads, which account for the rapid onset of spoilage associated with most seafoods. The shelf life of fresh fish could be extended by finding newer methods of controlling or eliminating these psychrophiles, coupled with new sanitary methods of handling fish products. This would greatly increase the market area of fresh fish and be of great benefit to the American trawl fisherman and to the American consumer.

The Bureau of Commercial Fisheries Technological Laboratory is currently studying several methods designed to improve the quality of products and extend shelf life by employing methods to control microbial outgrowth. These methods include radiopasteurization of seafoods, improvement in the shipboard handling of fish, and development of new methods of storing and shipping fishery products.

Some of the major projects of interest to the sanitarian and food processor are given below.

LAND-BASE IRRADIATOR

One of the Laboratory's major programs is to study the uses of atomic energy for the application of radiopasteurization of fishery products. The Marine Product Development Irradiator, located at the Gloucester laboratory, is a semi-commercial, cobalt-60 type irradiator which is capable of processing about 1 ton of fish per hr. Commercially packed fillets kept at 33 F are exposed to a 250,000 curie cobalt-60 source and receive a pasteurizing dose of gamma radiation. Dosages of about 200 kilorads have been found effective in killing approximately 99% of the bacteria, mainly the pseudomonads, thus doubling the normal shelf life.

Consumer benefit studies are currently being conducted. They include experiments which simulate actual commercial operating conditions, in order to field test radiopasteurized fishery products. Large quantities of commercially packed fillets are irradiated at Gloucester and shipped to distant cities such as Seattle, Washington, or Jacksonville, Florida. Samples from these shipments are continuously monitored for temperature of storage and organoleptic and microbiological quality. The results of these studies indicate that the 200 kilorad radiopasteurized fillets arrive at these distant cities in a high quality and very acceptable state and remain so for many days, whereas the controls, i.e., nonirradiated fillets, are fast approaching their spoiled state when they arrive and soon have to be discarded. These experiments and other related radiopasteurization studies will continue. A petition for the clearance of radiopasteurization of fishery products has been presented to the Food and Drug Administration.

The approval of radiopasteurization would be of great benefit to both producer and consumer. There would be a reduction in the amount of normal product waste if shelf life were extended. The producers would be able to expand their markets to distant inland cities. The added cost of radiopasteurization would be approximately 2 cents per lb, but the product cost to the consumer would be the same or less because of the reduction in the total amount of product spoilage. The inland consumer would also benefit by the availability of fresh, wholesome seafood as a variant to his diet.

SHIPBOARD IRRADIATOR STUDIES

A pilot model shipboard irradiator was installed on the exploratory fishing vessel, R/V Delaware, in 1966 and preliminary tests show promising results for this application. Studies using from 50 to 200 kilorads exposure of radiopasteurization applied at sea to freshly caught haddock extended their iced storage life up to 33 days as compared to a normal of 15-17 days. Dose levels of 50 kilorads applied at sea to freshly caught fish were as effective in extending shelf life as 200 kilorad levels applied to regularly commercially landed fish by the land based Marine Product Development Irradiator. Meanwhile, 50 kilorads applied by the land-based irradiator were not as effective in extending shelf life. The assumption is made that the low dose level applied to freshly caught fish having a low surface microbial population may be of considerably greater value in retarding microbial spoilage than radiation applied days later when the microbial population on fish surfaces may be considerably higher in number.

Another finding from the shipboard irradiator studies revealed that prerigor irradiated fish kept at ice storage were more acceptable to trained taste panelists than postrigor irradiated fish. More research into the nature of prerigor and its relationship to spoilage patterns is needed. There may even be a possible relationship between rigor and the onset of microbiological spoilage.

Thus, the results of these experiments demonstrate that irradiating fresh-caught fish at sea can benefit the fishermen. They can stay at sea longer, increasing their likelihood of obtaining a full load of good quality fish. Fish irradiated at sea could be re-irradiated on land after processing into consumer-type packages in order to further lengthen the usable storage life of fishery products.

VESSEL AND SHORE HANDLING SYSTEMS

The Food Engineering group at the laboratory is engaged in several projects related to vessel and shore handling systems. One project has been the re-design and improvement of deck handling systems for the fisherman. They are achieving this through a land-based "mock-deck" which enables them at a minimum of expense, to incorporate new procedures and to do time and motion studies on various systems for handling fish. Numerous innovations and improvements are being tested in an endeavor to improve or modify the existing and perhaps archaic fish handling procedures.

Not only are theories of automatic and industrial engineering being applied, but microbiological considerations are also being considered. In the probable future there will be less human handling, incorporated antimicrobial procedures, and a steady flow of fish from the cull to the final shipboard storage. Improvements in wash boxes, the use of sprays and dips, and the incorporation of antimicrobial agents in wash waters and ice are presently being considered. One of the innovations includes the vacuum evisceration of fish which has great promise not only for efficiency of operation, but also as an effective means of retarding microbial spoilage. The cavity of the vacuumed eviscerated fish has less microbial outgrowth than cavities of fish prepared by the usual slit eviscerated method.

The above improvements will yield a cleaner product with less chance of recontamination by humans or by shipboard filth. Procedures under investigation are being tested by both microbiological and organoleptical methods as well as studied from a cost economic point of view. Pilot studies at sea aboard the R/V Delaware to test some aspects of these systems are being planned for this September (1967).

A major consideration for vessel systems of fish handling includes boxing-at-sea. Many smaller, and some of the larger American and Canadian fishing boats do box their fish at sea. The Scandanavians and Britons are already doing so on a large scale. Boxing-at-sea has many possible advantages from a cost, storage, and handling point of view. It also offers many advantages from a sanitarian's point of view: less chance of recontamination, cleaner decks and pen holds, no forking of fish, and the ability to easily transfer from docked vessel to truck or producer without needless delays. The incorporation of antimicrobial agents into the ice would make boxing-at-sea a convenient method of transferring this ice, along with the fish, from the boat, via shipper to the processor.

One of the major problems of any perishable item is shipping. The Food Engineering group has been studying several aspects to improve upon existing shipping methods. Recently they developed an insulated, leakproof container originally designed for air shipping of fresh seafood. They soon discovered that the container has other important advantages. The leakproof feature permits it to travel with any carrier, and this is especially useful in reaching small cities, whether they are near or distant. This vastly increases a shipper's versatility when handling less-than-truckload quantities. The most significant point is that the insulation performs equally well at low temperatures, so it will prevent freezing as well as warming. Thus, fresh seafood can be introduced into our already-developed frozen distribution system. Product temperatures remain in the superchill range when this is done. Freight rates are very favorable, because no ice is required. Two test shipments have been made from Boston to Chicago and to Dallas with excellent results. Store personnel were very favorably impressed with the lightweight box.

These are only some of the projects being carried on at the Technological Laboratory at Gloucester, and they reflect only a few of the Bureau of Commercial Fisheries' programs designed to aid both the American and world fishing industry. The specific projects discussed are concerned with problems related to microbial spoilage and the need to improve sanitation procedures in order to improve the product and increase its shelf life. The fishing industry is learning from the experience of other food industries and, in turn, hopes to contribute general knowledge that will be of benefit to other food processors. Sanitation and microbial control plays an important role in the industry's outlook.

CURRENT ACTIVITIES OF PUBLIC HEALTH AGENCIES IN THE FIELD OF HOUSING[1]

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The interest of government in the field of housing dates back to the code of Hammurabi, over 4,000 years ago, and has continued to a greater or lesser degree ever since.

The interest of health officials in housing has also been prevalent for many years. At the present time, housing programs that are administrated by health officials account for approximately 40% of the total programs in existence in this country. However, this figure is falling rapidly, due to the fact many health officials don't emphasize the importance of a program in housing and related problems and let the program go by the boards. It is a well-known fact that the greatest disease rates are in slum areas. Taking lead poisoning as an example, there were 115 cases of lead poisoning in Chicago in the first nine months of this year. Almost all of it was concentrated in the slum areas of the city. Babies chewing on broken plaster or old woodwork account for the vast majority of the cases.

It is a responsibility of the health department to see that people live in healthful housing. Housing that poisons babies is not healthful.

One county health department in a southern state has had the cities within its jurisdiction adopt housing codes—or minimum standards of healthful housing, the modern terminology. One of these cities received the first rehabilitation or code enforcement Federal grant in the United States. The grant was close to $800,000, provided under the Housing and Urban Development Program. As its share the city added $400,000 for a project total of $1.2 million. Approximately $1 million of this was public improvements—streets, sidewalks, lights, etc.—that were planned on anyway and which city would have to provide sooner or later.

