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

Managing through a Crisis – Successfully

Evaluation of Methods to Analyze Raw Milk

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Past President's Message

What a successful 73rd meeting your association had near Minneapolis, Minnesota the first week in August! The big surprise was the total attendance of 850 people, about double most years. The key to this was an outstanding program planned by your Executive Board and the local Minnesota members. Attendance at some sessions was overflowing, until all could be held in part of the banquet hall. Field, food, milk and environmental sessions drew well, but the *Listeria* and *Salmonella* symposia seemed to be the big drawing cards. We attracted people who had never attended before. All social activities went well and accomodations were great. For this we owe Mike Pullen and Roy Ginn many thanks.

Exhibits

The twenty-seven exhibits were well received by nearly everone. Nearly 100 people visited them all and got their card filled with stickers resulting in three people receiving $50.00 each. Your Executive Board voted to approve up to 75 exhibits for the 1987 meeting in Anaheim. Hours to visit them were limited to when sessions were not being held and strict efforts are being made to keep them educational, as they were this year.

Ivan Parkin Lectureship

Dr. J.C. Olson, Jr. gave an outstanding presentation for the first lectureship and keynote address. Thanks to the Foundation Fund and money provided by sustaining members this will be continued.

Student Scientific Papers

For the first contest of scientific papers presented by students, we drew six. All were well presented and Christine Bruhn won the top prize of $500.00. Again this was recommended by the Foundation Fund and run by Dr. Lloyd Bullerman and his committee.

Visual Aids Library

Slide/cassette tape sets, videotapes and other visual aids will be purchased for loaning to members. This library will be at the Ames office. Limited funds will mean a small selection for the first few years, but it will grow because of Foundation Funds.

Affiliates

William W. Coleman II replaces Helene Uhlman who gave many years of service as Chairperson of the Affiliate Council. Contact was made with one officer of each affiliate this past year. A summary of the previous calendar year's activities as provided by each affiliate will serve as the basis to select the Shogren Award winner each year.

Financial Situation

Your association was barely in the black this year because of so many investments for the future. A new and larger computer was purchased, the 800 telephone line was added and more part time help was hired to solicit advertising. The result was a 75% increase in advertising and greater service to members.

Thanks

I appreciate the opportunity to serve as your president this past year. It was a tremendous opportunity to learn and with your Executive Board initiate a variety of new efforts. Your association is in good hands with Roy Ginn as President and Ron Case newly elected to the Executive Board. Volunteer to serve your association on committees. Thanks to the cooperation of the Executive Board and support of IAMFES staff and members your association continues to move forward.

Sidney E. Barnard
Past President, IAMFES

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Managing Through a Crisis - Successfully

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When a crisis occurs, the management of the issue should be handled like any other decision-making action in the organization. If crises are managed properly, they are not in themselves a crisis, but instead another activity that may occur on a day-to-day basis. However, the organization must be prepared.

One of the first things that any organization must determine in the area of crisis management is to define within that organization what a crisis entails. Then and only then can you develop a framework for handling that unusual event. After some determination is made on what a crisis will be, the next key determinate should be who will determine when the crisis plan is activated and how. And of equal importance, when and where will the plan be conducted?

When a situation or issue occurs that in the determination of the organization a crisis *is* at hand, one of the first things that must be done is to thoroughly analyze the crisis. When something occurs throughout the United States, or in areas in which you do business, or makes the evening news, or the front page of the paper, it is essential that you analyze and evaluate all crisis situations even if they are only remotely associated with your organization or business.

When a crisis occurs in your community or in your organization specifically, one of the first things that must be accomplished is to look for any similarities or consequential outcomes that may be tied to your business, employees, or customers. Second, determine your potential involvement in the situation, noting any associated implications and liabilities.

An example of such an assessment can be drawn from the 1985 outbreak of *Salmonella* in milk which ricocheted across the United States from its origin in Chicago, Illinois. What began as a leaky valve in a milk plant, turned into a national epidemic of *Salmonella* infection of over 17,000 people. When the issue first broke, it involved milk being sold by the Jewel Company in Chicago. When this issue occurred, one of the first things we did at Red Lobster was to look at the situation in a broad perspective. We asked ourselves these questions:

1. What product is involved? - Milk
2. Do we use that product in our restaurant? - Yes
3. Do we buy milk from that supplier or the original processor? - Unknown, but it must be determined.
4. What is the nature of *Salmonella* infection? - Person to person, and through food
5. Could *Salmonella* be transmitted from an infected worker to a guest? - Yes
6. Could we have employees that bought infected milk from Jewel? - Yes

After examining these factors, we realized immediately that we first must contact our restaurants in the Chicago area to determine if milk products are purchased from Hillfarm Dairies or the Jewel Company. We immediately found out that no milk products used by Red Lobster came from these sources. Many of our employees did their grocery shopping at Jewel Food Stores, and there would be a probability of our employees contracting *Salmonella* from the suspect milk. We immediately reaffirmed with all of our store management what steps they should take in case an employee became ill with *Salmonella* infection. All of this communication was completed within 12 hours of the first press release. It was interesting to note that within two weeks of the incident we had approximately 17 employees in the greater Chicagoland area that had become infected with *Salmonella* from the suspect milk. With our small number of restaurants in the Chicago area, we were probably one of the smallest of the total number of restaurant employers that became potential carriers and infectors of others. Our quick action and those by many other foodservice companies prevented the continuous spread of this disease through foodservice operations.

The *Salmonella* milk incident is a typical crisis issue in which you have at least four significant impacts to your business. First is the immediate impact of product presence in the marketplace, what actions must be taken with the product in question, and how to handle it safely if it needs to be moved to another location or destroyed. Second is any effect of illnesses on employees or others. Third, any long-term effects of the incident such as product trial, product shyness, etc. And four, probably the most important, is the impact of the incident on the reputation of the businesses involved. Certainly, Jewel Food Stores' sales were dramatically reduced as a result of this incident.

The best time to develop a crisis plan is when you are not in a crisis.

When a crisis occurs, cool heads with strategic thinking capabilities are a rare find. Therefore, the best time to structure your crisis plan is when individuals have no immediate pressure on them to make a critical management decision. There are two types of plans that should be considered in developing a crisis plan. First is the Field Plan and second is the Corporate Office Plan.

The Field Plan should incorporate the essentials for immediate actions, public safety, and communications information at the site of occurrence. Somewhere in your organization, specific procedures should be written and delegated to individuals at the site for handling members of the news media, regulatory officials, and consumers. After your Field Plan has been developed, the next thing to do is to *train* individuals on the plan and *test* the plan to ensure that it will work in a crisis situation. Many organizations have excellent field communications and on-site directions; however, they have never tested their plan to see if it is feasible. Consequently, when a crisis does occur, all those great words of wisdom written in a manual become archaic and nonimplementable. At Red Lobster we have developed a publication entitled *Disaster Preparedness Manual*. This booklet was developed and written specifically for handling disasters at the site. This is our Field Plan. It instructs management on what they need to have in the store prior to a disaster; what to do when the disaster becomes imminent; what to do while the disaster is occurring; and what to do after the disaster has passed.

The Corporate Office Plan is an adjunct to the Field Plan. In developing the Corporate Office Plan, the essential element is determining how to make the plan as effective and efficient as possible. During a disaster or crisis, a tremendous amount of misinformation is communicated. As one person tells another the story of the event, things are added to and taken away from the real situation. As a result, the crisis becomes more of a crisis as people communicate the event. The Corporate Office Plan must be structured to recognize this situation and minimize the number of people involved in the issue.

The most significant part of a Corporate Office Crisis Plan is to establish a Crisis Committee. The membership of this Crisis Committee should consist of someone in the Quality Assurance area, Operations, Legal, and Public Relations. These four individuals need to be given the full decision making and reactionary powers to deal with the crisis that is occurring. Each of these individuals should have sole responsibility for directing and orchestrating any activities that are related to the crisis at hand. The Crisis Committee should consist of the highest ranking individual in these areas. This group cannot be successful if they must obtain permission or concurrence from someone else. Timeliness and speed of reaction are essential in a well managed crisis situation. These four individuals should then direct, with technical input from others, the corporate position and direction for successfully managing the event. The president or chief executive officer of the company should not be a member of this Committee. It is important that this individual stay apart from the minute by minute management of the event and represent the company as the spokesman for what is occurring toward the resolution of the crisis.

One of the most important aspects of a Crisis Committee is to evaluate the crisis after it is all over. After the crisis has passed, it is an excellent opportunity to review what occurred; what happened in what sequence; and what could have been done differently to make the handling of the crisis more efficient or effective. At the same time, internal procedures can be reviewed to determine if changes need to be made in either the Field Plan or the Corporate Office Plan. Your future success in handling crisis situations is in providing a good evaluation of the most recent one, whether yours or someone else's. Experience is undoubtedly the best teacher, so don't let the teacher go home untapped.

Lastly, practice, whether real or enacted, makes perfect in managing your corporate crisis plan.

Dairy and Food Sanitation, Vol. 6, No. 10, Pages 430-435 (October 1986)

An Evaluation of Reference and Infra-red Analyses of Various Components of Raw Milk

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Introduction

Control samples of raw milk prepared specifically for the purpose of calibrating and monitoring infra-red testing equipment reflect a special need for precision in testing and agreement between or among methods approved for use as reference analyses. Control samples may be prepared by individual laboratories for their own use, or a centralized system may be used, in which one laboratory prepares control samples for and distributes them to a number of participating laboratories. The latter has two major advantages. First, only one laboratory needs to maintain the equipment and skilled technicians to perform the essential reference analyses. Cost of operation of individual laboratories is thereby reduced. At the same time, research suggests that centralization of the process is a major benefit in reducing between-laboratory variations in test (11).

However, centralization of control sample testing also introduces a need to select the most appropriate test methods for reference testing and also a need for high standards of precision (repeatability) in testing. For some components, more than one method is approved for reference testing. Fat analyses may be run by either the Babcock or ether extraction methods, lactose by polarimeter or copper sulfate method (1). In our laboratories, we make use of high performance liquid chromatography as a method of lactose analysis. The question arises as to just how well these methods agree with each other in the measurement of the same component. Recent work in Minnesota (3), as well as the work of others (8, 10, 12, 13, 14, 15) suggests that there are differences between Babcock and Mojonnier analyses, differences that increase in magnitude with increase in level of fat. Lactose analyses are complicated by the fact that some methods may, others may not take water of hydration into account. Lactose can also be estimated by difference. Ash, too, can be estimated by difference. To this point, no one has established the relationship between lactose and ash as measured versus calculated values. To date no one has assessed or suggested what standards of precision, if any, should be applied to reference methods used in con-

trol sample testing. In centralized programs, guidelines seem desirable if not essential.

The Association of Official Analytical Chemists (AOAC) (1) has established standards of precision and accuracy for infra-red measurements of fat, protein, lactose, and total solids. The work reported herein was done in large part to evaluate various methodologies in terms of their precision, relationship to one another, and applicability to testing raw milk samples used for control purposes.

Materials and Methods

Dairy Quality Control Institute, Inc. (DQCI, Inc.) currently prepares raw milk samples for calibrating and monitoring infra-red instruments. Samples are prepared in sets of twelve and are specifically selected to reflect a wide variation in level of fat/solids. Samples are made available on a weekly basis. For this work, these same samples were used, but were split and randomized such that they represented blind duplicates.

Twelve such sets were analyzed on a weekly basis over a six-week period (12 x 2 x 6 = 144 observations/component). Select analyses were conducted in DQCI, Inc. and Land O'Lakes, Inc. laboratories. Samples were preserved with potassium dichromate to a level of .034% w/w.

Milkfat was determined by both the Babcock and Mojonnier method, using techniques for the latter as described in, and for the former as modified to some extent from those outlined in Standard Methods for the Examination of Dairy Products (16). Specific changes and/or conditions used in Babcock determinations included (a) an adjustment in milk temperature to 15.5°C (60°F), (b) adjusting of the specific gravity of sulfuric acid to 1.825, (c) adjusting acid to 17.7°C (64°F) prior to addition of milk, and (d) the addition of precisely 17.5 ml of acid to milk samples.

Protein analyses were made on Tecator micro Kjeldahl apparatus (Tecator Inc., P.O. Box 405, Herndon, Virginia 22070). Lactose was analyzed by liquid chromatography in a procedure in the process of being published by Gulden (7) (Land O'Lakes, Inc., P.O. Box 116, Minneapolis, MN 55440). Ash content was measured by the oven method and solids-not-fat by the Mojonnier procedure, both as described in Standard Methods for the Examination of Dairy Products (16). Total solids were determined by Method 1, Association of Official Analytical Chemists procedure (1). In addition, samples were also analyzed on an infra-red instrument (Multispec, Inc., 23560 Lyons Avenue, Newhall, California 91321). Single determinations were made on 12 reference samples.

Results and Discussion

Precision (repeatability) of a method can be assessed as a measure of mean difference and standard deviation of the difference of duplicate analyses. This is the statistical procedure recommended by AOAC for infra-red instruments. The same statistics are also recommended by AOAC for measuring accuracy, i.e., agreement between infra-red and reference results. Accuracy can also be measured as the standard deviation of the regression. Using 1.96 times the latter value provides a value for accuracy at 95% confidence. In some ways this latter value provides a somewhat more readily understood measure. That is, accuracy at 95% confidence becomes ± the percentage derived. You could expect two methods to agree within that prescribed range 95% of the time over the entire range of values reflected in the samples. For the group of samples used in this study, milkfat content ranged from about 2.45 to 6.15%, with other components ranging generally in proportions more or less common to natural milk supplies.

For purposes of this discussion, standard deviation of the difference is used as the measure of precision and standard deviation of the regression as a measure of accuracy. Paired-t statistic was used to compare sample means at $p < .05$ for certain related items.

Table 1 is a summary of grand mean, mean difference, and standard deviation of the difference for all methods by component. As such, the data reflect the precision/repeatability of the methods involved for the specific components in question.

TABLE 1. *Grand mean, mean difference and standard deviation of the difference of several milk components analyzed in blind duplicate by various methods.*

Component and Source	Grand Mean	Mean Difference	Std. Dev. of Mean
Fat (Babcock):			
Technician 1	4.206	.001	.040
Technician 2	4.204	.004	.044
Fat (Mojonnier):			
Lab 1	4.189	.002	.017
Lab 2	4.193	.003	.033
Protein (Kjeldahl):			
Lab 1	3.601	.001	.014
Lab 2	3.639	.038	.099
Lactose (HPLC):	4.84	.024	.072
Ash (Oven method):	.772	.002	.015
SNF (AOAC TS-Moj. fat):			
Lab 1	9.106	.012	.026
Lab 2	9.106	.010	.041
Total Solids (AOAC):			
Lab 1	13.30	.010	.017
Lab 2	13.30	.013	.032

Fat

Grand mean values for fat as determined by two technicians using the DQCI, Inc. modified Babcock test were 4.206 and 4.204, a difference of only 0.002%. The standard deviation of the difference was 0.04 and 0.044, respectively. These results indicate a high degree of precision possible with the Babcock test when the method is standardized and run strictly according to procedures. The Babcock test did not equal the Mojonnier analysis in precision, comparing either one or two Babcock technicians with Mojonnier results of both laboratories. The Mojonnier method showed standard deviation of the difference of 0.017 and 0.033, respectively, for each of the two laboratories. Grand means were 4.189% and 4.193%. If the Babcock grand means and the Mojonnier grand means are averaged, the difference between them is 0.014%, the Babcock being the higher of the two. This and other considerations involving these two methods have been discussed in an earlier paper (3). If there is one important point to make here, it would appear to be the possibility that precision of the two methods can be held to a mean difference the equal or better than that suggested for infra-red instruments by AOAC (i.e., ≤ 0.02), and to a standard of perhaps ≤ 0.05 in standard deviation of the difference. Certainly the Mojonnier analysis showed a capability well within those limits. It is also noteworthy that a paired-t analysis of data generated by two Babcock technicians (both working in the same laboratory) and two Mojonnier technicians (each working in different laboratories) were not statistically significant at $p < 0.05$.

Protein

Both laboratories ran Tecator micro Kjeldahl analyses for protein, using 6.38 as the conversion factor for protein from nitrogen content. Grand means were 3.601 and 3.639, a difference of 0.038%. The standard deviation of the difference was 0.014 for one laboratory, 0.099 for the other, a fairly sizeable difference for which no explanation is readily apparent. It would appear that, with some effort devoted to pinpointing and eliminating the source of variability, precision could be improved such that a standard deviation of the difference to 0.05 could be achieved.

Lactose

The HPLC method used in this work showed a mean difference and standard deviation of the difference of 0.024 and 0.072 between duplicates, respectively. The latter value suggests that, for this test, a standard could readily be held to less than 0.1. In Table 2, it may be seen that lactose by HPLC yielded significantly higher values than lactose calculated by difference (lactose = SNF - (protein + ash). The grand means for lactose by HPLC and by difference for Lab 1 and Lab 2, respectively, were 4.84, 4.733, and 4.694%. Thus, calculated values ran about 0.1 to 0.15% lower than measured values.

TABLE 2. *Grand mean values of lactose and ash measured directly and by difference.*

Component and Method	Grand Mean
Lactose:	
By HPLC	4.84
By difference[a]	
Lab 1	4.733
Lab 2	4.694
Ash:	
By oven	0.772[c]
By difference[b]	
Lab 1	0.668[c]
Lab 2	0.629[c]

[a]Calculated: Lactose = SNF - (protein + ash), where SNF was determined as AOAC total solids - Mojonnier fat, protein by Kjeldahl, and ash by the oven method.
[b]Calculated: Ash = SNF - (lactose + protein), where SNF was determined as AOAC total solids - Mojonnier fat, lactose by HPLC, and protein by the Kjeldahl method.
[c]This value includes 0.034% potassium dichromate preservative.

As one possible explanation for part of this difference, it is perhaps noteworthy to consider water of hydration of lactose. At total hydration, about 5% of lactose is water. Official methods and the HPLC method used in this experimental work all measure lactose along with its content of hydrated water. Using the grand average value (4.84%) generated by HPLC, water of hydration could account for approximately 0.24% of that figure. That amount would more than compensate for the difference observed between lactose derived by HPLC and lactose derived by difference, the latter value of which presumably would not include water of hydration. In fact, the question arises as to why the difference between HPLC and calculated lactose content is no greater than it is. As possible explanation, it may be noted that protein values derived by Kjeldahl are inflated by the level of nonprotein nitrogen (NPN), again about 5% on average. Five percent of the average protein content of these samples amounts to about 0.18%. This is a spread of 0.06% between the two factors (water of hydration and NPN) that would tend to cause different results in measured vs calculated values. Although 0.06% does not account for the total difference observed, it does very much narrow that difference and leave considerably less of the spread to be accounted for by other factors (for example, the possibility that AOAC solids readings may be low). In any event, serious thought should be given, it seems, to considering how best to handle the questions of water of hydration and NPN. The potential impact on dairy plant accounting and the amount of solids reflected by such factors is most significant in high-volume operations.

Ash

As determined by the oven method, ash values showed a mean difference and standard deviation of the difference of duplicate analyses of 0.0022 and 0.0147. The grand mean value of 0.772 must be considered to reflect not only naturally occurring mineral constituents, but also about 0.034% potassium dichromate preservative. Data in Table 2 also indicate that ash values calculated by difference (ash = SNF - (protein lactose)) provide significantly lower results. Compared with a grand mean of 0.772% for the oven method, grand means for ash calculated by difference were 0.668 and 0.629%, respectively, for Lab 1 and 2. This is a difference of 0.10 and 0.14%, respectively. These were statistically significant differences ($p < .05$).

Solids-not-fat (SNF)

Both laboratories showed perfect agreement in grand mean values for SNF. In the data shown in Table 1, SNF is calculated as total solids minus fat, with both components determined by the Mojonnier method. Mean difference and standard deviation of the difference for Lab 1 was 0.012 and 0.026, and for Lab 2 0.010 and 0.041, respectively. It seems possible, therefore, that SNF reference determinations could well be expected to show a precision of ≤ 0.02 mean difference, and ≤ 0.05 standard deviation of the difference of duplicate analyses.

Total solids

Agreement in total solids results were also found to be exceptionally good for the two laboratories. Grand mean values were identical at 13.30%. Mean difference and standard deviation of the difference were 0.010 and 0.017 for Lab 1 and 0.013 and 0.032 for Lab 2, respectively. Both statistics are well within AOAC standards of precision established for infra-red instruments.

Total solids can be taken as a single measured value, or individual components making up total solids can be added to yield a total solids value. The grand mean, as a value measured by Mojonnier analysis, was 13.30, as already mentioned. The grand mean by addition of averages of all tests made on individual components was found to be 13.44%, a difference of 0.14%. Even if Mojonnier analyses for fat are used exclusively, (the higher reading Babcock results eliminated), the summed components still exceed the measured value, i.e., total solids equals 13.42%. In addition, it should be noted that total solids content in this study reflects both milk solids and about 0.034% potassium dichromate preservative.

In summarizing the preceding sections, it seems clear that the reference methods used in this study, with the exception of lactose analysis, are capable of providing standards of precision not greatly different from those demanded of infra-red instruments. Mojonnier analyses of fat were held within such standards by one laboratory and AOAC analyses of total solids were within those prescribed standards for both laboratories. The standards for fat are ≤ 0.02 for both mean difference and standard deviation of the difference, and ≤ 0.03 and ≤ 0.04 for these two statistics, respectively, for total solids. One laboratory was also able to carry out Kjeldahl analyses within infra-red standards. These facts are noted because of the obvious need for control samples handled by centralized laboratory systems to reflect the highest standards of precision possible. These data are also provided to indicate that all methods have some level of inherent variability, a level upon which no technician can be expected to improve. Though obvious, this latter fact seems essential to state in an era in which pressures on accountability are ever mounting.

Agreement between laboratories

In this study, two laboratories testing by Mojonnier and Kjeldahl procedures showed uncommonly good agreement. For SNF and total solids, grand means (average of all samples) were identical. Data in Table 4 also indicate excellent agreement by statistical measures applied within and between tests in individual laboratories.

TABLE 3. *Accuracy of infra-red analyses of various milk compounds.*

Component and Method	Std. Dev. of Accuracy ($\sigma y,x$)	95 % Confidence Limits of Estimated Reference Value ($\pm 1.96\ \sigma y,x$)
Milkfat		
Babcock	0.046	±0.09
Mojonnier	0.044	±0.09
Protein (Kjeldahl)	0.033	±0.06
Lactose (HPLC)	0.072	±0.14
Ash (oven)	0.036	±0.07
SNF (AOAC TS-Moj. fat)	0.040	±0.08
Total Solids (AOAC)	0.062	±0.12

TABLE 4. *Mean difference and standard deviation of the difference between two laboratories analyzing select milk components by reference methods.*

Component (Method)	Mean Difference	Std. Dev. of Mean
Fat (Mojonnier)	.0038	.0198
Protein (micro Kjeldahl)	.0383	.0993
SNF (AOAC TS-Moj. fat)	.0007	.0347
Total Solids (AOAC)	.0031	.0298

Standard deviation of the mean between laboratories for the Mojonnier fat test was equivalent to that observed between duplicate analyses for the same procedure. However, it should be noted that the comparison between laboratories consisted of the average of two analyses per component per laboratory. A paired-t test showed no statistical significance between means thus taken ($p < .05$). Essentially all the facts that hold true for fat can likewise be expressed for SNF and total solids. That is, statistical measures were comparable to within-laboratory results and means were not found to differ to a statistically significant degree ($p < .05$), i.e., at 95% confidence. Of all the components tested, only protein showed statistical values somewhat higher than might be expected, and then mainly as a result of difficulties encountered in one laboratory. Procedural changes have already resolved that particular problem.

Accuracy of infra-red analysis

Accuracy is defined as the measure of agreement between a routine method, such as infra-red, and a reference method. It is perhaps best described by the standard deviation of the regression ($\sigma y,x$) of the reference method (dependent variable) on the routine method (independent variable). The estimated component value of 95% of the individual samples can be assumed to lie within approximately $\pm$ 1.96 $\sigma y,x$.

During this study, the samples prepared for reference test analyses were also analyzed on an infra-red instrument. A single determination was made after correction for bias. Table 3 shows these results.

Standard deviation of the accuracy of the Multispec instrument was 0.046 and 0.044 for Babcock and Mojonnier analyses, respectively. These are essentially equivalent results and suggest little or no difference in accuracy of the infra-red estimates whether made against Babcock or Mojonnier results, at least under conditions existing in the laboratory where the infra-red determinations were made.

The infra-red method was able to estimate protein content with a standard deviation of 0.033. This value is lower than that achieved in previous work (6) with the estimate made against macro Kjeldahl analysis. It was in fact on a par with accuracy of estimates made against dye-binding methods as "reference."

Accuracy of the lactose analysis, with a standard deviation of 0.072, was the equivalent of values observed earlier in comparisons against the Milko-Scan (6). Accuracy of ash estimates, heretofore untested, was found in this work to show a standard deviation of 0.036, relatively high in comparison to other methods and other components present at higher levels in milk. In premium-type milk purchase programs, SNF and total solids are seeing increased use. In this work, standard deviation of accuracy for these components was 0.040 and 0.062, respectively. The former is somewhat lower than was found previously (6). In fact, accuracy of total solids expressed in this study was as good as accuracy for SNF in the previous work, i.e., 0.062 compared to 0.073.

Taken as a whole, this study is indicative of the kind of precision achievable with current reference/chemical methods of analysis, and of the accuracy possible in infra-red analysis under a centralized laboratory control program. It is at least suggestive of some useful standards/guidelines of control that can be considered appropriate in reference method analyses made on control samples of milk and in the agreement that should result when compared to infra-red estimates. The latter statistical values all fall well within data reported in the scientific literature (2, 4, 5, 9, 17, 18).

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Nominations for 1987 IAMFES Awards Now Due

Awards nominations are due for the 1987 IAMFES Awards. The success of the IAMFES Awards Program depends on organizations which generously and regularly fund the program, but also on you, for nominating persons you know who are worthy of the awards.

Contact Sidney E. Barnard, 8 Borland Lab, Pennsylvania State University, University Park, PA 16802 with information on your nominees. Present Executive Board members are not eligible for the 1987 awards.

The awards are as follows:

*Sanitarian's Award. This is a $1000 award and plaque presented to any Sanitarian for outstanding professional contributions during the past seven years.

*Harold Barnum Industry Award. This $500 award and plaque will go to an industry representative in 1987. It is presented for service to food safety and sanitation.

*Educator Award. This $1000 award and plaque will be presented to an educator. It is presented to a person who has shown outstanding service to food safety and sanitation.

*Citation Award. This plaque will be presented to an IAMFES member for dedicated service to the Association in helping fulfill its objectives.

*Shogren Award. This $100 award and certificate will go to the affiliate organization with the best state or regional program and participation in IAMFES.

*Honorary Life Membership. A plaque is presented to a member who has shown long and extensive service to IAMFES.

*Certificate of Merit. This is presented to members who are active within their state and international group.

Free Seminar Series for Environmental and Industrial Hygiene From Waters Chromatography

A free seminar series for environmental and industrial hygiene professionals, "Applications of Ion and Liquid Chromatography to the Analysis of Environmental Samples," will be sponsored in November at various locations across the U.S. and Canada by Waters Chromatography Division, Millipore Corporation.

In the U.S., the seminars will be held: Nov. 3, Green Bay, WI; Nov. 4, Washington, DC; Nov. 5, Minneapolis, MN and Emeryville, CA; Nov. 6, Philadelphia, PA; Nov. 7, Chicago, IL and Seattle, WA; Nov. 10, Morristown, NJ, College Station, TX and St. Louis, MO; Nov. 12, Binghamton, NY, Houston, TX, Irvine, CA and Indianapolis, IN; Nov. 13, Buffalo, NY and Norfolk, VA; Nov. 14, Baton Rouge, LA, Denver, CO and Cincinnati, OH; Nov. 17, Charleston, WV; Nov. 18, Boston, MA and Tampa, FL; Nov. 19, Toledo, OH; Nov. 20, Hartford, CT and Atlanta, GA; and, Nov. 21, Pittsburg, PA. In Canada, the seminars will be held in Montreal, Quebec; Toronto, Ontario; Burlington, Ontario; Ottawa, Ontario; Calgary, Alberta; and Edmonton, Alberta.

For more information about the seminar series, including specific locations and times, contact: Linda Heath, Waters Chromatography Division, 34 Maple Street, Milford, MA 10757. 617-478-2000, ext. 2978.

Seminar Series Helps Make Future Sales Champs

What separates the ordinary salesperson from the real sales champs in the food industry? That's a question dairy foods companies ask themselves every day as they compete for space and prominence in the nation's retail food outlets.

A new training program developed by the Milk Industry Foundation (MIF) and the International Association of Ice Cream Manufacturers (IAICM) will provide milk and ice cream industry retail sales personnel with techniques essential for improving sales call successes.

It's called SALES CHAMP 101: THE FUNDAMENTALS OF SELLING & MERCHANDISING, and it will be offered Nov. 10-14 at the Westin Hotel in Atlanta, GA.

The intensive five-days SALES CHAMP 101 seminar is the first of a series of sales skills and management workshops targeted specifically for sales personnel employed in the dairy foods industry. Developed by the MIF & IAICM and a special industry task force, these seminars have been designed to offer practical and innovative techniques for selling the products and product lines of the dairy foods industry to conventional grocery stores, convenience stores, warehouse box stores and superstores.