Certain regular expenses such as the cost of an on-site office, the portion of the time the regular city engineer works on the project, relocation specialists, the building or housing inspector or sanitarian, clerical help, lawyers, etc. may be charged to the city's share of the cost. When it is considered that the city has many of these people on the payroll already, the actual new expenditure by the city may approximate 10 to 20 per cent.

PROVISIONS FOR A CODE ENFORÇEMENT PROGRAM

Generally, projects must be undertaken in areas that are principally concerned with housing, that is, the areas must be either predominantly residential in character before renewal or after renewal.

The first requirement for participating in the urban renewal program is an approved Workable Program for Community Improvement. This is a plan of action by means of which a locality examines its problems of housing blight, evaluates what has been done to solve these problems, determines what still must be done and works out a plan and a schedule for doing it.

The first item in this plan is the adoption of an adequate set of codes and ordinances to regulate the construction, alteration, safety, sanitation, use and occupancy of dwellings and other structures. Five basic codes are required. They are building, plumbing, electrical, fire prevention, and housing. The employment of an adequate staff for the effective enforcement of the codes is also required. At present, the annual recertification of a locality's workable program will not be approved if these codes have not been adopted or if a planned program of systematic housing code enforcement on a city-wide basis has not been put into effect at least six months prior to the request for certification.

In addition to paying for part of the cost of the code enforcement program, the following additional aids are available.

1. Federal grant to cover the entire cost of relocation to eligible families, individuals, businesses, and nonprofit organizations.
2. Direct Federal 3% loans to eligible property owners or tenants for financing the required repairs.
3. Direct Federal rehabilitation grants of up to $1,500 to eligible families and individuals.

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[1]Presented at the Sixteenth Annual Meeting of the Indiana Association of Sanitarians, Indianapolis, October 5, 1966.

[2]Present address: National Center for Urban and Industrial Health, Public Health Service, Cincinnati, Ohio 45202.

4. FHA mortgage insurance for eligible properties.

Eligible public improvements which may be included in the cost of the program are (a) Streets, except expressways and freeways; (b) Curbs, gutters, and public sidewalks; (c) Traffic lights and signs; (d) Street name signs; (e) Publicly-owned street lighting systems and stationary fire and police communication systems; and (f) Street tree planting.

Section 116 of the 1965 Housing Act authorizes Federal grants to cities or counties to assist in paying the cost of demolishing buildings which have been determined to be structurally unsound or unfit for human habitation. The buildings to be demolished must be public nuisances and serious hazards to the public health or welfare. The demolition must be on a planned neighborhood basis. The governing body must have determined that all available legal procedures to secure remedial action by the owners have been exhausted and that demolition by governmental action is required.

The number of areas and the number of buildings requiring demolition must be limited so that there is reasonable expectation that the required demolition can be completed in two years or less. A Federal grant will cover up to two-thirds of the net cost of demolition of the unsound structure. These costs will be subject to an audit on completion of the program.

Rodent Control Activities

Another public agency activity in housing is the use of Office of Economic Opportunity funds for rodent control. Chicago has used these funds to good advantage. Chicago has hired and trained between 200 and 300 people to be what they call "Community Aides – Rat Control" and has sent them into the slum areas on a house-by-house, block-by-block, alley-by-alley basis.

Teams consist of one inspector, one foreman, and three laborers. The inspector enters each house and looks for rodents and insects and if there are signs the team comes into the house and sprays for insects, covers rodent holes, puts out poison bait and traps, etc. A complete record of time and materials is kept, and the owner of the house is billed for the service. If the control visit was not sufficient to do the job, the team comes back again. On any subsequent visits, the owner is not billed; he only pays once if it is the same infestation. If it is a different infestation – say, two or three months later – he is billed again.

This program has reduced substantially the number of rat bites reported in the city. The program not only covers the house, but also the yard and alley. In the outside area, some gassing of rat burrows is done, accumulations of trash, garbage, etc. found on the premises are cleaned up, and this cost is also billed to the owner.

Control of Non-Occupational Lead Poisoning

A second project included in the community development program is a lead poisoning survey. This program is designed to help alleviate the many non-occupational cases of lead poisoning in the city every year. Lead urine samples are taken of all babies in the slum area and anyone else who desires to have them taken. All the positive samples are again tested for a blood-lead determination. Approximately 80 per cent of those positive urine tests prove positive on the blood test. They are then treated by the Health Department. Due to this program, the number of lead poisoning cases reported has risen, but the number of deaths due to lead poisoning has also dropped substantially.

This problem of lead poisoning is one that is prevalent in all of our older cities. The lead-based paints and plasters, which were the only ones available many years ago, have come back to haunt us. The only way I have heard of so far is periodically checking everyone who will be likely to come down with the disease: namely, children. If you tried to cover or remove all the lead-based paints and plasters, the entire city budget would probably just make a dent in the cost of the solution.

One important fact that this program has shown is that where a house is in good condition – no cracked plaster holes in the wall, etc. – the number of lead poisoning cases is almost non-existent. This is even in neighborhoods that were built at the same time and with the same materials as the high incidence neighborhoods.

Tenant Education In Basic Housing Sanitation

Another problem that everyone in the housing field sooner or later runs up against is that of education of people in basic sanitation techniques. Baltimore has its Housing Classes, and Chicago has its Community Aides – Health Educators. In the Baltimore plan, when a tenant or owner is brought before the court for basically a sanitary violation, he is sentenced in the usual way and then the judge gives him the choice of going to the Housing Course while on probation or paying the fine and/or going to prison. The fine is usually the sentence, and the defendant usually takes the Course. The program has not been going on for a very long period of time, but the results so far are very encouraging. The Course is put on by a non-profit agency, but could just as well be done by the Health Department.

Another way of educating some of the people of the slum areas is being tried in Chicago. Approximately twenty Community Aides have been given training in health education and community development. These people follow the rodent control team and try to educate the residents who seem to be in the most need of education. Other personnel are attached to the what are known as Urban Progress Centers, which give training classes on housekeeping, home economics, etc. These Urban Progress Centers are in the city offices set up in the area.

The basic idea of these centers is to bring the civic services, such as health, social security, welfare, building department, etc., into the area where the people can get to them easily. It is a traumatic experience for a person to have to go from floor to floor or building to building trying to get some answers to his problems. Even with the most pleasant city employees, the person finally gets completely disgusted and gives up and goes home, complaining about city government. This problem is bad in some city governments, but in the Federal Government it sometimes gets completely ridiculous.

The State of Pennsylvania has recently released a survey of housing improvement conducted in 49 cities and towns in the state. Of the 49 cities, 35 of them had housing codes with 18 of these codes being administered by health departments. Only 25 of the cities gave cost data for housing activities, and the cost averaged $0.32 per capita. The survey also showed that the activity wanted most by the cities was code enforcement on a block-by-block basis and second was community development programs for housing and neighborhood improvement.

PUBLIC HEALTH SERVICE TRAINING PROGRAMS

The Public Health Service has three basic training programs in the area of housing. The first one is basically a three-day technical seminar for state and local agency officials and community leaders. The second program is a two-week training course in the field evaluation procedures of housing code administration. This course is designed basically for the people who will actually be out in the field making the inspection.

The third program is a four-week course on the American Public Health Association Housing Quality Appraisal Method. This takes in the technical information on the environmental factors of housing along with the actual inspection and office procedure. In addition, the course covers evaluation of the neighborhood and the factors that affect its residential quality.

The housing problems of the United States are not the easiest areas to solve, but they are not the hardest either. We have tools at hand now to solve many of the problems. The civil rights demonstrators have always had housing as one of their rallying cries, and they had good reason for it. Why should anyone be forced to live in an insanity hole when we have the power to correct this problem? It is our own complacency that lets us sit back and pass the "buck" when it comes to alleviating these conditions. Well, we come to the end of the line. As President Truman said, "The buck stops here." "Here" lies with the people in public health work, who can do the job.

THE FOOD-BORNE DISEASE PROBLEM TODAY[1]

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Sanitation is an area where progress comes slowly and is usually achieved only through dogged persistence and determination. But as we look back over the years, we can be gratified to see that progress has been steady and that we are gaining ground on food-borne disease and infections.