SALES CHAMP 101 workshops will be offered twice a year. Registration will be limited to the first 60 paid registrants. Seminar series leaders are Karl W. Kepner, Professor of Food Distribution at the University of Florida, and Van D. Spurgeon, President of Spurgeon Management Services, a leading food industry consulting firm.

SALES CHAMP 101: THE FUNDAMENTALS OF SELLING & MERCHANDISING will again be offered May 4-8, 1987 in Chicago, IL.

But the MIF & IAICM courses don't stop with the

basics.

The second level, SALES CHAMP 201: MANAGING SALES & THE SALES TEAM, is a 2-1/2 day seminar specifically for milk and ice cream industry retail account supervisors and sales branch managers. SALES CHAMP 201 will provide sales branch managers with training on effectively managing the sales force and sales activity for improved productivity and profitability. SALES CHAMP 201 seminars will be held Feb. 9-11, 1987 at the Orlando Marriott, Orlando, FL, and again Sept. 14-16, 1987 at the Marriott in San Antonio, TX.

For further information on the SALES CHAMP programs and registration materials (a discount rate is available to MIF & IAICM members who sign up for both seminar levels), contact Dawn Brydon, MIF & IAICM, 888 Sixteenth Street N.W., Washington, D.C. 20006; 202/296-4250.

7th Annual University of Wisconsin-River Falls Food Microbiology Symposium

The 7th Annual University of Wisconsin-River Falls Food Microbiology Symposium will be held December 11 and 12, 1986. The theme is Current Concepts in Foodborne Pathogens and Rapid and Automated Methods in Food Microbiology. Invited speakers include Dr. Anthony Sharpe, Health and Welfare, Canada; Dr. Daniel Fung, Kansas State University; Dr. Nelson Cox, Russell Research Center, USDA-ARS; Dr. Elmer H. Marth, University of Wisconsin-Madison; Dr. Maribeth Cousin, Purdue University; and Dr. Catherine Donnelley, University of Vermont.

Among the systems and tests to be discussed are DNA Probe for Detection of *Salmonella,* Rapid Screening of *Salmonella* by Enzyme-Immunoassay, The *Salmonella* 1-2 Test, Petrifilm, Bactomatic, Bio-Foss, etc. Several other speakers are being contacted.

For further information and registration contact Dr. P. C. Vasavada, Food Science Department, University of Wisconsin, River Falls, WI 54022; telephone (715) 425-3150.

Northeast Dairy Practices Council Guidelines Offered

The Northeast Dairy Practices Council is offering four new or revised "Guidelines" which were prepared by the several subcommittees working within the Council. The following abstracts of these "Guidelines" were prepared by subcommittee chairmen. Copies of the guidelines are available at the prices indicated from R. P. March, Executive Secretary, Northeast Dairy Practices Council, 150 Riley-Robb Hall, Cornell University, Ithaca, NY 14853-5701.

Publication NDPC 18: Guidelines for Abnormal Milk - Fieldman's Approach. Revised July 1986. Single Copy: $3.00.

Abstract

This guideline briefly discusses the significance of the problem of abnormal milk and gives instructions to dairy fieldmen concerning an appropriate procedure to follow to assist dairymen with a mastitis problem in their herds. Also included in the appendix are the Abnormal Milk Programs or requirements for each of the northeastern states.

Prepared by The Abnormal Milk Subcommittee of the Quality Assurance Task Force; Lee Southwick, Subcommittee Chairman.

Publication NDPC 30: Guidelines for the Potable Water on Dairy Farms. March 1986. Single Copy: $3.00.

Abstract

This guideline is written for regulatory officials, sanitarians, cooperative extension agents, engineers and others who are advising dairy farmers on potable water supplies in the northeastern states. This material will assist the reader in evaluating existing water supplies and in the approval of new systems. Specific discussion, including tables and diagrams, are provided to evaluate existing water quality problems; find probable causes and possible solutions; locate and construct new water sources; interpret laboratory reports; provide water treatment; understand backflow prevention; and give common sense reasons why violations can create hazards and provide some acceptable options to make needed corrections.

Prepared by a subcommittee of the Cleaning and Sanitizing and Quality and Assurance Task Forces; Armand E. Dragon and Albert F. Zimmerman, Co-chairmen.

Publication NDPC 52: Guidelines for Emergency Action Plan for Outbreak of Milk-Borne Illness in the Northeast. July 1986. Single copy: $2.00.

Abstract

This guideline contains a plan for an emergency communications network and chain of command for key sanitarians to be used in the event of an outbreak of serious milk-borne illness in the Northeast. Product recall procedures are listed, emergency telephone numbers for each state are provided on page 5. References are given for

information concerning investigational procedures and epidemiology. General procedures for plants are on page 7.

Prepared by a subcommittee of the Communications and Uniformity Task force; L. S. Hinckley, Subcommittee Chairman.

Publication NDPC 53: Guidelines for Vitamin Fortification of Fluid Milk Products. July 1986. Single Copy: $2.00.

Abstract

This guideline is designed to help the processor concerning proper fortification of fluid milk products with vitamins A and D. It briefly discusses the history and need for vitamin fortification. Information is given about types of vitamin concentrates available, the problems involved in fortification, and the best methods for properly fortifying the fluid milk products.

Prepared by A. F. Zimmerman and J. W. Nisonger with the assistance of L. Latchford, G. Senyk, W. F. Shipe and S. E. Barnard.

Babson Bros. Co. Breaks Ground in Naperville

On Friday, June 13, Nick Babson, Chairman and President of Babson Bros.. Co., broke ground for new office and warehouse facilities in Naperville, Illinois. The new building site lies on over nine acres of land. The two-story office building consists of 36,000 square feet while the contiguous warehouse will have 126,000 square feet of space.

Developer for the property is Hawthorn Realty Group with Nagle, Hartray & Associates, Ltd. as the architectural firm. Both are Chicago-based companies. Contractor for the building is Stava Construction Cc. of Schaumburg.

Located at the southwest corner of Illinois 5 (East-West Tollway) and Route 59, the new building site is approximately 15 miles west of the company's current location in Oak Brook. The building will be part of the newly-developed East-West Technological Center. Babson Bros. Co. expects to move into the new facility in late spring 1987.

Babson Bros. Co. has been at its present site in Oak Brook since 1965. Prior to moving to Oak Brook, the company was located in Chicago.

A leader in the dairy farm equipment industry for 80 years, Babson Bros. Co. also has offices in Mississauga, Ontario, and Runcorn, England.

Changes Continue at State Training Branch

The 1985-1986 year was certainly a time of change and transition for the State Training Branch (STB) of the Food and Drug Administration. By October 1, 1985, the branch was moved from Cincinnati, Ohio, to Rockville, Maryland, and an all new staff was brought on board.

With the move came the typical headaches that might be expected--forwarding of mail, new telephone service, and adjustments to new quarters. With just a few exceptions, the FY'86 schedule of courses were kept, and training materials provided to lending library users. The STB staff hopes that any inconveniences which were experienced as a result of the move were minor.

The STB's training course schedule for FY'87 has been set, which includes a new course in milk protection and one in food protection. Changes to existing courses are being made by specifically directing course content to the sponsoring agency's needs, and by emphasizing trainee participation. An additional change involves the resurrection of the radiological health course. A total of 44 courses are scheduled for FY'87 featuring our traditional Current Concepts in Food Protection and Milk Pasteurization Controls and Tests courses. In conjunction with the Association of Food and Drug Officials, CEU's are being issued for successful completion of courses.

Some changes have been made in the STB lending library. Procedures have been changed to speed up the lending process. Many titles have been transferred to video tapes. New titles have been added and others discarded. A new packaged course, "Basic Concepts in Food Protection" has been developed. Packaged courses on the Pasteurized Milk Ordinance, Hazard Analysis and Critical Control Points in Food Service, and Legal Aspects of Enforcement should be completed by Spring 1987.

STB requests your input of ideas for new courses, or subjects to be added to existing courses. STB

hopes to serve as repository of training aids. If you have developed a training aid, please share a copy with STB. In turn, STB will share it with your colleagues through the STB Lending Library.

Contact with the State Training Branch including requests for a copy of the FY'87 "Catalogue of Courses and Training Materials" can be made by writing or calling Gary E. German, Director, Food and Drug Administration, State Training Branch, HFC-153, 560 Fishers Lane, Rockville, Maryland 20857; telephone (301) 443-5871.

Dr. Lech Ozimek

Appointment to Chair of Dairy Processing Technology Research

The Food Science Department is pleased to announce the appointment of Dr. Lech Ozimek to the newly created Chair of Dairy Processing Technology Research at the University of Alberta.

Dr. Ozimek was born in Poland where he obtained his Master's and Ph.D. degrees at the University of Agriculture and Technology in Olsztyn. Upon completion of his Ph.D. in 1979, he accepted an appointment as Assistant Professor in Food Chemistry and Technology in the Institute of Food Engineering and Biotechnology at the University of Agriculture and Technology in Olsztyn. In 1982 he came to the University of Alberta, Department of Animal Science, as a Visiting Scientist until 1984 when he accepted an appointment as a Research Associate.

The Chair in Dairy Processing Technology Research has been created and is funded jointly by the Alberta Dairymen's Association, Alberta Agriculture and the University of Alberta. Included in the Chair are responsibilities of Director of the Alberta Dairymen's Association Research Unit; responsibilities for establishing a full research program in dairy processing technology; and responsibilities for liaison and interaction with the Alberta Dairy Industry.

Iowa State University Offers New Degree

Iowa State University instituted in 1986 a new B.S. degree in *Agricultural Microbiology*, administered by the Department of Microbiology. The degree is intended to provide a rigorous program in microbiology and supporting basic sciences as well as a strong background in the aricultural sciences.

The program includes two years of biological sciences, including biology, zoology, botany and genetics; a year of physics; general and analytical chemistry and one year of organic and one year of biochemistry. Students must also take introductory courses in soil science, animal science, crop production, and food technology and selected advanced courses in an area of applied agriculture. English and speech are required, as well as courses in the social sciences, humanities, and mathematical disciplines. Required courses in microbiology include general, pathogenic, advanced general bacteriology, molecular biology/physiology, microbial diversity, immunology, and virology for the major. During the senior year, students present an undergraduate seminar and pursue specialized coursework in an applied area of study, such as microbial biotechnology, food microbiology, soil microbiology, genetic engineering, etc. To foster creativity and independent study, students are encouraged to engage in an original senior research project.

Graduates of the program are specially equipped to obtain a position with any of the increasing number of high technology industries related to agriculture.

Fish for Your Heart

Fish has long been hailed as "brain food," but now it is also being lauded as food to help protect your heart.

Most kinds of fish are low in cholesterol, fat and calories as well as some oils that may help to prevent heart attacks, says Annette Reddell Hegen, a

seafood consumer education specialist with the Texas A&M University Agricultural Extension Service.

These special polyunsaturated oils, different from those of vegetable origin, are called omega-3 fatty acids. All fish and shellfish contain them, she says, but oilier, fattier fish are the richest sources of the fatty acids. Marine fish have more of the omega-3 fatty acids than freshwater fish.

Some research studies have shown that eating large amounts of omega-3 fatty acids can decrease the tendency of blood platelet cells, involved with clotting, to stick or clump together, reports the specialist.

This may decrease the likelihood of forming clots that can block blood flow to the heart and result in a heart attack says Hegen.

Omega-3 fatty acids may also decrease blood levels of fatty triglycerides and cholesterol. As a result, some heart disease experts are encouraging greater consumption of fish, particularly the oily kinds.

Salmon, tuna, mackerel and herring are all rich in omega-3 fatty acids. Fatty acids are not affected by processing, so canned, fresh or frozen fish all contain the oils.

For a variety of free seafood recipes, Hegen suggests writing the Texas Agricultural Extension Service, Seafood Marketing, P.O. Box 158, Port Aransas, Texas, 78373.

New Product News

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

Monarch Introduces 1313-SD Chlorinated Alkaline Cleaner

• *Monarch*® 1313-SD, a new heavy duty chlorinated alkaline cleaner specially formulated for efficient cleaning of heavy soil in high iron or hard water conditions, has been introduced by the Monarch Division of H.B. Fuller Company.

Formulated for cleaning in hard water where iron and other mineral impurities complicate soil removal, new *Monarch* 1313-SD cleaner is suitable for mechanical and automated cleaning applications in dairy, beverage, and food processing applications.

The formulation of *Monarch* 1313-SD cleaner improves detergency by conditioning the water, to provide maximum performance with heavy soil loads. Low foaming 1313-SD liquid cleaner provides effective dispersion of organic soils without phosphates.

New *Monarch* 1313-SD cleaner provides improved cleaning of protein soil, while minimizing the need to supplement cleaning solutions with chlorine to maintain strength.

Monarch 1313-SD cleaner is authorized by the U.S.D.A. for use in federally inspected meat and poultry plants.

For more information contact Andy Marti, H.B. Fuller Co., 3530 Lexington Ave. North, St. Paul, MN 55112. 612-481-1588.

Please circle No. 255
on your Reader Service Card

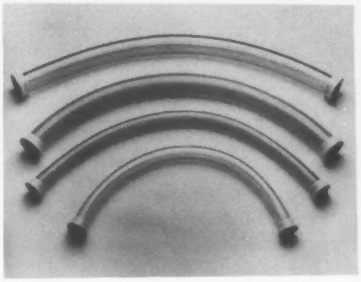
Lactic Acid Test Kit

• A test kit for the enzymatic determination of Lactic Acid in a variety of materials is now available from Boehringer Mannheim Biochemicals.

With this kit, Lactic Acid may be determined quickly and accurately with minimal sample preparation. Working procedures are available for a variety of foods, and for the differentiation of D from L forms of Lactic Acid.

For more information, contact Boehringer Mannheim Biochemicals Research Kit Department at 800-428-5433 (in Indiana call collect, 317/849-9350).

Please circle No. 256
on your Reader Service Card



Defoamer Tubes for Milk Cartoning Eliminate Bacteria Traps

• Sanitary defoamer tubes for milk cartoning operations feature a unitized ferrule construction to encourage an unrestricted product flow, thereby eliminating bacteria traps that occur in conventional defoaming systems. The Sani Flo® sanitary assembly does not rust, scale or pit on the inside or outside surfaces and exhibits a lightweight toughness and durability.

Sani-Tech Defoaming tubes are available in clear and braided tubing in 1" and 2" sizes to fit NEP 110, NEP 170, NEP 210, H 90 and H 75 fillers.

Sani Flo®, with internally heat fused Q-Line® fittings, is available from stock. Optional Tri-Clamp® fittings with Sani Flo STHT tubing (reinforced silicone) are also available upon request, for hot fill aseptic applications.

Sani-Tech Defoamer Tubes conform to applicable FDA, USDA and 3A standards for materials in contact with foods and dairy products.

For more information, contact Meg DuPont, Sani-Tech, Box 1010, Andover, NJ 07821. (201) 579-1313.