One of the first food laws involving sanitation and public health in this country was enacted by Massachusetts in 1784, which provided:

"Whereas some evilly disposed persons, from motives of avarice and filthy lucre, have been induced to sell diseased, corrupted, contagious or unwholesome provisions, to the great nuisance of public health and peace, be it enacted by the Senate and House of Rep. in General Court assembled, ..., that if any persons shall sell any such diseased, corrupted, contagious or unwholesome provisions, whether for meat or drink, knowing the same, without making it known to the buyer, ..., he shall be punished by fine, imprisonment, standing in the pillory, and binding to the good behaviour, or one or more of these punishments, according to the degree and aggravation of the offence." California passed legislation on April 16, 1850 providing: "If any persons or person shall knowingly sell any flesh, or any diseased animal or other unwholesome provisions, or any provisions or adulterated drink or liquors, every person offending shall be fined not more than five hundred dollars, or imprisoned in the County jail not more than six months."

I am confident that all of us agree with the spirit, intent, and punitive provisions of those early efforts to protect the public health and welfare.

Sanitation, in a strict sense of the word, is a relatively new science, developed since 1874 when Pasteur announced and established that microbes "are self-propagating organisms which probably furnish the essence of all of the contagia of disease." This was the beginning for organized public health work. In the ensuing years, as our knowledge of disease and pestilence increased with scientific discovery, plague, cholera, typhoid, typhus, and other filth diseases have been brought under control, until today outbreaks are a rarity when modern sanitation exists.

Our efforts cannot be relaxed, however, because we have not overcome one of the greater threats and hazards to public health, the food-borne infection. Let us turn to the past 15 months and consider some of the experiences of the Food and Drug Administration which emphasize the continuing problem and identify today's need for improved sanitation and microbiological control of production of our food supply.

Salmonellae

In March 1966, through the epidemiologic studies and capabilities of the National Communicable Disease Center and cooperating departments of health, the contamination of dry milk with *Salmonella* came to light. You are all familiar with the findings of *Salmonella new brunswick* in dry milk. During the surveillance and sampling to determine the origin of the contamination, numerous other non-fat dry milks were found to contain *Salmonella.* The problem has not been overcome, but improved sanitation and positive pasteurization processes, coupled with microbiological control programs, appear to be reducing the incidence of contamination.

In April 1966, the Food and Drug Administration encountered *Salmonella* in thyroid powder imported from Denmark, and, within a few weeks, in imported thyroid from Italy, Canada, Argentina, and Uruguay. Expansion of our sampling and surveillance operations soon revealed the contamination of other products of animal origin with *Salmonella,* such as pancreatin, pepsin and liver powder. Contamination of similar items, of both foreign and domestic origin, has not been a rarity. This problem of contamination still prevails and has resulted in numerous recalls of domestic products and detentions of import lots.

In the tri-State area of New York, New Jersey, and Pennsylvania, there was a widespread outbreak of salmonellosis over the 1966 Memorial Day weekend when more than 300 persons suffered the classical symptoms of this disease. Smoked fish produced by one New York processor was found contaminated with *Salmonella java.* This same serotype was isolated from stools of patients as well as from stools of several plant employees. Later it developed that S. *java* was present in the frozen stock of fish for processing.

This incident was soon followed by discovery of *Salmonella* in carmine red, the alum lake of cochineal. This came to our attention as a result of an outbreak of *Salmonella cubana* infections in patients in an

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[1]Presented at the 54th Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, Miami Beach, Florida, August 13-16, 1967.

Eastern hospital. Epidemologic investigation disclosed that all of the victims had received capsuled carmine red, administered as an intestinal marker or indicator in connection with gastrointestinal studies. Examination of the hospital stock of carmine red revealed S. *cubana.* Additional hospital outbreaks were reported from California, Ohio, and Oregon. The production of the contaminated carmine red was traced to one basic manufacturer. The dye is also widely used as a coloring in foods and drugs, and it soon developed that pink summer coatings for candy containing carmine red were contaminated with S. *cubana.* We found that viable organisms carried over into the finished candy. Food seasonings, meat extenders, and barbecue sauces containing carmine red were also found to be contaminated. Numerous recalls of these contaminated foods resulted.

More recently, *Salmonella* was found in chocolate coatings and in finished chocolate candy in which the coatings were used. We do not know the mechanics of contamination or whether the nature of the process is such that conditions favorable to growth of *Salmonella* exist in the processing. The industry is currently conducting research in that area.

Salmonella in dried yeast continues to be a problem. Apparently, a high degree of sanitation must be maintained to control and prevent contamination of the finished product. Contamination of dried yeast has serious public health aspects, since it is frequently used in feeding formulae in hospitals and institutions.

Emphasis thus far has been placed on *Salmonella,* for it is a good illustration of recent advances and confirmations in our knowledge of food-borne infections. Salmonellosis prior to World War II was not recognized as a common food-borne infection. In recent years, undoubtedly as a result of better reporting procedures, improved media and methodology, and greater familiarity with the organism, the National Communicable Disease Center receives reports of about 20,000 isolations from human sources per year. Today, on a nationwide basis, the total number of reported food-borne salmonellae outbreaks are running staphylococci a close second.

While considerable progress has been made in our knowledge and understanding of food-borne infections, even greater knowledge and progress is due in the next few years. As we develop increased knowledge, sanitation becomes more and more important as the logical control measure. Most of our foodborne infections, other than *Staphylococcus,* and to a lesser extent *Clostridium botulinum,* are produced by organisms of intestinal origin or habitat. Therefore, basically we are dealing with a fecal-oral route of contamination. The public health and epidemiological literature reports with increasing frequency food-borne outbreaks affecting large numbers of persons.

SHIGELLAE

Let us look briefly at *Shigella* as an example. Shigellosis has, in general, been looked upon as a filth disease, endemic in some mental institutions, and in some lower socioeconomic communities. Within the past 2 years isolations of *Shigella* have been reported from turkey droppings used as cattle feed, checked eggs, liquid whole eggs, frozen eggs, and a chicken feed mix. During this period, outbreaks were associated with a school lunch line where 201 of 326 pupils served became ill with gastroenteritis. Greenberg, in a 1966 Public Health Report, described a shigellosis outbreak affecting three-fourths of the 320 Army personnel eating a common meal. Potato salad was the suspected vehicle of transmission. The potatoes had been handled under insanitary conditions after cooking, and, for several periods of time, the potatoes, and later the potato salad, were not refrigerated.

The National CDC *Shigella* Surveillance Report covering the fourth quarter of 1965 described two food-borne outbreaks, one involving shrimp salad, the other macaroni salad and rice.

You are familiar with the shigellosis outbreak last November associated with bottled pasteurized milk. These recent episodes may be indicators that we may have more of a food-borne *Shigella* problem than we realize. But here again, we are handicapped by a paucity of data to evaluate laboratory procedures for recovery and isolation of shigellae from foods.

VIBRIO INFECTION

Since 1955, the Japanese have experienced repeated widespread outbreaks of gastroenteritis evidenced by violent epigastric pain and symptoms resembling salmonellosis. The main food involved in these outbreaks has been raw, or partially cooked, inshore fish, though other foods, having no relation to fish, have been implicated. The causative agent, *Vibrio parahemolyticus,* an intestinal organism, has been isolated from stools of the affected. Dr. Gail Dack earlier this year reviewed food-borne outbreaks reported in Japan in 1965. Of 456 outbreaks involving 13,349 cases, *V. parahemolyticus* was implicated in 275, or 60 per cent. There have been no reported infections of parahemolyticus occurring in the United States, but is this infection restricted to Japan? Have we no problem in the United States? Food illnesses of unknown cause occur with regularity in the United States every year. Some of our progressive epidemiologists are studying the problem presented by V.

parahemolyticus in Japan in relation to some of our outbreaks of unknown etiological nature.

VIRAL FOOD-BORNE ILLNESS

Reportedly there are over 100 different viruses which thrive in the human intestinal tract. The incidence of food-associated hepatitis outbreaks has increased in the past 2 years. These have been reported from various parts of the country and have implicated a variety of foods. It is most unfortunate that we are hampered by the inadequacy of present laboratory techniques for isolation and recovery, however, the spread of the virus through food and water has been demonstrated epidemiologically.

MORE SANITATION NEEDED

Effective control of the food-borne illnesses, whether they be bacterial or viral in nature, entails a much higher and more rigid level of sanitation than generally has been practiced, or required, by industry, or by health and regulatory officials. Studies in milk-drying plants have demonstrated the significance of control and proper use of air and air systems in food processing. We are presently looking into the role of airborne microbial contamination, especially in dusts, fogs, and other aerosols that may be created during the processing.