Please circle No. 257
on your Reader Service Card

New Stainless Cleaning Devices For CIP Offered by G&H Products

• A new range of stainless steel tank cleaning devices from G&H Products Corporation, Kenosha, Wisconsin, includes polished sprayballs, washing devices, cleaning turbines, and disc jets. G&H Products Corp. is a leading supplier of clean-in-place (CIP) systems and other sanitary flow equipment to dairy, food, beverage and other processing industries.

Type GHRK sprayball is a pressed ball made of stainless steel sheet, available with diameters of 2-1/2" and 3-3/4" for tube sizes of 1" and 2" OD. G&H offers three different drilling patterns: bottom half drilled, top half drilled or fully drilled.

The two cleaning turbines, GHTA and GHTB, are duplex rotary type. Cleaning fluid is added through a connecting pipe and distributed to a horizontally rotating nozzle and to vertically rotating nozzles, the primary cleaning nozzles.

Type GHRD-M washing disc was designed for use with CIP operations in small vertical tanks or vessels. Passing through the housing, cleaning fluid is thrown out in a circular spray when it hits the diffusor, thoroughly wetting the top and sides of a tank with direct spray. Distance from diffusor to housing is adjustable to achieve the exact spraying action required. Once set, a locking nut holds the diffusor in place.

For CIP operations in vertical tanks and vessels requiring high efficiency cleaning, such as silo tanks, G&H offers its powerful Type C disc jet. After passing through a center pipe, cleaning fluid is forced against the disc and thrown out in a circular spray, effectively washing the sides of the tank.

For more information contact G&H Products Corporation, P.O. Box 1199, Kenosha, WI 53141. Phone: 414/694-1010 or 1-800-558-4060.

Please circle No. 258
on your Reader Service Card

Labconco Water Prodigy

• Labconco Corporation introduces the Water Prodigy, the only product currently available which incorporates a unique combination of purification technologies in a self-contained, bench top design to provide water of consistently ultra-high purity. The unit has been specifically designed to meet the application needs of analytical research such as HPLC, fluorescence analysis, AA spectroscopy, ion chromatography, TOC and microbial analysis.

The technologies built into this compact and self-contained unit include reverse osmosis, adsorption, deionization, micro-filtration and photo-oxidation.

This combination insures deionization of the feed water and removal of organic contaminants, race colloidals, micro-organisms or particles, trace organic compounds and ions. Inorganic quality is assured by the 18 megohm-cm resistivity values attained. The media and materials in contact with the high purity water have been specially selected to provide low TOC integrity and unique composite cartridge prevents entry of airborne organisms, organic vapors and CO_2 into the pure water reservoir.

The Water Prodigy accepts raw tap water or prepurified water from an external still or ion exchange unit. The purified water is continuously recirculated to eliminate static water zones, maintain water quality at all times and inhibit microbial growth. An integral water quality meter displays resistivity in megohms-cm and incorporates automatic temperature compensation of resistivity.

Simple to use, the Water Prodigy includes a unique dispensing pen which has been designed for sensitive fingertip control and single handed operation. It is particularly useful for filling volumetric flasks and other tasks requiring exact measurement. When not in use, the pen tip rests in a built-in holder.

The Water Prodigy provides up to 0.5 liter per minute of high purity water, or 15 liters per day. Its quiet and reliable operation insures consistent type I water with a minimum of service.

Disposable deionization, adsorption and filtration cartridges are readily available and are easy to replace as they become exhausted.

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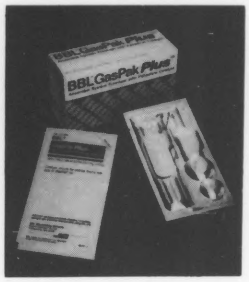

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Food Science Facts
For The Sanitarian

Dr. Robert B. Gravani
Cornell University
Ithaca, NY

Yersinia enterocolitica

In recent years, many people have seen newspaper stories and heard reports of food poisoning caused by a "new" bacterium called *Yersinia enterocolitica*. Although these bacteria were first described in 1939, their significance in foods is still being actively researched.

The major outbreak of Yersiniosis (the illness produced by the organism) that was fully investigated occurred in Holland Patent (Oneida County), New York. In September, 1976, about 217 school children became ill and had symptoms of abdominal pain and fever. Thirty-six children were hospitalized and 16 had appendectomies. After a thorough investigation by the New York State Health Department and the Centers for Disease Control in Atlanta, Georgia, it was found that chocolate milk contaminated with *Yersinia enterocolitica* caused the illnesses.

This outbreak, as well as several others that occurred since 1976, have stimulated a tremendous interest in learning more about *Yersinia enterocolitica* and its importance as a foodborne pathogen. This issue of Food Science Facts will provide some basic information about this unique organism.

Habitat

Yersinia enterocolitica is a small, rod shaped bacterium that is found in:

- The intestinal tract and feces of wild and domestic animals.
- Raw foods of animal origin.
- Non-chlorinated water supplies.
- Lakes, streams and rivers.

Yersinia enterocolitica has been isolated from a variety of animals including deer, raccoons, geese, hares, chinchillas, pigs, cattle, chickens and from horses, dogs and cats. Non-chlorinated water supplies such as wells, lakes, streams and rivers have also been shown to harbor this organism.

Foods Involved

Yersinia enterocolitica and related bacteria are common in nature and have been isolated from a wide variety of foods including dairy products (raw and pasteurized milk, ice cream, egg nog, cream and cheese curd), raw or rare meats (beef, pork, lamb and poultry), seafoods (fish, clams, mussels, oysters, shrimp and crab) and fresh vegetables. It is important to recognize that all of these foods are eaten regularly without any ill effects because not all types of *Yersinia enterocolitica* are capable of causing illness in humans. Some types (or strains) of *Yersinia* are known as environmental (or non-invasive) types and can be present in foods without causing illness. The real problems are those infrequently found pathogenic strains that cause foodborne illness.

Scientists are continuing to study these bacteria to determine why some cause disease and others do not. Presently, there are some theories about why this occurs, but no definite answers.

While many foods provide an environment that will allow *Yersinia* to grow, proper care in the processing, preparation, handling and storage of foods will help reduce the chances of a *Yersinia* outbreak.

The Disease

In order to develop Yersiniosis, food contaminated with disease producing (virulent) strains of *Yersinia enterocolitica* must be consumed. The organisms then enter the digestive tract and cause gastroenteritis. Yersiniosis is considered an infection because adequate numbers of actively growing pathogenic bacteria are needed to cause the disease.

This illness appears most often in children and teenagers but it also can occur in adults. The symptoms usually appear no less than 24-36 hours after consuming the contaminated food and often occur from 3 to 7 days after ingestion.

The symptoms include abdominal pain, fever and diarrhea. Vomiting and skin rashes have also been observed in some outbreaks. The one symptom of many

Yersinia enterocolitica infections that helps distinguish it from other causes of gastroenteritis is the sharp pain in the lower right quadrant of the abdomen. When this pain is accompanied by fever, the illness is often mistaken for appendicitis. In recent U.S. food related outbreaks, several children underwent appendectomies. In these cases, the appendix was usually normal, but the lower intestine and/or surrounding lymph nodes were inflamed. The type of symptoms depends on the strain of disease causing *Yersinia enterocolitica* that is present in the food.

The illness usually lasts 2 to 3 days, although some patients will experience mild diarrhea and abdominal pain for 1 to 2 weeks. Deaths are rare, but they can occur due to complications.

Transmission of the Disease

Yersinia enterocolitica, like other bacteria that cause gastroenteritis, enter the human body through the mouth. Evidence indicates that animals harboring *Yersinia* are an important mode of transmission. These animals may appear to be well or they may have diarrheal illness. The presence of this bacterium in the intestinal tract of animals explains its occurrence in raw meats, raw milk and in lakes, streams, rivers and other non-chlorinated water supplies. In addition to the animal-to-food/water-to-human mode of transmission, *Yersinia* is also thought to be transmitted from person-to-person. Humans who carry *Yersinia* in their intestinal tracts and don't show signs of illness, can transmit these organisms to other people if good sanitation is not practiced.

The Organism

Unlike most other bacteria that cause foodborne illness, *Yersinia enterocolitica* can grow at refrigeration temperatures. If present on foods that are refrigerated, the organism can multiply, but at a slower rate than at room temperature. The bacterium is sensitive to heat, and is easily killed at temperatures over 140°F. When processed foods were incriminated in outbreaks, post heat treatment contamination was suspected. *Yersinia* is sensitive to salt concentrations of greater than 5% and acidic pH levels (<4.6). These same levels of temperature, salt and acidity also inhibit the growth of Salmonellae.

In the past, *Yersinia enterocolitica* has been difficult to isolate and identify and may have been responsible for more food or waterborne outbreaks than were reported. In recent years, microbiologists have learned more about these bacteria and have developed newer, more rapid and sensitive techniques of isolation and identification.

Prevention and Control

Since refrigeration cannot be relied on to control the growth of *Yersinia enterocolitica,* food industry employees must follow the rules of good food manufacturing practices.

- Only properly chlorinated water should be used in food processing, food retailing and food service establishments.
- Raw foods should be kept segregated from processed foods.
- Animals should not be allowed in food establishments.
- Good personal hygiene should be practiced by all employees.

By understanding more about the nature of these unusual bacteria and by following the principles of good sanitation, Yersiniosis can be prevented.

Q FEVER AMONG SLAUGHTERHOUSE WORKERS - CALIFORNIA

During May 1985, five cases of hepatitis were reported to the Solano County (California) Health Department among workers at a local meat packing plant that process sheep. Illnesses were characterized by fever, malaise, myalgias, severe headache, and abdominal pain, but no jaundice. Symptoms lasted at least 1 week, then gradually resolved. Hepatitis was suspected because all cases had moderately elevated SGOT values. However, none had serologic evidence of acute infection with either hepatitis A or B (i.e., negative immunoglobulin M [IgM] antibody to hepatitis A and hepatitis B surface antigen). Since all five patients were exposed to domestic animals in the course of their work, the differential diagnoses included Q fever, brucellosis, and leptospirosis. Sera from four of the patients who were originally thought to have had hepatitis from other causes were positive for lgM antibody to Q fever by the immunofluorescent antibody test (lFA), indicating recent infection.

A serosurvey was conducted to identify the extent of the outbreak. Forty-two of approximately 100 employees agreed to be surveyed, including the five employees described above. Twelve (29%) had complement-fixation (CF) titers to Q fever rickettsiae; eight (67%) of the 12 had recently experienced a critical illness compatible with Q fever. Nineteen (45%) of the surveyed employees were positive by IFA test (but negative by CF test) for lgG antibody. Eleven of the 42 employees were negative both by CF and IFA. The 31 persons with serologic evidence of infection worked in a variety of jobs in areas throughout the plant, but no further investigation was performed to determine areas of highest risk.

Employees were educated about the illness through printed material and a question and answer session. A letter was mailed to physicians in the vicinity of the meatpacking plant informing them about Q fever. An investigation conducted by the California Occupational Health and Safety Administration resulted in the implementation of a surveillance program that included screening for Q fever by serology and for valvular heart disease among new employees. No feasible environmental control measures were identified.

Editorial Note: Q fever, caused by the rickettsial organism *Coxiella burnetii*, is found in at least 51 countries on five continents. The primary reservoirs are cattle, sheep, goats, and ticks, but many species of animals, both wild and domestic, are susceptible to infection. The infection in animals is usually subclinical, although organisms are excreted in milk, urine, and feces. In the infected parturient ewe, rickettsiae are found in especially high numbers in amniotic fluid, placenta, and fetal membranes (the placenta may contain 10^9 organisms per gram during late gestation). A single inhaled organism is sufficient to initiate infection. Because they are extremely resistant to desiccation and to physical agents, organisms survive for long periods in the inanimate environment.

Humans are usually infected by inhalation of aerosolized particles from contaminated environments. Disease resulting from sheep occurs most commonly during the lambing season because of the high numbers of organisms shed at this time. Humans are at risk at other times as well, since the organism may be shed periodically from domestic animals and may be found in raw milk, arthropods, and other animal products, e.g., wool. Other occupational exposures to sheep have accounted for four reported outbreaks among employees in urban research facilities.

The incubation period for Q fever in humans is 14-39 days, averaging 20 days. Most commonly, Q fever causes a mild influenza-like illness that rarely requires medical attention. Q fever may manifest as a systemic illness, as in the first four cases, with symptoms characterized by sudden onset of severe headache, retrobulbar pain, a fever of 40°C (104°F) or greater, chills, general malaise, myalgia, and chest pain. Other more severe manifestations include pneumonia and hepatitis. Although the acute disease is usually self-limited, Q fever endocarditis occasionally develops, typically 3-20 years following the acute infection, and is often fatal. Patients with underlying heart disease are at particular risk because it affects previously damaged heart valves. Prompt treatment with tetracycline or chloramphenicol is effective in shortening the course of acute illness.

Q fever has also been described among children. Infection with *C. burnetii* was diagnosed in 18 children under 3 years of age who were hospitalized in the Netherlands during a 16-month period. These patients presented most commonly with fever of unknown etiology or with pneumonia. Four of the children had relapsing episodes of fever that lasted 2-11 months before presentation. The duration of hospitalization averaged 25 days, and ranged from 4 days to 80 days.

Q fever is difficult to diagnose clinically, and radiologic findings of the lungs, when present, may not be diagnostic. However, the diagnosis is readily made serologically.

Q fever is reportable in 24 states. Because Q fever may be mild and self-limited or mistaken for an acute viral illness, diagnosis requires a high index of suspicion. An occupational history should be obtained; contact with animals should suggest Q fever or another zoonoses. Q fever should be considered in the differential diagnosis of patients with atypical pneumonia, an influenza-like illness during periods of low influenza activity, in patients with abnormal liver function tests when serologic evidence for hepatitis A or B is absent, and in children with fever of unknown origin. To facilitate diagnosis, a pilot state laboratory-based Q fever surveillance program has been initiated in California, Colorado, Idaho, Iowa, Montana, New Mexico, and Oregon. Participating state laboratories have volunteered to test selected serum specimens for Q fever antibody. Positive specimens are reported both to the physician and to the state epidemiologist, who subsequently completes a case history form. Physicians in these seven states are encouraged to report such cases through their local/state health departments to the Viral and Rickettsial Zoonoses Branch, Division of Viral Diseases, Center for Infectious Diseases, CDC. *(MMWR 4/11/86).*

CIGUATERA FISH POISONING - VERMONT

On October 29, 1985, the Epidemiology Division, Vermont Department of Health, learned of two persons with symptoms consistent with ciguatera fish poisoning. Both had eaten barracuda at a local restaurant on October 19. One ill person, a 48-year-old woman, had vomiting, diarrhea, myalgia, and chills 4 hours after the meal, followed the next morning by pruritus, flushing, burning of the tongue, and reversal of hot and cold temperature sensation of objects held in her hands. The second

ill person, a 30-year-old male bartender at the restaurant, sought medical attention for severe myalgia and gingival and dental dysesthesia several hours after eating barracuda. In both patients, most symptoms subsided; however, some pruritus and temperature reversal persisted 6 weeks later. A third patron reported pruritus to the restaurant after the meal but was lost to follow-up. No additional cases were identified by contacting the two local emergency rooms and requesting case reports in the *Vermont Disease Control Bulletin*.

The restaurant had served 24 portions of barracuda received fresh by air from a fish distributor in Florida. Two other restaurants in Burlington had received barracuda from the same shipment. One served 44 portions, and the second froze all portions received. The fish distributor reported that the fish was purchased from boats fishing in Florida's coastal waters but could not identify the exact location. The distributor ships to locations throughout the contiguous United States. No information was available about the distribution of other fish from the same catch.

All portions of a single barracuda frozen by one restaurant and tested for ciguatoxin by enzyme immunoassay at the Department of Pathology, University of Hawaii, were positive for ciguatoxin.

Editorial: Human ciguatera poisoning can occur after consumption of a wide variety of coral reef fish, such as barracuda, grouper, red snapper, amberjack, surgeonfish, and sea bass. Ciguatoxin and related toxins are derived from dinoflagellates which herbivorous fish consume while foraging through the macro-algae. Humans ingest the toxin by consuming either herbivorous fish or carnivorous fish that have eaten the contaminated herbivores. Large, more predacious reef fish are generally more likely to be toxic. Since the toxin is heat-stable, cooking does not make the fish safe to eat.

As the domestic and imported fish industry expands its market, the diagnosis of this "tropical" disease must be considered even in areas to which coral-reef fish are not native. Ciguatera fish poisoning can be diagnosed by the characteristic combination of gastrointestinal and neurologic symptoms in a person who ate a suspect fish. The diagnosis can be supported by detection of ciguatoxin in the implicated fish.

Hawaii now uses a "stick test" immunoassay to detect ciguatoxin in fish. The test is sensitive, specific, inexpensive, and easy to use in the field. In Hawaii, if an outbreak-related fish tests positive for ciguatoxin, the reef area of catch is posted to discourage further fishing in that area. In Miami, Florida, because barracuda have been frequently associated with ciguatera poisoning, a city ordinance bans the sale of barracuda. (*MMWR 4/25/86*).

IRRADIATION

Food irradiation may quickly become a common food-processing technique. Irradiation, the use of ionizing radiation on food, may reduce the incidence of food-borne illnesses and increase the life span of fruits and vegetables by killing insects and bacteria found in foods. (*Environmental Nutrition* 8:12, 1, 1985).

Although irradiation has been limited in the United States to such purposes as sterilizing medical equipment and controlling microorganisms in spices, other countries have taken advantage of it. At least 28 countries currently utilize irradiation. In Japan, for example, 10,000 tons of potatoes are irradiated annually to prevent sprouting.

In the past few decades, the U.S. government has established several studies on the use and safety of irradiated foods. Although irradiation processes produce radiolyticcompounds (*not* radioactive compounds), these compounds, the World Health Organization says, pose no toxicological hazards or nutritional losses (at least no more than other processing tecniques such as canning).

The Food and Drug Administration (FDA), though still exploring the effects of high-dose food irradiation, has initiated a proposal asking for wider use of low-dose food irradiation (1 M rad or less). The U.S. Department of Agriculture (USDA) has also proposed using irradiation in pork to stop such microorganisms as Trichina from developing. Decisions on both proposals are expected sometime this year.

An irradiated food is now required to have a label identifying its processing technique. However, the new proposals by the FDA and USDA would not require labeling at a retail level. Despite strong consumer opposition, the FDA states that the label "irradiation" sounds too similar to "radiation," and thus would misinform consumers. Also, food irradiation would stand in direct competition with other food-preservation techniques such as freezing and canning, and none of these techniques require labels. The acceptance of food irradiation by the FDA and the USDA is a breakthrough. If the proposals go through, however, the ultimate test of this food-processing technique will be the consumers' acceptance of the technique as a safe one and their willingness to pay a few extra cents to determine the future of food irradiation. *(Medical Update 3/86)*.

TORNADO DISASTER - PENNSYLVANIA

On the afternoon and evening of May 31, 1985, 27 tornadoes swept across parts of Ohio, Pennslvania, western New York, and Ontario, killing at least 91 persons, injuring more than 800 others, and leaving thousands more homeless. This disaster was the worst tornado storm in the United States since April 1974, when 315 people were killed by twisters that swept through 11 states causing damage totaling more than $600 million.

In Pennsylvania, the hardest hit state, these tornadoes resulted in 65 dead, 700 injured, 1,000 homes destroyed, and hundreds of millions of dollars in property damage. The 13 tornadoes that struck Pennsylvania ranged in speed from 75 mph to 250 mph, in width from 100 yards to 2 miles, and in distance on the ground from 4 to 56 miles. According to the Pennsylvania Emergency Management Agency, Pennsylvania has averaged eight tornadoes a year since 1953. The 1985 tornadoes were the worst to hit the state since record-keeping began in 1854. The worst previous tornado had been in June 1944 when 45 people were killed, 362 injured, and 800 homes damaged in the southwestern part of the state.

Previously, CDC evaluated tornado disasters in Texas, Illinois, and the Carolinas. These studies assessed various factors hypothesized to influence the risk of injury from tornadoes. For the Pennsylvania tornado disaster, a study was designed to document information on deaths and hospitalizations to evaluate selected factors that may influence why some people die from their injuries, while others do not. The study focused on five contiguous counties (Erie, Crawford, Mercer, Venago, and Forest) that were hardest hit (46 of the 65 fatalities). Due to the total relocation of highly affected neighborhoods and the inability to identify a representative sampling frame for uninjured persons in the immediate post-tornado period, the study

looked at fatally injured and hospitalized injured persons. The latter were frequency matched to fatally injured persons 2:1 on two variables, tornado track and age stratum, and compared to detect risk factors for lethality. Public health nurses from the Pennsylvania Northwestern District Health Department were trained to use a standardized questionnaire and conducted the interviews in person whenever possible. Interviews were completed with respondents (next-of-kin, neighbor) for 89% of the fatally injured and with respondents (self, next-of-kin) for 90% of the hospitalized persons.

Certain demographic and impact-phase characteristics (age, sex, location, protective warning, and protective measures) have been found in previous studies to be risk factors for injury; however, in this study, these characteristics did not appear to explain severity of injury. Assessment of injury outcome characteristics in this study revealed that fatally injured persons were more likely to sustain injuries to the head and/or neck than were seriously injured persons. Further review of fatally injured persons showed that all but a few appeared to have been killed "instantaneously" and did not die en route to or in hospitals.

Editorial Note: Public health consequences of tornadoes are very important in the United States. During the 1970s, 507 tornado-related disasters resulted in 830 persons killed, 20,969 persons injured, and 490,316 persons treated with emergency care.

The present study shows that, for selected known risk factors, fatally injured persons did not differ significantly from serious injured (hospitalized) persons. Since deaths were usually "instantaneous," differences among postevent factors, recovery/transport times, and efficacy of emergency medical care do not appear to have contributed to fatal outcome. More likely explanations include differences in amounts of mechanical energy impacting critical body parts and/or unrecognized pre-event or event-phase risk factors. Future research and public health attention should be geared to such preventive activities as early warning and education.

Overall statistics showed that 52% of the persons both fatally and seriously injured had less than 1 minute's warning and 65% had less than 5 minutes' warning. Furthermore, 31% of the initial warnings to seriously injured persons consisted of the person seeing or hearing the tornado, high winds, or flying debris. In some other tornado disasters, citizens have had earlier and more explicit warnings.

This study also showed that only 34% of the seriously injured persons knew the difference between a tornado warning and a tornado watch. Another study has shown that 36% of persons who sighted tornadoes did not know what they were.

Further emphasis needs to be placed on public health strategies for preventing or mitigating tornado-associated morbidity and mortality in high-risk areas. Community action programs should be oriented towards disseminating tornado warning/watches from the National Weather Service and tornado education for citizens. This tornado disaster, along with the majority of all tornadoes, occurred during the late afternoon when radio/television audiences are at their lowest. Therefore, utilization of positive alerts (sirens) are important.

Citizens should be taught what the warning systems are in their communities and what should be done when the warning systems are activated. They should know and practice the following safety measures:

1. Persons in buildings should seek shelter indoors, on the lowest floor, preferably in a basement. Central rooms, including closets and stairwells, are safer than rooms along the outside of the house, and areas near windows should be avoided.
2. Drivers should not attempt to drive away from a tornado. Instead, they should seek shelter indoors immediately on hearing a tornado warning.
3. If drivers in open country cannot find indoor shelter, they should drive away from the tornado path at right angles. If there is not time to escape, persons outdoors should lie flat in the nearest ditch or ravine.
4. Even properly anchored mobile homes are unsafe when wind speeds exceed 50 mph. In tornado-prone states, mobile-home parks should have alternative tornado shelters. *(MMWR 4/11/86).*

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Five Awards Presented at Pennsylvania Conference

At the banquet of the Pennsylvania Affiliate, Glenn Vance, Eastern Milk Producers Cooperative, was given the Sanitarians Award, and G. William Fouse, Pennsylvania Department of Agriculture, was presented with the Distinguished Service Award. IAMFES Certificates of Merit were given to Allen Murray and Arthur Freehling. The Laboratory Director's Association gave Albert Zimmerman, Quality Control Laboratory, a plaque for his many years of outstanding service to the dairy and food industries.

More than 250 persons attended the three-day program of the Pennsylvania Dairy Sanitarians and Laboratory Directors Conference to listen to the 45 speakers and panelists. A variety of presentations on regulations, tests, food poisoning, nutritional value, and quality, and the two panels on laboratory and field staff working together, and convincing farmers were well received.

Officers for the Pennsylvania Dairy Sanitarians Association elected for 1986-87 were L to R - Arthur Freehling, Past President; William Reisinger, Vice President; Gerald Shick, President Elect and Thomas Moore, President.

Allen Murray and Arthur Freehling received Certificates of Merit from IAMFES President, Sidney E. Barnard.

FAMFES Annual Educational Conference

The Annual Educational Conference of the Florida Association of Milk, Food and Environmental Sanitarians was held April 22-23, 1986, at the International Inn on International Drive, Orlando. There were about 75 registrants present for the four sessions. Kathy Hathaway, Executive Manager, and Kate J. Wachtel, Advertising Director of IAMFES brought an interesting display about International and its journals and both participated in the conference.

The program, which was approved by the University of Florida for continuing education credit, included discussions on 15 topics: Food Sanitation at Disney World; Water Quality in Relation to Food Processing; Microbiological Criteria for Foods; A New Food Poisoning--*Plesiomonas shigelloides;* Food Science and Human Nutrition at the University of Florida--What's Happening Now; Irradiated Foods; Current Developments in the Florida Citrus Industry; Milk and Frozen Dessert Labels; Discussion of Current Antibiotic Detection Methods; 3M Petri Film, An Alternative to Pour Plates; The Increased Surveillance in Milk and Frozen Dessert Plants; Water Supply: Quality-Quantity in These Changing Times; Corporate Quality Control; New Culture Developments for Food Processors; and APV Crepaco Plant Computer Operations.

During the Annual Business Meeting, the following officers and directors were elected for 1986-87: President, R. F. (Dick) Jolley; President Elect, Dr. Oliver W. Kaufman; Past President, Cliff E. Muncy; Secretary/Treasurer, Dr. Franklin W. Barber. Directors: Dr. James J. Jezeski, David Fry, Marian Ryan, Sonya Gambrell, and William Hensley.

The Annual Banquet, with Norman Rasmussen as Master of Ceremonies, was an Award Program. Dr. Ronald Schmidt, chairman of the University Scholarship Award Committee, brought the group up to date on the activities of past scholarship winners and presented this year's winner, Ms. Tammy J. Thomas, a Junior in Food Science and Human Nutrition at the University of Florida. Ms. Thomas has a cumulative grade point average of 3.61 on a 4.00 scale. Her current career objectives are to pursue a position in quality control/quality assurance with a preference for the dairy industry.

Past President certificates were presented to Jim Strange (1984-85) and Cliff Muncy (1985-86). Certificates of Appreciation were given to Dr. Ken Smith and Doris Marchetti in recognition of their years of service to FAMFES.

Kathy Hathaway, on behalf of the International Association of Milk, Food and Environmental Sanitarians, presented IAMFES Certificates of Merit to Dick Jolley and Dave Fry in appreciation of their efforts and dedication

to IAMFES and FAMFES. So that members of FAMFES might participate in a recognition given during the 1985 Annual Meeting of IAMFES, Kathy presented the Honorary Life Membership Award to Dr. Franklin W. Barber.

It was agreed that once again much worthwhile information had been presented for FAMFES members and guests at the Annual Educational Conference.

1986-87 FAMFES Officers and Directors L to R - Dr. Oliver Kaufman, President Elect; Cliff Muncy, Past President; Wm. Hensley, Director; Sonya Gambrell, Director; Marian Ryan, Director; Dr. James Jezeski, Director; Dick Jolley, President; Dave Fry, Director and Dr. Franklin Barber, Secretary/Treasurer.

Dr. Franklin Barber receives the IAMFES Honorary Life Membership plaque from Kathy Hathaway.

KAMFES 1986 Educational Conference for Fieldmen and Sanitarians

The Kentucky Association of Milk, Food and Environmental Sanitarians, Inc. held its annual educational conference, February 25-26, 1986, at the Executive Inn, Louisville, Kentucky.

The program was both informative and timely. Some of the topics presented included liability insurance, indoor air, product safety, sulfites, seafood sanitation, listeria in cheese and the Chicago Salmonella Story.

The following officers and directors were elected: President, Bland Dorris; President-Elect, Dale Marcum; Vice-President, Lois Wellinghurst; Secretary-Treasurer, Betty Kelly; Region II Director, Porter Bailey; Region III Director, Richard Wellinghurst; Region V Director, Holly Wade; Region VI Director, David Klee.

At the awards luncheon, life memberships were awarded to Irving Bell, Owen "Buddy" McKinney, Delmer Hail and Roger Barber. The Outstanding Sanitarian of the Year Award was presented to Roger Basinger of the Hancock County Health Department. The Dairy Industry Fieldman Award was presented to Danny Jasper of Southern Belle Dairy. The Steve Sandlin Achievement Award was given to Ginger Burgbacher of the Fivco District Health Department. The Service Award was presented to the Information and Support Section, Division of Food and Sanitation.

Over 200 members were in attendance. The 1987 meeting will again be at the Louisville Executive Inn, February 23-25.

1986 KAMFES Officers L to R - Lois Wellinghurst, Vice President; Betty Kelly, Secretary-Treasurer; Bland Dorris, President; Dale Marcum, President Elect and John Draper, Past President.