The importance and influence of plant environmental conditions; personal hygiene and sanitary practices of employees; separation of raw material and finished goods processing areas; and proper maintenance of equipment, including proper design to permit adequate cleaning, have been manifested repeatedly.

Confidence in theoretical temperatures rather than a determination of actual product temperatures in thermal processes relied upon to achieve pasteurization or kill, have lulled some operators into a false sense of security. Careful exploration of all thermal processes for weaknesses such as cool spots, shielding from caking or coating, uneven heat penetration, and similar physical factors must be undertaken by the sanitarian, the equipment designer, and the prospective purchaser. We have learned that the foci or vectors of contamination in a food plant are usually obscure and rarely can be pinpointed with any degree of assurance.

Our mode of living and technology probably renders us more susceptible to food-borne infection today. The convenience foods, ready-to-eat items, and frozen prepared dinners requiring only minimum heating prior to serving open avenues for mass infection. Our production and distribution system is such that today the output of a plant may be distributed nation wide, or even worldwide. This means that an infected employee, or a breakdown or deterioration of some phase of plant sanitation, can infect thousands of consumers instead of a limited surrounding community. Our population concentration, human and food animal, with the resultant waste disposal and pollution problems, is likewise conducive to spread of infection.

This means that we have greater problems in sanitation, and that the level of sanitation *must* be raised to offset the greater hazards.

While sanitation is basically and fundamentally a preventive science, we have been, to some extent, working to run down and determine the factors responsible for bacterial contamination. We must give more study and consideration to assure that contamination *does not* occur. Before this goal can be fully attained, however, we need to develop more sound scientific knowledge upon which meaningful control programs can be based. Microbiological methods must be developed, refined, and made more specific and sensitive.

MORE INFORMATION NEEDED

The Food and Drug Administration is taking steps to develop some of this needed scientific data. The National Academy of Sciences is undertaking a broad study of *Salmonella* and its impact on human health, food technology, and animal agriculture in the United States. The project will be carried out under the joint sponsorship of the U. S. Department of Agriculture and the Food and Drug Administration. The project will include a survey of the problem of contamination in the food and agricultural industries by salmonellae, the chain of events that leads to outbreaks of salmonellosis in man, and the effectiveness of current control methods.

The National Academy of Sciences (NAS) will, among other things, seek answers to such questions as:

(*a*) At what point in the chain of transmission of the organism can control methods be most effective in preventing outbreaks of disease?

(*b*) How can the combined resources of Government, the academic world, and industry be utilized most effectively to reduce the potential threat of salmonellae to public health and animal health?

A review and evaluation of FDA's surveillance and enforcement program to control the problem of salmonellosis will be part of the study.

Overall, the NAS study will determine the adequacy of the existing data based on salmonellosis.

Simultaneously, the Midwest Research Institute will carry out a systems analysis of the scope and depth of the salmonella program relative to the total environment, the food and drug industry, and the

American consumer. This project will attempt to bridge the gap between the mass of available scientific data and management approaches for effective control of salmonellosis. In this system ecological study, systems analysis will be combined with mathematical modeling to chart the relationships of the sources, carriers, vectors, and transfer of salmonellae that lead to infection of the American consumer.

An FDA-University-Industry round table meeting of microbiologists having experience with the fluorescent antibody procedure for detection of *Salmonella* was held in June at the Food Research Institute, University of Wisconsin. This was the initial step toward working out, by a cooperative approach an exchange of scientific experiences, a rapid screening technique which shows promise of saving considerable analytical time, thus enabling industry to increase its control measures.

We have plans for research programs on foodborne infections involving some of the other enterobacteria and *Clostridium perfringens*. One of our major food programs for fiscal year 1968, and continuing over the next 5 years, is the potential hazard to the consumer of all types of microbiological contamination.

The responsibility for the laboratory investigations and developments must rest with our clinical and investigative scientists, but guidance, development, and demand for the higher levels of sanitation, and particularly preventive sanitation, must come from the field sanitarian. The role of the sanitarian has been a major one, but it takes on an even greater importance and responsibility because of the increasing complexity of our technology and environment.

THE UBIQUITOUS POTATO[1]

Few foods are capable of growing in as wide a variety of soil and climate as the common potato. Its history can be traced back to 200 A.D. at which time it was cultivated by the Peruvian Indians high in the mountain areas of the Andes. The Spanish explorers found the potato distributed throughout South and Central America, Mexico, and up into the area of what is now the southern United States. Although the wild plants were recognized as a source of food, domestication was limited to the Andean areas of South America.

Today one can see in the markets of Lima, Peru, extraordinary and unusual types of potatoes, the results of centuries of cultivation. They are golden yellow, purple, pink, pale lilac, blue, spotted, and striped. They can be smooth skinned or warty, round or obling, crenated or cylindrical.

Spanish and English explorers obtained potatoes from the Indians to provision their ships. Introduction into European countries soon followed. Records are not clear as to the mode and date of introduction into England, but it was probably during the latter part of the 16th century. Potato cultivation became quite extensive in Ireland and to a lesser degree in England during the 17th century.

Although the potato may have been indigenous to parts of the United States, it was first introduced into the eastern United States in 1621 from England via Bermuda. Later, in 1719, Irish settlers brought potatoes to New Hampshire. The Irish had much to do with acceptance and cultivation of potatoes in New England.

It has been said that few foods have been so designed that they can nourish large masses of people. Nutritional deficiencies are little known in countries where patatoes are the principal food. Down through history there are many instances of humans remaining relatively healthy and disease free on a diet of potatoes and little else for long periods of time. A potato crop failure in Ireland and the resultant famine forced many people to immigrate to America. The fact that potatoes can be grown on relatively poor soil, cultivated and harvested with primitive tools, yield more food value per acre than grain, has been credited with contributing much to Europe's population explosion in the early 1800's.

It wasn't until after the turn of the century that science unlocked the secret of the nutritive value of the potato. When compared to other foods on a dry weight basis, it is an excellent source of many vitamins and minerals, proteins, and, of course, carbohydrates. Potato proteins are deficient, however, in two amina acids, thiamine and cystine. Contrary to popular belief, the potato can be classed as a protein food for it furnishes over 2% of the total protein in our national food supply.

Potatoes can be held under relatively crude storage conditions for rather long periods of time and still maintain much of their nutritive value. Wild animals will not consume potatoes when there is other food around. These storage characteristics have often made the white potato the principal source of certain essential vitamins and minerals necessary to maintain health during times of national emergencies. However, the bulkiness and weight of the potato have made it difficult and costly to transport long distances. Much of the processing today is directed toward weight and volume reduction of this important food product.

Potato dehydration is not exactly a recent technological achievement. The natives of Peru dehydrated potatoes by freezing at night, expressing the juice from the thawed potato with their bare feet during the day. The cycle was repeated several times until the moisture content was low enough to yield a stable product. Several centuries later the freeze-drying process was "discovered" again and is now one of the fasting growing segments of the food processing industry. The first World War gave considerable impetus to potato processing, particularly dehydration. After another world conflict, coupled with the increased use of convenience foods, potatoes are being processed at an astronomical rate. The most spectacular increase has been in frozen potato products, although they are in second place to the longer established dehydrated products.

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[1]From Oregon State University's *Food Processing Review*, September 22, 1967.

WHAT THE SANITARIAN SHOULD KNOW ABOUT SALMONELLAE AND STAPHYLOCOCCI IN MILK AND MILK PRODUCTS[1]

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SALMONELLAE

Eighteen months ago, no one thought salmonella contamination was a problem for the milk industry. In fact, the milk industry was not even represented at the National Conference on Salmonellosis held at the Communicable Disease Center in March 1964. However, in the past 18 months, the discovery of salmonellae in powdered milk has caused the recall of many nationally distributed brands, resulting in economic losses in the millions of dollars. What are salmonellae? Why do we worry about them? What can be done to eliminate them from milk and milk products?

The organism.

The genus *Salmonella* is one of the genera in the family *Enterobacteriaceae*. The organism is named after Dr. D. E. Salmon, an American bacteriologist and veterinarian who in 1885 isolated *Salmonella cholerae-suis*, then believed to be the agent of hog cholera. Species of the genus *Salmonella* are classified together because they share similar morphological, antigenic, and biochemical characteristics. The bacteria reside in the intestinal tracts of people and animals, and are spread through feces to food, water, and other animals. The number of different salmonella serotypes is around 1200 today, and it increases regularly as new types are discovered. Salmonellae are said to be ubiquitous in nature, and the organisms have been isolated from almost every variety of mammals, birds, amphibians, and reptiles, and even from some insects. A few of the species seem to be host-adapted: *Salmonella typhi* and (to a lesser extent) *Salmonella paratyphi* to man; *Salmonella pullorum* and *Salmonella gallinarum* to fowl; *Salmonella abortus-equi* to horses; and *Salmonella abortus-ovis* to sheep.