Outstanding Sanitarian Award, Roger Basinger, Hancock County Health Department, Hawesville, KY.

Outstanding Industry Service Award, Danny Jasper, Southern Belle Dairy, Somerset, KY.

Seventy-Fourth Annual Meeting of IAMFES

Anaheim, California
August 2-6, 1987

Instructions to Prepare Abstracts of Contributed Papers

Procedure

1. Use the printed Abstract form that appears on the other side of this page. Complete the form using a typewriter equipped with a reasonably dark ribbon.
2. Type in the title, capitalize the first letter of the first word and of any proper nouns.
3. List authors and institution(s). Capitalize first letters and initials. Indicate with an asterisk the author who will present the paper. Give complete mailing address of the author who will present the paper.
4. Check the proper box to indicate if the paper will be presented by a graduate student and is to be entered in The Developing Scientist Award Competition.
5. Type the abstract *double-spaced*, in the space provided on the abstract form.
6. Mail *two* copies of the abstract before January 15, 1987 to:

   Kathy R. Hathaway
   Executive Manager, IAMFES
   P.O. Box 701
   Ames, Iowa 50010

7. Enclose *two* self-addressed standard post cards. One will be used to acknowledge receipt of the abstract and the other to notify the speaker about the scheduling of the paper. Two cards must be included with *each* abstract that is submitted.

Content of the Abstract

The abstract should describe briefly: (*a*) the problem that was studied, (*b*) methods used in the study, (*c*) essential results obtained, and (*d*) conclusions. Statements such as "results will be discussed" should not appear in a abstract.

Oral Presentations

Papers will be scheduled so a speaker has a maximum of 15 minutes, including discussion. Hence the actual presentation should be no more than 11-13 minutes so that time for discussion will be available. Projectors for 2 × 2 inch slides will be available. If the speaker needs other projection equipment, Kathy R. Hathaway (address given earlier) should be contacted as soon as possible.

Subject Matter for Papers

Papers should report results of applied research in such areas as: food, dairy, and environmental sanitation and hygiene; foodborne disease hazards; food and dairy microbiology; food and dairy engineering; food and dairy chemistry; food additives; food and dairy technology; food service and food administration; food and dairy fermentations; quality control; mastitis; environmental health; waste disposal, pollution, and water quality.

Developing Scientist Award Competition

Open to graduate students enrolled in M.S. or Ph.D. programs at accredited universities or colleges who will present their own original research. Candidates cannot have graduated more than one year prior to deadline for submission of abstracts. Form must be signed by the student's major professor or department head signifying approval. An extended abstract form will be required later.

Additional Abstract Forms

Extra copies of the abstract forms may be obtained from Kathy R. Hathaway (address given earlier).

Membership in IAMFES

Membership in IAMFES is NOT necessary for presenting a paper at the annual meeting.

(OVER)

Annual Meeting

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

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Major Professor/Department Head approval (signature & date) _____

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Seventy-Fourth Annual Meeting of IAMFES

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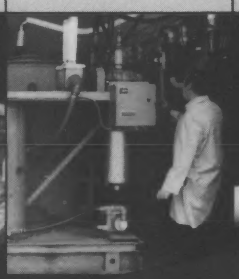

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NATIONAL SANITATION FOUNDATION

In Search of Perfection. How to Create/ Maintain/Improve Quality. Sud Ingle. Prentice-Hall, Inc., Englewood Cliffs, NY 07632. 1985. 344 pages. Paperback - $16.95.

Sud Ingle has provided a book that positions and stresses Quality to every member of an organization. The message that "Quality is everyone's job" is clearly stated and repeated throughout the book. In addition, ongoing quality improvement is a necessity to keep customers satisfied, and happy customers are a key to the success of a company.

The book is divided into the following chapters: In Search of Perfection, Basics of Organizational Quality Improvement (OQI), Managing for OQI, Statistical Problem-Solving Methods, Quality Planning and Deployment, New Product Introduction - Quality of Design, Vendor Quality Control, Manufacturing Quality, Service Quality, Quality Auditing, Quality Circles, Training and the Future of OQI. In addition, the author has included an appendix section covering available sources for statistical and OQI training, quality costs, statistical process controls, design of experiments, basic QA manuals and evaluating organizational quality performance.

"In Search of Perfection" charts a path, by using Sud Ingle's dynamic "Quality Wheel", for assisting companies to increase quality, productivity and profits. It provides and describes in very easy language practical tools to develop, maintain and improve quality. The author clearly explains how to improve a company's organization, overall performance by monitoring and improving the following areas: planning and policy, quality deployment, vendor evaluation, quality tables, in-process quality control, quality measurements, information training, field testing, implementing statistical process control effectively, and quality costs.

An important message that is transmitted in this book is that the quality control department neither creates nor fixes problems all by itself. The quality department is a liaison that collects, analyzes and solves problems that are created due to poor quality decisions made by other groups. Quality is and must be the responsibility of all employees in an organization.

This book should be read by all industry members, especially upper management and quality professionals. At such a reduced price, all quality professionals should have a copy of this great book.

Ricardo J. Alvarez, Ph.D.
Corporate Director, Quality Assurance
Pizza Hut, Inc.
P.O. Box 428
Wichita, KS 67201

Abstracts of Papers Presented at the Seventy-Third Annual Meeting of the IAMFES

Minneapolis, Minnesota, August 3-6, 1986

Abstracts of most papers submitted for presentation at the 73rd Annual Meeting of the IAMFES appear on this and the following pages. The complete text of some of the papers will appear in future issues of the *Journal of Food Protection* or *Dairy and Food Sanitation*.

BIOTECHNOLOGY

Biotechnology - Implications for the Food and Dairy Industry. Susan K. Harlander, *Department of Food Science and Nutrition, University of Minnesota, St. Paul, MN 55108.*

Biotechnology will have a profound impact on the dairy and food processing industry due to the tremendous potential for genetic improvement of microorganisms. Recombinant DNA technology is being applied to microorganisms used in dairy fermentations to genetically "tailor-make" starter cultures which can degrade cholesterol, resist bacteriophage infection, and produce antagonistic compounds that inhibit spoilage organisms and extends shelf life. Engineering microorganisms to produce high-value "natural" food additives, ingredients and processing aids such as enzymes, flavors, colors, vitamins, sweeteners and stabilizers via industrial fermentation processes holds great promise. At the molecular level, protein and enzyme engineering can be used to modify substrate specificity and thermal stability of enzymes and alter functionality of proteins used in food systems. Other applications of interest include development of monoclonal antibodies and DNA probes for detection of pathogens, creation of novel processing methods and upgrading of waste streams to value-added products.

Current Status of New Reproductive Biotechnologies that Affect the Dairy Industry. A.G. Hunter, *Department of Animal Science, University of Minnesota, St. Paul, MN 55108.*

A major goal of the dairy producer is to have a herd of high-producing, efficient, long-lived, prolific, disease-resistant cows that make money. Today's high-producing cow is mainly the result of intense genetic selection through artificial insemination (AI). This has been the only major genetic selection tool for improving cattle. However, powerful biotechnologies are emerging that when coupled with AI, promise significantly better cattle in the near future. The dairy industry will be highly influenced by the results of this current biotechnology revolution. The emerging biotechnologies include: (*a*) use of growth hormone via daily injections or via permanent incorporation of its gene into the genome of cattle; (*b*) embryo generation (calves from calves; in vitro egg maturation and fertilization); (*c*) embryo micromanipulation (splitting, nuclear transplantation [cloning], parthenogenetic generation, mosaic or chimeric animals, foreign gene injection); (*d*) pre-selection of offspring via embryo or sperm sexing (monoclonal antibodies); and (*e*) methods for obtaining more offspring (superovulation, embryo freezing and transfer, synchronization and detection of estrus and pregnancy detection). Collectively, these emerging biotechnologies will have a significant impact on the amount, composition, and consumer acceptance of milk and its manufactured products.

FOOD TOPICS

Quality Assurance in the Food Industry. Dale Anderson, *General Mills, Inc., Minneapolis, MN.*

Quality assurance in the food industry must address the entire operation and ensure that all systems and procedures are reviewed and functioning properly. Quality assurance should be the concern of every employee, not just the concern of selected individuals or departments. The concepts of quality and quality assurance are changing and the importance of quality in the marketplace is more important than it has ever been. As a result, quality assurance programs, while maintaining many traditional roles, are changing to meet new demands and requirements. The key aspects of quality assurance programs and the changes that are occurring to meet new consumers and competitive demands will be discussed.

Consumer Response to Food Irradiation. Christine M. Bruhn, H.G. Schutz and R. Sommer, *Center for Consumer Research, University of California, Everson Hall, Davis, CA 95616.*

Food irradiation offers many advantages to the consumer including improved sanitary level of food. Critical to the realization of these advantages is consumer acceptance. Initial consumer response to irradiation has been uncertainty or fear. Based upon a series of studies, this paper examines the extent of attitude change when different types of consumers were presented with the scientific facts on irradiation by small group

discussions with leaflet, leaflets obtained through the mail, and poster displays. Value structure and demographic characteristics of consumers acceptig and resistant to irradiation were assessed. Subjects showed a higher concern for other areas of food safety and particularly the use of chemicals and sprays on food than toward food irradiation. After educational efforts, many consumers adopted a minor concern stance, but concern among ecologically sensitive consumers increased to a major level. Method of conveying information was not as significant a variable on concern as consumer type. In the samples surveyed, women, young people, and those who place a high value on an ecologically balanced world were the most concerned with the safety of irradiated foods. Willingness to buy irradiated foods was based on the safety of the process rather than the advantages of any specific food. Although educational efforts did not always lower concern, they usually increased stated willingness to try irradiated foods.

New Concepts in Food Packaging. Curtis L. Larson, *3M/ Packaging Systems Division, 3M Center, 230-BF-13, St. Paul, MN 55144.*

A sound-on-slide presentation will illustrate selected packaging problems and the way technologies have been used to solve them. The converse, of technologies looking for problems, will also be covered. Several new concepts will be proposed relating to food. Some have commercial use today, some do not. The main theme is that packaging components can significantly enhance the performance of common packages.

Multiple-Cause Failure of Low-Acid Canned Food Processes. Irving J. Pflug, *Dept. of Food Science and Nutrition, University of Minnesota, St. Paul, MN 55108.*

Failure of low-acid canned food processes is usually attributed to one cause. In this report, multiple-cause failure of the manufacturing-sterilizing processes of low-acid canned foods will be described. The data are analyzed statistically to show the probable spoilage pattern that will occur when there is a multiple-cause failure.

Sulfites in Foods. Steve L. Taylor, Robert K. Bush and W.W. Busse, *The Food Research Institute, 1925 Willow Drive and the Department of Medicine, University of Wisconsin, Madison, WI 53706.*

Sulfites are widely used as food additives for a variety of technical functions including the inhibition of enzymatic and non-enzymatic browning, antimicrobial actions, dough conditioning, and bleaching effects. Sulfite residuals in foods vary from <10 ppm to 2000 ppm. Sulfites are highly reactive and in most foods, little sulfite remains as free, inorganic sulfite. Most of the sulfite is either volatilized as SO_2, oxidized to sulfate, or reacted with food components including proteins and carbohydrates. The Monier-Williams method for total SO_2 determination detects free sulfite plus a portion of the bound forms of sulfite. Sulfites have recently been implicated as triggers of asthmatic reactions in sensitive individuals. A survey of the prevalence of sulfite sensitivity conducted at the University of Wisconsin revealed that perhaps 80,000 to 100,000 of the nation's 9 million asthmatics may be sulfite-sensitive. Food challenges of confirmed sulfite-sensitive asthmatics demonstrated that these individuals' asthma is triggered by some sulfited foods (lettuce, dried apricots, white grape juice) but not others (dehydrated potatoes, shrimp, fresh mushrooms). The differences in reactions to sulfited foods may be due to either the residual level of sulfites or to the form of sulfite that is present.

FOODSERVICE INDUSTRY

Bacteriologic and Parasitic Studies on Nasal Swabs and Fecal Specimens of Foodhandlers in a Nigerian University. A.A. Adesiyun, O.J. Ajannusi[1], S.J. Akpa and J.A. Egamana[2], *Departments of Veterinary Public Health and Preventive Medicine, [1]Parasitology and [2]Microbiology, Admadu Bello University, Zaria, Nigeria.*

Nasal swabs obtained from 186 foodhandlers in a Nigerian university were cultured for staphylococci on Baird-Parker agar (BPA) and the enterotoxigenicity of *Staphylococcus aureus* strains was determined by the microslide technique. Fecal samples from 150 of these personnel were cultured for *Salmonella, Shigella* and *Yersinia* species. Helminth eggs were detected by the floatation method. Forty-seven (25.3%) workers were carriers of enterotoxigenic *S. aureus* in their anterior nares. Of the 207 staphylococcal isolates tested, 55 (26.6%) were enterotoxigenic. Staphylococcal enterotoxin A (SEA) was produced by 18 (8.7%), SEB by 9 (4.3%), SEC by 14 (6.8%), SED by 13 (6.3%) and SEE by 9 (4.3%). Two (1.3%) cooks had *Salmonella* infection, one being positive for *Salmonella typhi* lysotype A, subtype Tananarive and the other with *Salmonella hayindogo,* a new type, subtype 1 with a serologic formula of 1,3,19:e,h:1,6. *Yersinia intermedia* was isolated from 3 (2.0%) of the workers. Hookworm infection was most common with 47 (31.3%) being positive. Infection by *Trichuris* spp., *Ascaris* spp., *Strongyloides* spp. and tapeworms was detected in 3 (2.0%), 2 (1.3%), 2 (1.3%) and 1 (0.7%) workers, respectively. The health risk posed to consumers of foods handled by the infected workers cannot be over-emphasized.

Guidelines for Uniformity in Facilities Planning and Plan Review. James J. Brinda, *Minnesota Vikings Food Services, Inc., 5200 West 74th Street, Edina, MN 55435.*

The professionalization of the Sanitarian has provided the nations food protection programs within the 50 states and its counties and cities with about as many variations of systems for food facility plan review. The Food and Drug Administration model food code serves as a standard for inspection of the operating food establishment. Training programs provided by federal and state training officers attempt to bring about uniformity of code interpretation and facility inspection. But, no such system exists for: (*a*) mandatory plan submission prior to

commencing food facility construction or remodeling, or (*b*) mandatory training and competency testing of the professional sanitarian responsible for approving the facility layout, interior surface materials, foodservice equipment and installation.

Effects of Potassium Sorbate on the Microbial Content and Keeping Quality of a Restaurant Mexican Hot Sauce. Lutgarda S. Palomar, Lisa M. Flores, Peggy A. Roh and Lloyd B. Bullerman, *Department of Food Science and Technology, University of Nebraska, Lincoln, NE 68583-0919.*

Spoiled and unspoiled restaurant-made Mexican hot sauces were examined for the presence of pathogenic and spoilage microorganisms. Studies to determine whether microorganisms isolated from the sauce are able to grow and cause spoilage were also carried out. Effects of potassium sorbate at various levels (0, 0.02, 0.03, 0.05, 0.1 and 0.2%) on the keeping quality of the sauce were also determined. The spoiled sauce had microbial counts 4 log cycles higher than the unspoiled sauce. Spoilage bacteria were either very few or absent in all the samples of spoiled and unspoiled sauce, and were unable to grow when reinoculated into fresh sauce. The pH of the sauce was below 4.5. Yeasts increased after 10 d of incubation and were the main organisms that caused spoilage. Potassium sorbate at 0.05% was inhibitory to yeasts in both original and inoculated sauces. Levels of 0.02 and 0.03% potassium sorbate were only fungistatic.

The Microbiological Evaluation of Handwashing Practices for Foodservice Personnel. Donald Vesley, J.L. Lauer and R. Lillquist, *University of Minnesota, Boynton Health Service, 410 Church Street, Minneapolis, MN 55455.*

Despite the universal acceptance of handwashing as a major component of infection control programs in clinical, laboratory or foodservice settings, there is little agreement or standardization relative to methods for evaluating the effectiveness of handwashing regimens. The availability of a mechanical handwashing device (VIVO II, Scientific Growth, Inc., Phoenix, AZ) has enabled us to develop protocols for standardized comparisons of different methods and products. For non-germicidal regimens the effluent from the wash itself is collected and high numbers of microbes recovered reflect successful handwashing. A follow-up standardized machine wash provides a comparison based on percentage removed by the original wash. For germicidal regimens, percentage reduction based on a control hand (standardized preliminary wash) vs. a test hand (standardized follow-up wash) must be used because the germicidal action changes the significance of high counts in the effluent from the actual wash. Studies on student volunteers are described which imply the ability of an 8-s machine wash to yield results equivalent to a manual wash (15-s, Ivory Soap) provided that a relatively high machine pressure (42 lb./in.^{2}) is maintained. However, a germicidal product in manual washing (15-s, Betadyne) provided a greater percent reduction than an 8-s nongermicidal machine wash.

The Safety of Airline Foods - Current Concerns and Initiatives. John Feldman, *US FDA, 240 Hennepin Ave., Minneapolis, MN 55401.*

Two reviews of airline food service practices, conducted by FDA in the past two years, will be discussed. These will demonstrate improvement in some areas and identify areas that need continued surveillance. In addition, use of sulfites and yellow no. 5 in foods will be explored.

Safety of Airline Foods. Ulfert H. Esen, *Food Services of United Airlines, United Airlines Food Services, LaGuardia Airport, Flushing, NY 11371.*

Foodborne infections and intoxications associated with commercial air travel occur seldom. However, any such occurrence is greatly feared by all airlines and airline caterers. This presentation will focus on a review of 21 such outbreaks betweeen 1961 and 1984. Reviewing the causative organism, agents and circumstances leading to the outbreaks. The prevention of such foodborne infections and intoxications can only be achieved through thorough understanding of the basic principles of food hygiene and food technology at all catering facilities.

Safety of Airline Foods. W. Joel Simpson, *Director of Quality Assurance, Dobbs Houses, Inc., 5100 Poplar Avenue, Memphis, TN 30137.*

The safety of airline foods has been the focus for attention in recent months, largely as a result of FDA's temperature survey at major airports during the summer of 1985. This paper will review the unique aspects of airline food production and delivery, the associated risks, and the rigid controls which are exercised in flight kitchens, from one company's viewpoint. This issue of temperature controls and time/temperature relationships will be emphasized, as well as recent developments in training materials for airline catering employees.

Safety of Airline Food. Jeffrey M. Spykerman, *US FDA, 240 Hennepin Ave., Minneapolis, MN 55401.*

I plan to discuss the current as well as past and future problems (and triumphs) of the airline food service, including as it relates to the health of the travelling public. I will draw upon my 13 years of inspectional experience of airline foodservice facilities mostly in the St. Paul and Minneapolis, MN area, as well as inspectional findings aboard commercial aircraft.

LISTERIA AND LISTERIOSIS

Analysis of Raw Milk for the Epidemic Serotype of *L. monocytogenes* Linked to an Outbreak of Listeriosis in California. C.W. Donnelly, E.H. Briggs and G.J. Baigent, *De-*

partments of Animal Science and Medical Microbiology, University of Vermont, Burlington, VT 05405.

An outbreak of listeriosis which occurred in Los Angeles and Orange Counties, California between January and June 1985 was linked to consumption of Mexican-style fresh cheese by susceptible individuals, most of whom were pregnant Hispanic women. 1,123 raw milk samples from 27 farms which supplied the incriminated cheese plant and 27 control farms were analyzed in an attempt to isolate the epidemic serotype of *Listeria monocytogenes* responsible for this outbreak. Analyzed samples consisted of milk from individual farm bulk tanks as well as strings of 25-40 cows. Raw milk samples were directly enriched for 24 h at 37°C and analyzed by flow cytometry, or cold enriched at 4°C for 1 month and analyzed by flow cytometry. Growth from direct or cold enrichment was streaked to McBride's *Listeria* agar and suspect colonies were biochemically identified as *L. monocytogenes* using the BBL Minitek system. The epidemic serotype of *L. monocytogenes* was not isolated from raw milk of farms supplying the incriminated cheese plant. *L. monocytogenes* serotype 1 was isolated from 16 string samples of one control farm. Results from flow cytometry analysis yielded a 5.86% false-positive rate and a 0.53% false-negative rate when compared with cultural procedures.

An ELISA Method for Detection of *Listeria monocytogenes* in Raw Milk. J.M. Farber and J.I. Speirs, *Microbiology Research Division, Bureau of Microbial Hazards, Health Protection Branch, Health and Welfare Canada, Sir Frederick Banting Research Center, Tunneys Pasture, Ottawa, Ontario, Canada K1A 0L2.*

An ELISA method for detection of *Listeria monocytogenes* in raw milk was developed. Initial trials using antibodies prepared in rabbits were unsuccessful in that false-positive reactions were observed. Subsequent trials with monoclonal antibodies directed against flagellar antigens appeared more promising. Inoculated raw milk samples, either with or without a 24-h enrichment in a selective broth containing 15 mg of acriflavin HCl/L and 40 mg of naladixic acid/L were filtered through hydrophobic grid membrane filters (HFMF). The ELISA reaction was performed either directly on the HGMF or on a nitrocellulose "blot". Alternatively, sediments from raw milk samples were fixed onto wells of Immulon II microtiter plates and the ELISA reaction was carried out using horseradish peroxidase-antimouse G, A, M as the labelled antibody and o-phenylenediamine as the substrate.

Survival of *Listeria monocytogenes* in Ground Beef. Jennifer Johnson, M.P. Doyle and R.G. Cassens, *1805 Linden Drive, University of Wisconsin, Madison, WI 53706.*

Listeria monocytogenes, due to its association with animals and animal products and its proven pathogenicity, is an organism of potential importance to the meat industry. Survival of *L. monocytogenes* in ground beef held at 4°C for 2 weeks was investigated. The ground beef was inoculated with Type 1 or Type 4 *L. monocytogenes* at a level of 10^5 to 10^6 organisms/gram and then packaged in either oxygen-permeable or oxygen-impermeable bags. Bags were sampled randomly on days 0, 2, 3, 5, 7, 11, and 14 and *Listeria* counts were determined by duplicate spread-plating on McBride's agar; pH of the meat samples was also determined. The number of *L. monocytogenes* in the ground beef remained constant throughout the sampling period and was not affected by oxygen permeability of the package. The pH of meat increased slightly during storage but was always in the range of 5.6 to 5.9. This work indicates that *L. monocytogenes* is capable of surviving 14 d of refrigerated storage without any real decrease in cell numbers and could pose a health hazard if initially present at high levels. Work is currently underway to determine the survival of *L. monocytogenes* at the lower pH values characteristic of fermented sausages.

Surveillance of Soft and Semi-Soft Cheese for *Listeria*. M.A. Johnston, A. Loit, U. Purvis and J. Farber, *Field Operations Directorate and Food Directorate, Health Protection Branch, Health and Welfare Canada, Ottawa, Ontario, Canada K1A 0L2.*

Recent outbreaks of listeriosis associated with dairy products prompted a survey to determine the incidence of *Listeria* in domestic and imported cheeses and to assess the manufacturing practices of the cheese industry. A total of 211 samples of soft and semi-soft cheeses from 38 Canadian and 60 foreign manufacturers was examined for *Listeria* and for phosphatase. Two samples contained *Listeria monocytogenes*, and one sample contained *L. innocua*. The three lots of cheese were all manufactured by one plant in France. Nineteen samples from 6 Canadian and 10 foreign manufacturers gave positive phosphatase tests. Additional information confirmed that some of these cheeses were made from unpasteurized milk and were not held 60 d before sale. Five of 25 manufacturers inspected at the time of sampling were not adhering to good manufacturing practices and used unpasteurized milk to make cheese. Although *Listeria* was not found in Canadian cheese, the possibility of a *Listeria* outbreak occurring in Canada is real if conditions do not improve in a few plants. Continued surveillance by government and by industry is recommended to ensure the microbiological safety of such cheeses.

Growth Patterns of *Listeria monocytogenes* in Skim, Whole and Chocolate Milk and in Whipping Cream at 4, 13 and 35°C. Eileen M. Rosenow and Elmer H. Marth, *Department of Food Science and The Food Research Institute, University of Wisconsin, Madison, WI 53706.*

Autoclaved samples of skim, whole and chocolate milk and whipping cream (32-35% milkfat) were inoculated with 5×10^2 to 1×10^3 *Listeria monocytogenes* cells/ml and incubated at temperatures between 4°C and 35°C. Generation times at 35°C (strain V7) were 0.65 h in chocolate, 0.67 h in cream,

and 0.69 h in skim and whole milk, with maximum populations of 1.32×10^9, 2×10^8, 2.9×10^8, and 2.67×10^8 CFU/ml, respectively, attained after 48 h. At 13°C strain V37CE had a doubling time of 4.98 h in chocolate, 5.29 h in cream, 5.93 h in whole, and 7.22 h in skim milk. Final CFU/ml after 7 d were 1.36×10^8 (skim), 1.88×10^8 (whole), 1.05×10^9 (chocolate), and 3.84×10^7 (cream). Some strain variation occurred at 4°C. Generation times at 4°C for strains V7, California isolate, and V37CE ranged from 1.29 to 1.56 d in skim, 1.26 to 1.50 d in whole, 1.34 to 1.52 d in chocolate, and 1.16 to 1.66 d in cream. At this temperature, the California strain grew fastest followed by V37CE and V7. Maximum CFU/ml averaged 4.57×10^7 in 38-46 d (skim), 4.19×10^7 in 38-63 d (whole), 7.66×10^8 in 48-63 d (chocolate), and 1.86×10^7 in 38-63 d (cream). All strains reached highest population in chocolate milk, regardless of incubation temperature. Generally, doubling time for *L. monocytogenes* was shortest in chocolate milk followed by whole and skim milk and cream.

Behavior of *Listeria monocytogenes* During the Manufacture and Ripening of Cheddar Cheese. Elliot T. Ryser and Elmer H. Marth, *Department of Food Science and The Food Research Institute, University of Wisconsin, Madison, WI 53706.*

The ability of *Listeria monocytogenes* to survive the Cheddar cheese-making process and persist during ripening of cheese was examined. Pasteurized whole milk inoculated with 5×10^2 *L. monocytogenes* (strain Scott A, V7 or California)/ml was made into stirred curd Cheddar cheese in a pilot-plant-sized vat. Cheese was ripened at 6 or 13°C. *Listeria* counts were obtained by surface-plating samples diluted in Tryptose Broth (TB) on McBride Listeria Agar (MLA). Initial TB dilutions were stored at 3°C and plated on MLA after 2, 4, 6, and 8 weeks if the organism was not detected originally. Selected *Listeria* colonies from each sample were confirmed biochemically. During Cheddar cheese manufacture, *Listeria* counts remained relatively constant. After pressing the curd overnight, numbers of *L. monocytogenes* increased to about 1×10^3/g. Generally, greatest numbers of *Listeria*, about 5×10^3 cells/g, were in cheese after 14 d of ripening. *Listeria* counts for all 3 strains decreased during further ripening, and no appreciable difference in survival was seen in cheese aged at 6 or 13°C. Strains Scott A, V7 and California persisted at levels of >10 cells/g for as long as 224, 196 and 126 d in Cheddar cheese of normal composition. Strains V7 and California were uniformly distributed throughout another set of cheese blocks and numbers of *Listeria* decreased uniformly during 98 d of storage.

Fate of *Listeria monocytogenes* During the Manufacture and Ripening of Camembert Cheese. Elliot T. Ryser and Elmer H. Marth, *Department of Food Science and The Food Research Institute, University of Wisconsin, Madison, WI 53706.*

The ability of *Listeria monocytogenes* to survive during manufacture of Camembert cheese and persist during the normal cheese ripening process was examined. Pasteurized whole milk inoculated to contain 5×10^2 *L. monocytogenes* (strains Scott A or V7)/ml was made into Camembert cheese according to standard procedures. *L. monocytogenes* in surface, interior and wedge-shaped cheese samples was enumerated by surface-plating appropriate dilutions in Tryptose Broth (TB) on McBride Listeria Agar (MLA). Initial TB dilutions were stored at 3°C and plated on MLA after 2, 4, 6, or 8 weeks if the organism was not detected originally. Selected colonies from each sample were confirmed biochemically. Results showed that *Listeria* counts for both strains increased to about 5×10^3 cells/g of cheese 24 h after it was made. After proper mold development followed by 21 d of ripening at 6°C, there was no apparent change from the initial in numbers of strain V7 whereas strain Scott A decreased to <10 cells/g. Rapid growth of strain V7 in cheese was detected after 35 d of ripening. Strain V7 reached levels of 1×10^7, 1×10^7 and 1×10^5 cells/g, respectively, in wedge, surface and interior cheese samples taken after 56 d of storage. In addition, growth of strain V7 during this period paralleled the increase of pH of cheese to 7.0 during ripening.

Listeriosis in the United States. Claire V. Broome, C.A. Ciesielski, M.J. Linnan and A.W. Hightower, *Division of Bacterial Diseases, Centers for Disease Control, Atlanta, GA 30333.*

Listeria monocytogenes has recently been documented as a cause of common-source foodborne outbreaks in the Canadian Maritime Provinces, 1981; in Boston, 1983; and Southern California, 1985. The outbreaks have been notable for a case-fatality rate of 30%, including stillbirths and perinatal deaths. The largest outbreak in Southern California included 142 cases. The vehicles implicated have included cole slaw, pasteurized milk and Mexican-style soft cheese. It has been difficult to identify these outbreaks prospectively because listeriosis is a rare disease, and is not currently reportable. We have analyzed data from a 28% sample of U.S. hospital discharges to define the epidemiology of sporadic cases, and have identified additional common source clusters which had not been previously recognized. We estimate that at least 800 cases occur in the U.S. each year; increased public health attention must be directed toward preventing disease due to this agent.