In addition to being ubiquitous, salmonellae are notoriously hardy. They are able to withstand temperature changes, pH changes, and desiccation better than most other non-spore-forming enteric bacteria. Salmonellae are frequently isolated from frozen food products, and they are able to survive in ice for long periods of time. Sensitivity to heat and pH vary depending on the particular salmonella serotype and the food medium involved, but no salmonellae can survive exposure to the time-temperature effect of pasteurization and to pH values lower than 3 and higher than 9.

Salmonellosis in humans.

In man, clinical symptoms of salmonellosis occur usually between 8 and 48 hr after he has ingested the organism. Salmonellosis is manifested in 4 distinct clinical syndromes: gastroenteritis, bacteremia with metastatic spread, enteric fever, and asymptomatic carriage. In the most common syndrome, gastroenteritis, the patient usually suffers from abdominal cramps, diarrhea, fever, nausea, and vomiting. The disease is usually self-limiting, lasting only a few days, however serious complications and even death can occur. Particularly susceptible to complications of salmonella infection are infants, young children, the elderly, and patients already debilitated from other medical illnesses. Although there are variations in pathogenicity, it is best to assume that all salmonellae are capable of producing disease in man. Knowing what concentration of organisms will produce human illness is obviously very important to the food industry. Unfortunately, this is still an unresolved issue, and estimates have varied from as few as 15,000 to as many as several million. Undoubtedly a number of variables such as host-resistance and infecting serotypes are important. Because the organism is capable of multiplying both in food products and during household food preparation, it is important to strive for elimination of all salmonellae from all foods, particularly those foods that will be eaten without being cooked.

How common is salmonellosis in the United States? The Salmonellosis Unit of the National Communicable Disease Center has received reports of approximately 20,000 laboratory-documented cases per year since 1963, but these may actually be no more than 1% of the actual cases. Figure 1 shows the age distribution of patients with laboratory-confirmed salmonellosis. About 55% of reported cases are in children under the age of 10, and this is the age group that is particularly susceptible to complications of

[1]Presented at the 54th Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, Miami Beach, Florida, August 13-16, 1967.

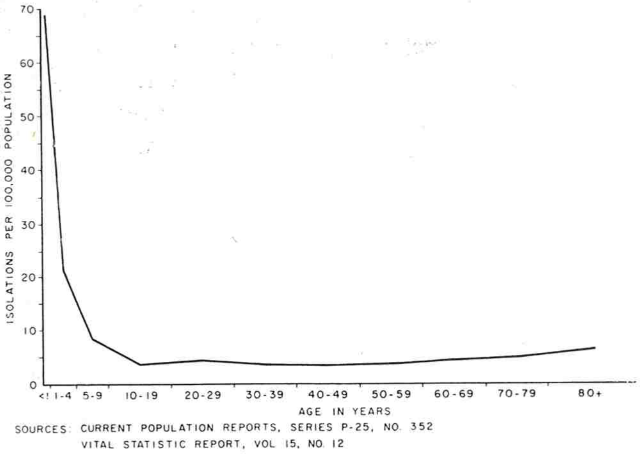

Figure 1. Age distribution in 1966 of patients with laboratory-confirmed Salmonellosis.

salmonella infection. Cases occur in all parts of the United States in all seasons, but they are more common in summer, when warm temperatures and outdoor meals create conditions favorable for bacterial multiplication.

Salmonellosis in cattle.

Various *Salmonella* serotypes infect cattle of all ages, causing either clinical disease or sub-clinical infection. Clinical salmonellosis is more common in calves than in older cattle. Many die, and those that have had salmonellosis, even mild or sub-clinical infections, usually continue to excrete salmonellae in their feces *(7)*.

Until recently, salmonellosis in cattle was not considered a serious problem in the United States, but now its appearance among dairy and beef cattle, particularly those held in feed lots, is becoming a major problem. In 1966, 4.5% of all nonhuman isolations of salmonellae in this country were from cattle *(10)*. In Arizona, 33% of the feed lot animals (1 to 2 years of age) examined between 1958 and 1962 were infected with salmonellae *(7, 8)*. In early 1966, an outbreak of severe *Salmonella* infection occurred in herds in midwestern Canada, with mortality rates of 32% in adult animals and 63% in calves. Abortions occurred in 16% of the cows *(8)*. These infections were attributed to contaminated bone meal.

Salmonella infection in dairy cattle is clearly not uncommon, and in all probability will continue as long as the animals are fed contaminated animal feed. Transmission of infection from infected cattle to man occurs primarily through man's consumption of raw or improperly pasteurized milk and milk products, and through ingestion of insufficiently cooked and contaminated beef that is insufficiently cooked.

Salmonella contamination of milk.

Salmonella contamination of milk may be either intrinsic or extrinsic. The former more commonly occurs during the febrile stage of bovine salmonellosis, while extrinsic contamination may occur through introduction of animal feces. Milk is a favorable medium for growing salmonellae and is actually used together with an inhibitory dye as an enrichment medium to isolate salmonellae.

Numerous outbreaks of salmonellosis in this country and abroad have been traced to raw or improperly pasteurized milk and milk products. Five epidemics caused by consumption of contaminated raw milk have been reported to the Salmonellosis Unit in the 5 yr that national surveillance has been in effect. Four of those 5 outbreaks occurred in the western United States, where the practice of drinking raw milk is more common. The latest—in Washington State earlier this year—involved at least 40 persons, 33 of whom were hospitalized *(11)*. In the last 5 yr, no cases of human salmonellosis have been traced to pasteurized milk, and none should be, since pasteurization effectively destroys salmonella contamination.

In 1966, epidemiologic investigation of 35 cases of salmonellosis resulting from a rare serotype, *Salmonella new-brunswick*, showed that over 80% of the families involved were regular users of instant nonfat dry milk. On further investigation, organisms of this same serotype, *S. new-brunswick,* were found in several samples of certain nationally distributed brands of powdered milk. The trail eventually led to a single processing plant, which was handling 11 million lb of milk a year, most of which was instantized. The processing plant bought raw whole milk direct from about 250 farms and also obtained raw skim milk from four dairies. In all, approximately 800 farms served as routine sources of milk for the plant.

Figure 2 is a diagram of the skimmilk drying and instantizing plant. The initial steps of cream separation and butter making have been omitted. The part of the process of interest began with skim milk passing through a plate heater. In this heating process, the temperature of the milk supposedly rose to 162 F and stayed there for 10 to 15 sec. There were, however, no thermostatic controls, flow diversion valves, or time controls; consequently, there was no assurance of pasteurization, and at no point later in the process did the milk receive enough heat for it to be pasteurized. Milk was then concentrated in a series of three vacuum pan evaporators prior to drying. The temperature in the evaporators appeared actually to favor the growth of any microorganisms that gained entrance *(4)*.

"Roller drying" and "spray drying" are both used by the milk-drying industry. The plant in question used the more common method—spray drying. The process consists of introducing a fine mist of concentrated milk, under pressure, into a very hot chamber. Drying occurs instantaneously, and the fine powder produced is known as "spray dried base powder."

A pneumatic system transports this powder to a sifting apparatus that removes coarse aggregates of

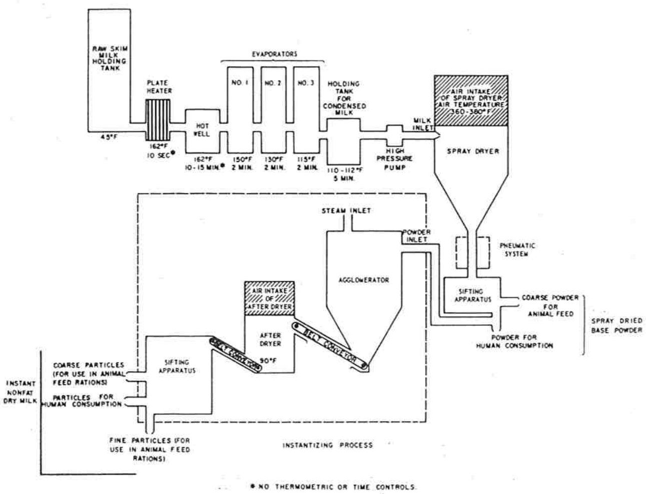

Figure 2. Schematic diagram of the skimmilk drying and instantizing plant.

material that cannot be used for instant nonfat dry milk. The next step is the agglomerating or instantizing process, in which moisture in the form of steam is applied to the base powder; the agglomerant is dried, and the net result is a particle with increased surface area relative to weight, which dissolves more easily when mixed with water. This product is instant nonfat dry milk. Base powder can be instantized at the drying plant, sold to other companies that in turn instantize and package it under a variety of brand labels, or sold for use by the baking industry. The milk processed by the plant in question was instantized there and distributed to jobbers and repackagers; it eventually filled the boxes of several widely distributed brands of instant nonfat dry milk. Some of this plant's dried milk was also purchased by federal and state governments for distribution through various food supplement programs *(4)*.

In addition, milk of the same quality as the products for human consumption and subjected to the same processing, but which is too coarse or too fine for marketing, is added to various animal feeds.

When epidemiologic evidence pointed to this plant, the Division of Environmental Engineering and Food Protection, PHS, began a thorough inspection of the procedures, design, and construction of the equipment, and the cleaning methods used in the plant. The equipment for handling liquid milk was designed so that it could be cleaned easily, but the spray dryer and instantizing system presented several cleaning problems. A baffle plate inside the dryer and a trough and screw used to remove the milk powder had open seams and crevices, which made adequate cleaning extremely difficult. The instantizing system had several welded joints with rough surfaces, numerous crevices and open seams, and a series of thin rods and dividers located in the after-dryer; these design features allowed caked material to collect in inaccessible places. The plant procedure was to dry-clean the spray dryer with brushes daily and wet-clean them once a month. The agglomerator was subjected to wet cleaning weekly, but because of the sticky consistency of the product at this stage of processing, deposits of milk accumulated in much less than a week *(4)*.

Air intakes for the dryer and after-dryer were located in the room with the sifting and bagging operations, where the atmosphere was thick with dried milk solids. The filters on these intakes were changed frequently, sometimes even while the equipment was in operation.

Samples of milk in various processing stages and of the environment were examined for bacteria by the Epidemic Aid Laboratory Section, National Communicable Disease Center. Several of the milk samples were found to be contaminated with S. *new-brunswick*. Eleven isolations were obtained from samples of instant nonfat dry milk collected on the first, second, and fifth days of a 5-day survey.

This outbreak disclosed several important aspects of salmonella contamination of dried milk: (*a*) because of the large number of suppliers to a processing plant, such as the one in question, it is both very difficult to identify the original source of contamination and very important to guard against such contamination; (*b*) the temperature requirements for pasteurization should be strictly adhered to and regulated with extreme care; (*c*) milk drying and instantizing machinery is exceedingly difficult to clean; once salmonellae are introduced into the plant, it requires great efforts to eradicate them; and (*d*) powdered milk is distributed extensively at the wholesale level, and introduction of contamination from a single cow can "snowball;" for example, salmonellae excreted from one cow can contaminate a lot of milk from a single farm and milk from this farm then forms a portion of a dairy lot, which eventually reaches the processing plant; the dried milk from one plant may be purchased by several companies and blended into nationally distributed brands.

In all probability, this is what happened in the S. *new-brunswick* story. Although the original *Salmonella* source was never discovered, it probably was a single cow at one of 800 dairy farms. Once salmonellae were introduced, they spread throughout the plant. Finally, milk powder from the plant was distributed nationally by a number of large companies over a several-month period and caused human illnesses in 17 states from California to Massachusetts.

As a result of this investgiation, the USDA and USFDA, in cooperation with many dairies and milk processing plants, have undertaken a continuous sampling program, which consists of examining milk and environmental samples from the various milk drying plants. To date, about 14 nationally distributed brands of powdered milk have been recalled because of *Salmonella* contamination, and many different *Salmonella* serotypes have been identified. The magnitude of the problem is tremendous. In the first 6 months of 1967, the USDA collected product and environmental samples from approximately 200 dry milk plants in 19 states; 1% of the 3,315 product samples analyzed and 8.2% of the 1,475 environmental samples contained salmonellae. In those 6 months alone, 21 different *Salmonella* serotypes were isolated *(12)*.

It will not be easy to eliminate salmonellae from powdered milk. But a start can be made by requiring effective pasteurization of all raw milk, careful cleaning and sanitizing of plants and equipment, and frequent testing of finished products.

Staphylococci

The organism.

Staphylococcus aureus, a gram-positive coccus, causes a variety of clinical illnesses in humans and animals; they range from skin infections and gastroenteritis to overwhelming sepsis and death. The organism grows slowly at temperatures below 25 C and it is killed by pasteurization. Different strains of the organism produce a variety of biologically active enzymes and toxins, of which the most important for this discussion is enterotoxin. Staphylococcus enterotoxin is a water soluble protein with a molecular weight of between 15,000 and 25,000. It is heat resistant and can survive boiling for as long as 30 min. Also difficult to deactivate chemically, it can survive at a pH as low as 5.0 and as high as 8.0 *(5)*.

Epidemiology

Staphylococci are widely distributed in nature. They exist commensally in large numbers on normal human skin and mucous membranes and are found most abundantly in the anterior nares. In nature, staphylococci are found in many species of wild and domestic animals and birds, but their role in causing disease in these animals is unclear. However, documented illnesses, particularly of bovine mastitis, have occurred in sheep and cows. Courter and Galton, in 1962, estimated that about 70% of all dairy herds in the United States had staphylococcal mastitis *(6)*.

Staphylococci in milk or milk products cause gastroenteritis in consumers when they ingest the heat-stable enterotoxin produced by the organisms. Symptoms, consisting of nausea, vomiting, abdominal pain, and watery diarrhea, occur from 1 to 6 hr after ingestion of the food. Recovery is usually within a day, and death is most unusual *(9)*.

Staphylococci in milk and milk products.

Foodborne disease outbreaks resulting from staphylococcal contamination have been traced to milk, cheese, and especially to cream- or custard-filled bakery products. Only 2 major reported outbreaks have been associated with dried milk, 1 in England involving nearly 1,200 persons *(1)*, and 1 in Puerto Rico in 1955 involving 775 schoolchildren, who became ill after consuming spray-dried milk produced in the United States *(2)*. The milk had been stored in unrefrigerated freight cars for up to 48 hr before being dried.

There are several reasons why food poisoning outbreaks caused by staphylococcal enterotoxin in milk are so uncommon: (*a*) it takes an exceedingly large inoculum to produce sufficient toxin to cause illness; (*b*) the milk must be held at a fairly high temperature for a reasonable time, i.e., above 80 F for at least 24 hr, to produce sufficient toxin to cause disease; (*c*) unless the milk is drawn under very hygienic conditions, other organisms will overgrow the staphylococci; (*d*) the contaminated milk is usually diluted with milk from other cows, thus diluting the toxin below the point where it will cause illness *(5)*; (*e*) only about 4% of staphylococcal strains isolated from milk are capable of producing enterotoxin *(3)*.

The rarity of these conditions demonstrates the importance and efficacy of refrigeration and pasteurization of raw milk prior to drying. Enforcement of these basic sanitary principles will prevent outbreaks of milk-borne staphylococcal disease.

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ASSOCIATION AFFAIRS

STATE SANITARIANS AND FIELDMEN MEET IN WISCONSIN

The twenty-third annual meeting of the Wisconsin Association of Milk and Food Sanitarians (WAMFS) was held jointly with the Wisconsin Dairy Plant Fieldmen's Association on September 14 and 15, 1967, in Madison, Wisconsin.

Highlights of the two-day program included talks on "Water Pollution and Waste Disposal" by Tom Frangos, Wisconsin Department of Resource Development; "New Developments in Detergents" by Dick Bakke, Klenzade Division, Economics Laboratories, Inc.; "The Grade A Milk Program Today" by W. R. McLean, U. S. Public Health Service; and "Changes in Agricultural Extension" by Henry Ahlgren, University of Wisconsin.

The program also included a tour of the World Food Fair at the Dane County Fair Grounds as well as business meetings of both groups.

The WAMFS unanimously passed the following resolution at its meeting: "The Wisconsin Association of Milk and Food Sanitarians expresses to the Executive Board of the International Association of Milk, Food, and Environmental Sanitarians our approval, in principal, of the proposed merger of the International Association of Milk, Food, and Environmental Sanitarians and the National Association of Sanitarians, and our general agreement with the tentative By-Laws of such a unified organization, as set forth in the "Third Draft" of said By-Laws.

"The Wisconsin Association of Milk and Food Sanitarians requests the Executive Board of IAMFES to make every effort to eliminate the provision for two classes of membership (active and associate) based on formal education or other criteria, as provided in Article II, Sections 1, 2, and 5; Article III, Section 1; and Article V, Section 2.

"We also recommend changes in Article VII, Section 1, and Article IX, Section 3, to provide that each state Affiliate be represented in the Governing Council by its Secretary, as in the present IAMFES Affiliate Council, or by a 'Designated Representative'."

The WAMFS's "Sanitarian of the year" award went to Mr. Harry Wood, Quality Control Supervisor of the Fairmont Foods Laboratory. Gary Moe, Mondovi, Wisconsin received the WDPFA award of a $300 scholarship. Gary is a freshman at Wisconsin State University, River Falls.

INTERIM REPORT OF THE COMMITTEE ON SANITARY PROCEDURES—1966-1967

The following is a brief interim report of the activities of the Committee on Sanitary Procedures from July 1, 1966 to July 1, 1967.

3-A Ad Hoc Meeting on Milking Systems, Des Plaines, Illinois, September 29, 1966. Dick B. Whitehead presided at the request of the 3-A Chairman, Dean R. Stambaugh, who was unable to attend this particular meeting. Dick B. Whitehead and C. A. Abele represented CSP-IAMFES and R. F. Rintlemann sat in as representative of IAMFES. This was the first of a series of meetings in the process of formalizing the much needed Milking Systems Practices. A most productive and informative meeting.

3-A Ad Hoc Meeting on HTST Pasteurization, Atlantic City, New Jersey, October 26, 1966. Dick B. Whitehead represented CSP-IAMFES at this meeting. The purpose of the joint meeting was to give ADMI representatives an opportunity to set forth in detail an alternative method for the integration of timing pumps or timing devices into the HTST Pasteurization Circuit. Primary application would be for the Dry Milk Industry. A most informative and enlightening session.

3-A Ad Hoc Meeting on HTST Pasteurization, Schiller Park, Illinois, November 17, 1967. Dick B. Whitehead represented CSP-IAMFES at this meeting. The purpose of the meeting was to consider a request from the ADMI for an amendment to the 3-A Accepted Practices for HTST Pasteurization to allow a timing pump of the high pressure or homogenizer type to be located downstream of the flow diversion device in a HTST Pasteurizing System used to repasteurize condensed product for drying in a process in which the product pressure required for drying is at least 1000 pounds per square inch. A very informative meeting — agreed ADMI would make arrangements to test as many of these methods as soon as possible and provide for committee observation.

3-A Sanitary Committees Meeting, Miami Beach, Florida, April 6, 7, 8, 1967. Representing IAMFES and CSP were C. A. Abele, B. J. Conner, Floyd Fenton, H. R. Irvin, W. M. Jordan, Joseph H. Karsh, C. K. Luchterhand, James A. Meany, Sam O. Noles, O. M. Osten, R. M. Parry, R. G. Semerad, H. L. Thomasson and D. B. Whitehead. R. G. Semerad sat with CSP as a guest from USDA.

I consider this a laudable participating number of our Committee in the interest of CSP-IAMFES. This was a very productive upgrading and updating session. New amendments completed and signed ready for publication are as follows:

(a) Evaporators and Vacuum Pans (#1600) was amended to permit rolled tubes.

(b) Plastics (#2000) was amended to include ABS resins, and vinyl fluorocarbons.

(c) Silo Tanks (#2200) was amended to clarify venting and agitator motor location.

(d) Air Under Pressure Practices were amended to provide for high pressure air.

(e) Permanent Pipelines Practices were amended to substitute a more effective surface comparator standard.

The new Supplement #7 for diaphragm valves has not yet been signed. The official copies are in preparation, pending the completion of a new drawing. It is to be (regrettably) reported that further action on the HTST practices amendment was tabled pending the demonstration of an operational trial to test the hook up, instrumentation and controls which were specified in the amendment. Representatives of ADMI were asked to proceed with arrangements for such a trial, at which CSP-USPHS rpresentatives may be present.

Meeting of Users and Ad Hoc Groups on Milking Systems Practices, Miami Beach, Florida, April 8, 1967. Chaired by D. J. Norton, DFISA Task Committee on Milking Systems. CSP-IAMFES represented by C. A. Abele, J. S. Karsh, R. M. Parry, H. L. Thomasson and D. B. Whitehead. F. E. Fenton also present representing both CSP-IAMFES-USDA. This too was a most constructive meeting. It would appear that many thorny problems are being both understood and objectively resolved.

One other meeting represented considerable impact and involved participation by your Chairman, D. B. Whitehead, was a Salmonella Conference conducted at Oklahoma City, Oklahoma, March 6, 1967 (Oklahoma State University Extension Center). D. B. Whitehead participated on a panel discussing this serious problem of Salmonella with members of Agriculture, Food and Drug and Public Health Service. I feel that it is significant in reporting on this particular activity due to the fact that Sanitary Practices and design and construction of equipment play a considerable part in the control of this very serious contaminate.

It is also to be pointed out that there has been continuous and active participation in exchange of ideas by phone and letter of the various Committees Members. Particular note is to be made of R. M. Parry's activity as it relates to the Milking Systems Practices.

National Conference on Interstate Milk Shipments, Miami, Florida, April 2-6, 1967. A major portion of the CSP-IAMFES was present at this meeting. It is important to note that members of CSP representing IAMFES are quite active in all phases of the industry therefore providing them with an objective attitude and a full knowledge of the problems when equipment standards or sanitary practices come before our Committee for consideration.

Another significant milestone in the activity under consideration by IAMFES for and by CSP activity has been the exploration and contact with the major segments of the Food Industry outside of Milk Industry with the idea of broadening CSP activity into other major food fields. A brief resume of activity and concepts may be found in the rather brief review of these activities to be given at IAMFES Meeting at Miami Florida, August 15, 1967.

I wish, personally, and for the entire Committee, to express our deep feeling of loss for the person and personality of Milton Fisher as well as for the great loss of his contribution that we will suffer because of his recent death. Milt did not speak in a loud voice, but his message was always clear and his council constructive and welcome over the many years that he was a member of CSP-IAMFES and a dedicated participant in the 3-A Program.

Committee Members

Dick B. Whitehead, *Chairman*, C. A. Abele, D. C. Cleveland, Kenneth Carl, M. R. Fisher*, P. J. Dolan, Harold Irvin, W. K. Jordan, Joseph Karsh, C. K. Luchterhand, James A. Meany, Sam O. Noles, Richard M. Parry, George H. Steel, H. L. Thomasson, F. E. Fenton, O. M. Osten and Dudley J. Conner.

*Deceased.

NEWS AND EVENTS

SEEKS SAFETY GUIDELINES TO PREVENT FOOD POISONING

Food safety "guidelines" to virtually eliminate chances of botulism and other types of food poisoning are being sought by a Michigan State University food scientist, Dr. Richard V. Lechowich. These guidelines would insure food safety, even if the food product is mishandled after processing.

"The real challenge is to find additives or new methods of processing that will make food safe without affecting its quality or taste," said Lechowich. "And it has to be something that will work under various conditions and with various types of the same product."

"Many times in our research we'd find something that would prevent the growth of bacteria which causes food poisoning in a particular food product, for example. Then we'd try it on the same product a few months later and find it doesn't work. The variables that influence bacterial growth are so small that we can't always detect them. But the bacteria can, and they will thrive under one set of conditions and die in another."

Much of Lechowich's research is concerned with finding a method for eliminating chances of botulism poisoning from smoked fish, particularly the whitefish chub which has been the most commonly smoked fish in Michigan. At present, alewives are competing with the whitefish chubs for space in the Great Lakes—and the alewives are winning. Introduction of Coho salmon, a predator of the alewife, may improve the situation.

Dr. Lechowich said he is trying to find some combination of fish moisture, acidity, salt content and/or additive that will leave the smoked fish safe from food poisoning, even if they are subjected to temperature abuse.

But this isn't easy. As Dr. Lechowich noted, the oil content of fish changes from one season to the next. As a result, the moisture content of the fish changes and this affects its ability to absorb salt, sodium nitrite and other compounds which can inhibit bacterial growth and prevent chances of food poisoning.

"We'd like to establish a quality control index," explained Lechowich. "This would tell us quickly whether a product was safe for consumption or what would have to be done to make it safe. Once we can establish guidelines and determine all the variables that affect bacterial growth, we can develop fast tests for determining the safety of food products. This information would also be useful for testing the safety of other foods, including synthetic food products."

Dr. Lechowich is also studying salmonella and staphylococci food poisoning to find the tolerance of these bacteria to different levels of moisture, acidity and temperature. This basic research would also help to insure food safety.

DAIRY CONFERENCES SCHEDULED AT UNIVERSITY OF WISCONSIN

Two mid-winter meetings of interest to dairy plant operators, fieldmen and sanitarians have been scheduled to be held at the University of Wisconsin, Madison. The first is the annual Dairy Manufacturers' Conference on January 31 and February 1 and the second is the annual Dairy Plant Fieldmen's Conference on February 1-2, 1968.

Topics of timely interest are set up for discussion on the program for the Dairy Manufacturers' and include Aflatoxins in Foods, Continuous Italian Cheese Manufacture, The State's Role in Dairy Product Promotion, Butter and Cheese Sauces in Canned Vegetables, Rennet Coagulation Test with a Recorded End Point, Egg Products for the Dairy Industry, A Realistic Approach to Milk Pricing, Linear Programming for Profit Maximization, New Horizons in Food Production, Wisconsin's New Water Pollution Laws, Pros and Cons on Changing the Federal Definition of Butter, Latest Developments in Starter Cultures, and Instrumentation for Milk Fat Testing.

The program for the Dairy Plant Fieldmen's Conference will likewise cover a broad area of interest. Discussion topics include Automation of Records, Dairy Production Research of Special Interest to Dairy Plant Fieldmen, The Status of New Methods of Testing Milk for Fat and Solids-Not-Fat, Fly Control Recommendations for 1968, Current Problems With Bulk Milk Handling, The Pesticide Situation and the Dairy Industry, What Dairy Plant Fieldmen Should Know About the Food and Drug Administration Program on Milk and Dairy Products, Enforcement of State Laws and Regulations Affecting Dairy Quality Improvement Work, and The Problem of Evaluating and Accepting New Milk Handling Equipment on the farm.

A number of experienced speakers from other universities and organizations will assist members of the staff of the University of Wisconsin Department of Food Science and Industries in putting on the two programs. Further information on the conferences may be obtained from H. E. Calbert, Department Chairman.

DAIRY SCIENCE CLUB AT TEXAS A&M HOLDS STEAK FRY

The Texas A&M University Dairy Science Club held its annual fall steak fry at Hensel Park in College Station recently. Twenty-five club members and their wives attended the picnic. Together with the faculty and staff, forty-five people attended the occasion.

The social committee provided recreation for the event. The biggest attraction was a football game, with Undergraduates scoring 0, Faculty and Graduate Students 6. Dr. H. E. Randolph coached and was quarterback for the winning team.

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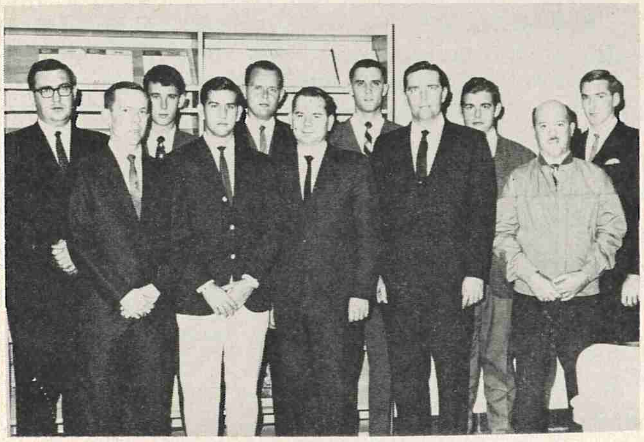
PRODUCERS CREAMERY COMPANY REPRESENTATIVES SPEAK AT TEXAS A&M



Officials of Producers Creamery Company, Springfield, Missouri, were recent speakers at Texas A&M University for the Food Plant Management class. Dr. Larry Claypool, Director of Research spoke on the Organization's research approach; and Mr. Floyd Wood, Personnel Director, spoke on the personnel selection, training and management.

Identified in the attached photograph, from left to right: Dr. H. E. Randolph, Associate Professor, Texas A&M; Bill Armstrong; Gary Webb; Alex Fondeur; Terry Broswell; Dr. Larry Claypool, Research Director of Producers Creamery; Dennis Simmons; Mr. Floyd Wood, Director of Personnel for Producers Creamery; Ray Nolan; Al Lopez; and James Howard.

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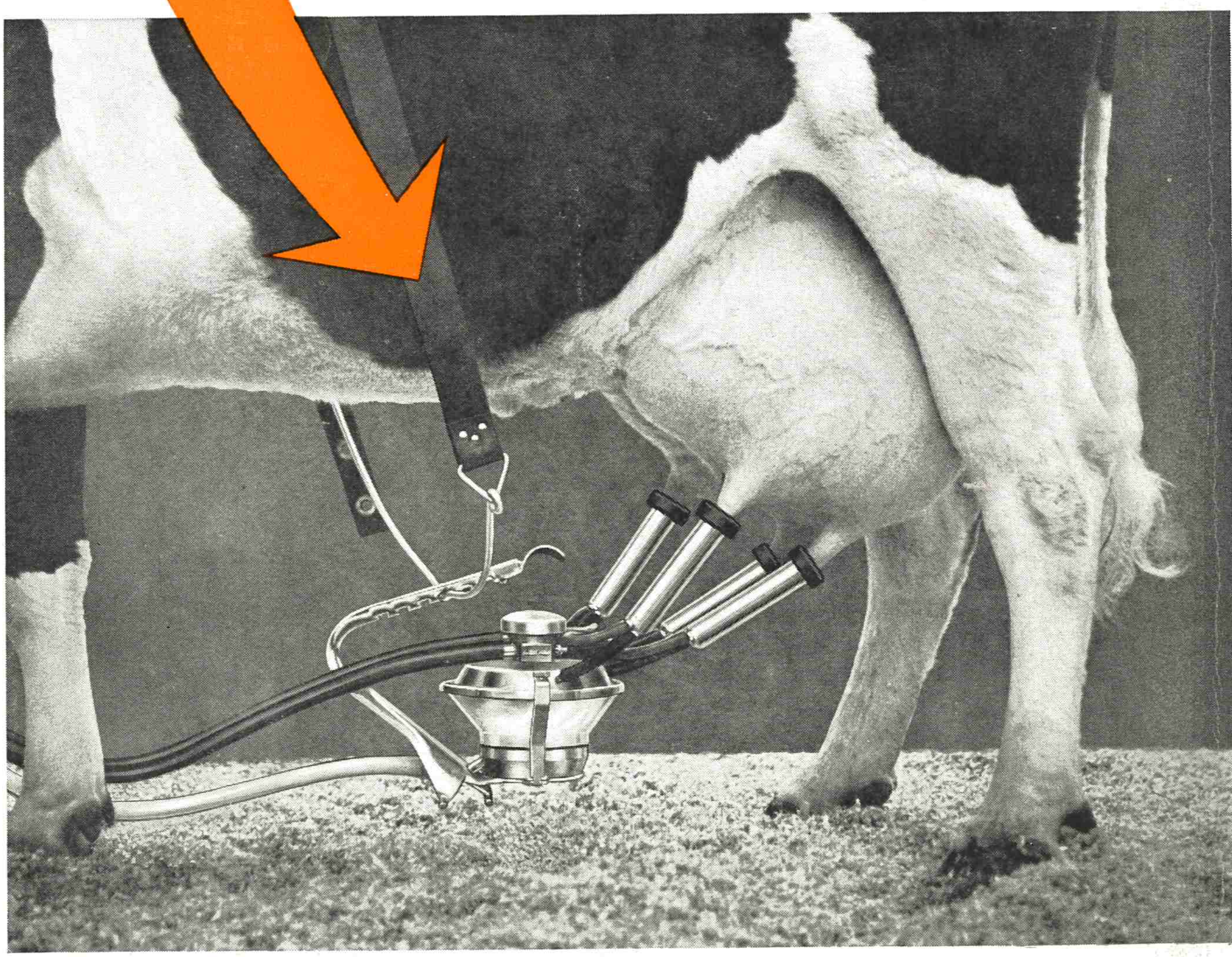

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