Use of a Modified Fluorescent Antibody Procedure for the Rapid Detection of *Listeria monocytogenes* in Dairy Products. Catherine W. Donnelly, *Department of Animal Sciences, University of Vermont, Burlington, VT 05405.*

Fluorescent antibody (FA) techniques have been used successfully to identify the presence of *Listeria monocytogenes* in clinical specimens such as cerebrospinal fluid and blood. In these specimens, *L. monocytogenes*, if present, may exist in pure culture. FA techniques have been less successful for presumptive identification of *L. monocytogenes* in foods where contaminating microflora indigenous to a particular food product may exist. *Listeria* antisera exhibit cross reactivity with *Streptococcus, Staphylococcus,* and *Micrococcus* spp. In addition, FA procedures are time consuming, tedious and subjective. To overcome shortcomings associated with conventional

FA procedures for rapid identification of *L. monocytogenes* in milk and other dairy products, FA procedures were automated through use of flow cytometry (FCM). Through a process of selective enrichment and FCM, presumptive results on presence or absence of *L. monocytogenes* in raw milk or other dairy products can be obtained within 26 h. These procedures are rapid, highly sensitive and are particularly useful to monitor outbreaks of listeriosis where analysis of large numbers of samples within a short time period would be required.

Comparison of Methods for Detecting *Listeria monocytogenes* in Cheese. Michael P. Doyle and Jean L. Schoeni, *Food Research Institute, University of Wisconsin, Madison, WI 53706.*

Ninety samples of soft, surface-ripened cheese from a lot suspected to be contaminated with *Listeria* were assayed for *Listeria monocytogenes* by three different procedures. These included: (*a*) cold enrichment (held at 4°C and sampled at 1, 2, 3, 4, 6 and 8 weeks); (*b*) the Food and Drug Administration enrichment procedure (held at 30°C and sampled at 24 and 48 h, with and without alkali [0.5% KOH] postenrichment treatment); and (*c*) the shortened enrichment procedure of Doyle and Schoeni (held at 37°C under microaerobic conditions with agitation and sampled at 24 h). Enrichment cultures were plated in duplicate on McBride Listeria agar and plates were incubated under microaerobic conditions at 37°C for 48 h. Ten colonies typical of those formed by *L. monocytogenes* per plate were selected for confirmation. *L. monocytogenes* was isolated from 41 of the 90 (46%) cheese samples. Interestingly, no single procedure detected the organism in all of the samples determined to be *Listeria*-positive. Most isolations (21) were made by the cold enrichment procedure, with 16 and 13 isolations made by the FDA and Doyle-Schoeni procedures, respectively. Most isolations (12) by the cold enrichment method were from the 1-week sampling. The organism was isolated from only 9 of the 41 *Listeria*-positive cheese samples by more than one procedure.

Behavior of *Listeria monocytogenes* in Milk and Cheese. Elmer H. Marth, *Department of Food Science and The Food Research Institute, University of Wisconsin, Madison, WI 53706.*

Listeria monocytogenes can cause encephalitis, septicemia and mastitis in sheep, goats, cattle and water buffalo. The mastitis, either acute or chronic, can lead to *L. monocytogenes* in raw milk, although the bacterium also has appeared in milk of apparently healthy cows. Environmental sources (e.g. silage, soil) of the bacterium also can result in contaminated raw milk. Behavior of *L. monocytogenes* in milk and milk products, until recently, has received only limited attention. Earlier work in Yugoslavia (1974, 1979) and Bulgaria (1964) indicated survival in 28-d-old fully ripened white brined cheese; survival for at least 7 d in refrigerated cultured cream and in unsalted cheese made from skim milk; survival for 50-70 d in Kachkaval cheese, 15-60 d in white pickled cheese and more than 6 d in yogurt, all made from ewe's milk. Our work has shown that *L. monocytogenes* can grow in autoclaved skim milk, whole milk, chocolate milk and cream held at 35°C (generation time-GT- .64-.69 h), 13°C (GT 3.01-3.65 h), and 4°C (GT 1.51-1.64 d). When nonfat dry milk was made from inoculated skim milk, ca. 90% of the organisms were inactivated during drying, but the remainder survived for 8 to 12 weeks in finished product at room temperature. Small numbers of *L. monocytogenes* also survived cottage cheese manufacture and remained viable for 28 d in refrigerated creamed or uncreamed cottage cheese. The organism survived from 90 to more than 300 d in Cheddar cheese made by the stirred curd procedure. Survival followed by substantial growth (as the pH increased during ripening) occurred in Camembert cheese.

Thermal Resistance Characteristics of *Listeria monocytogenes*. Robert M. Twedt, *Division of Microbiology, Food and Drug Administration, Cincinnati, OH 45226.*

Following a milkborne outbreak of listeriosis in Massachusetts in 1983, the FDA initiated comprehensive studies on thermoresistance of the implicated pathogen, *Listeria monocytogenes*. The objectives were to determine if the species could survive pasteurization, whether survivors could multiply in milk under refrigeration, and whether an intracellular location in infected cow's milk gave added heat protection. *L. monocytogenes* strains isolated during investigation of the 1983 outbreak and a cheese-related outbreak of 1985 and from a broad survey of farm bulk tanks were studied. Strains were heated in a variety of milk and dairy products using sealed glass tubes and a slug-flow heat exchanger. The rate of inactivation was linear over a wide pH range. The $D_{71.7°C}$ for *L. monocytogenes* strain Scott A in raw whole milk was 0.9 s. Heat resistance was a stable characteristic, unaltered by heat stress. In skim milk, heavy cream, and ice cream mix, D-values for accepted processing temperatures ranged from 0.8 to 1.6 s. None of the strains examined would have survived proper pasteurization. Heated *Listeria* failed to multiply during storage in raw, pasteurized, or sterile milk at 4°C. However, unheated bacteria grew well in pasteurized milk during cold storage. Intracellular location, the result of an immuno-elicited phagocytosis reaction, did not protect *L. monocytogenes* from thermal inactivation.

MILK: PRODUCTS, REGULATION AND TESTING

Cholesterol and Cholesterol Oxides - Significance in Dairy Products. Paul B. Addis, B.D. Sander and D.E. Smith, *Department of Food Science and Nutrition, 1334 Eckles Avenue, University of Minnesota, St. Paul, MN 55108.*

Recent research has raised questions concerning the proposed link between cholesterol and atherosclerosis. Cholesterol oxides, frequent contaminants in cholesterol preparations, were found to be atherogenic, whereas pure cholesterol was not in side-by-side comparisons, including rabbit feeding studies and cell cul-

ture assays. More recently, convincing evidence has been published which indicates that linoleic acid hydroperoxide is atherogenic. Taken together, research on the potential atherogenicity of cholesterol oxides and linoleic acid and presumably other hydroperoxides emphasizes the importance of preventing oxidative rancidity in foods to reduce the risk of coronary heart disease in the human population. Dairy products contain only moderate levels of cholesterol and predominantly saturated fat. However, some products are heated and/or dehydrated, processes which could induce lipid oxidation. Results of cholesterol oxide studies of some dairy products will be presented.

Prevalence of Milk Contamination by Certain Antibiotics as Detected by an Immunoassay Method. Joseph W. Amshey, Laurel Samoiloff and Vita S. Theriault, *Angenics, Inc., 100 Inman Street, Cambridge, MA 02139.*

The prevalence of contamination of milk by various antibiotics can now be estimated using immunoassay methods capable of identifying each drug specifically. Users of a commercially available immunoassay method for antibiotics (SPOT™ Test) which individually detects penicillin G, cephapirin and cloxacillin were contacted by telephone and encouraged to report the results of their testing during an arbitrarily selected period of time. The relative prevalence of contamination by each of the three drugs and ampicillin was determined for the population of samples where the test user reported the drug they detected or where a sample was available to us for analysis. Contamination by ampicillin was verified by a similar method to the SPOT™ Test under development in our laboratory. Of 153 positive loads reported, 114 or 75% were penicillin, 28 or 18% were cephapirin, 8 or 5% were cloxacillin and 2 or 1% were ampicillin. One or 0.7% was contaminated with an unknown lactamase-sensitive drug not ampicillin. The frequency distribution of zone sizes was tabulated for samples where it was reported. For penicillin, 56% of the reported zone sizes were $\geq$19 mm versus 43% for cephapirin and 0% for cloxacillin, presumably reflecting the relative detection sensitivity of the disc assay, milk-out rates, etc. For penicillin, 10% of the positives were <16 mm as compared to 7% for cephapirin and 25% for cloxacillin.

Total Solids Composition of Regular Homogenized Milk. Sidney E. Barnard, Edward D. Glass, Jr., Daniel D. Phelps, Gregory J. Desautels and Louise M. Moir, *Pennsylvania State University, 8 Borland Laboratory, University Park, PA 16802.*

Samples of milk purchased at stores in Pennsylvania were tested in duplicate for total solids by Mojonnier procedures. At the same time milkfat content was determined by the Multispec at the Dairy Herd Improvement Central Laboratory in Pennsylvania. The purpose was to determine the percentage of samples having the current minimum of 11.5% total solids and how many would reach a proposed higher standard. Because there are both milk dealers and farm juggers in Pennsylvania, results were separated. All except 4.7% of the samples tested 11.5% total solids or higher. Most of those testing lower, contained less than the minimum milkfat of 3.25%. During calendar year 1985, a total of 874 milk samples were tested in all months of the year. There were more problems with low total solids tests during the summer months. A major contributor to low total solids tests was samples containing less than 3.25% milkfat. Twelve percent of the samples contained less than 3.15% milkfat. It would seem relatively easy to raise the total solids of regular milk by being sure that all milk contains at least 3.25%. This means testing every batch and standardizing or checking samples every few minutes from continuous systems.

Detection of Antibiotic Residues in Milk by a Rapid Test Strip Assay. D.M. Bleile, C.D. Gallup, A.J. DeLizza, J.E. Dyck, G.T. Barnard, W.C. Hsu, S.N. Hanjan, R. Varro, D.J. Litman and P. Khanna, *Syntex Diagnostics Division, P.O. Box 10058, Palo Alto, CA 94303.*

An 8-minute, internally referenced test strip assay has been developed for the detection of β-lactam antibiotics in raw cow's milk. An immunochemical test strip technology has been incorporated into convenient kit form, designed for use on the farm, tank truck, and loading dock. The principle of the assay relies on recognition of antibiotic residues by highly specific antibodies combined with new enzyme immunoassay methodologies. The protocol includes placing a test strip in milk to which an antibody-enzyme reagent has been added. Color development on reactive surfaces of the strip proceeds after addition of a developer solution. Essentially all penicillins and cephapirin are detected by a single test strip. Results may be interpreted visually or with instrumental assistance. The performance characteristics of the assay have been established for spiked milk samples, as well as milk from treated cows. The assay is reliable for detection of penicillin G at 0.008 IU/ml (5 ng/ml) and cephapirin at 10 ng/ml. The assay format permits extension to detection of additional analytes.

Increasing the Calcium:Sodium Ratio in Cottage Cheese. B.J. Demott, *The University of Tennessee, PO Box 1071, Knoxville, TN 37901-1071.*

With the objective to increase the nutritive value of cottage cheese, the incorporation of calcium into cream to be used for dressing was investigated. Cream containing one of 16 different combinations of $CaCl_2 \cdot 2H_2O$ and/or NaCl was added to cottage cheese curd. The Ca concentrations were 50 to 106 mg/100 g and the Na concentrations were 278 to 348 mg/100 g of cheese. Samples containing <106 mg Ca/100 g of cheese had like-moderately flavors, but samples having >106 mg Ca/100 g of cheese had dislike-slightly flavors. Statistical analyses showed Ca concentration to have both linear and quadratic effects, and Na concentrations to have a quadratic effect upon flavor scores. Best flavors were on those samples containing 60 to 77 mg Ca/100 g and 295 to 330 mg Na/100 g of cheese. However a like-moderately flavor was still present for those samples containing 89 mg Ca and 312 mg Na/100 g of cheese. This is a Ca:Na ratio of .28, nearly double the 0.15 found in commer-

cial cheese. Consumer panel data indicate that the concentration of Ca can be increased from a normal of about 60 mg/100 g to at least 89 mg/100 g without influencing the flavor.

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

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

Computer Applications in DHIA Laboratories. George E. Gramling, *National Dairy Herd Improvement, Inc., 3021 E. Dublin-Granville Road, Columbus, OH 43229.*

At present there are 68 laboratories analyzing milk components for DHIA in the U.S., with 32 of these located in either Wisconsin or California. These 68 laboratories are using 58 Multispec and 58 Foss instruments for fat and protein analysis. Fifty laboratories analyze for somatic cells using 22 Coulter counters and 56 Fossomatics. Over 31 of the 68 laboratories analyzing for fat and protein use computers in their daily operation. Of the 36 laboratories outside Wisconsin and California, over 28 use computers. The prime uses of computers in DHIA laboratories are for quality control and for lowering turnaround time. Turnaround time has been lowered by several methods. Three laboratories teleprocess all barnsheet data including the milk component data; 17 teleprocess to the DRPC's the component data and 7 use the computer to print out the component analyses on the barnsheet pages which are sent to the DRPC or on a disc. This information is then sent by overnight mail. The usual procedure using computers for quality control includes the following: requires daily repeatability checking of the milk analysis instruments, hourly water and milk controls, retesting samples at the end of each herd which are outside certain high or low limits, and the weekly machine calibration check. The tolerances for each test are included in the computer program and for the machine to proceed, the tests must meet the tolerances. Additionally, these laboratories receive daily summaries of all samples tested, including various breakdowns such as number of samples not tested; samples per technician for the day, etc. In the near future, it is hoped all DHIA laboratories will be computerized.

Growth and Enterotoxin Production by *Staphylococcus aureus* in Creams with Various Amounts of Milkfat. Margaret I. Halpin and Elmer H. Marth, *Department of Food Science and The Food Research Institute, University of Wisconsin, Madison, WI 53706.*

Outbreaks of staphylococcal food poisoning associated with butter and dairy desserts prompted us to determine if enterotoxigenic strains of *Staphylococcus aureus* can grow in dairy products with various amounts of milkfat. *S. aureus* strains 100-A, 196-E, 254, 473, 505 and 521 (all produce enterotoxin A) were inoculated into creams containing 16, 32, 36, 40 or 80% milkfat. Creams of 16 or 32% milkfat were inoculated with 10^3 *S. aureus*/ml, those of 36 or 40% with 10^4/ml and plastic cream (80% milkfat) with 10^5/ml. Staphylococcal counts (Baird-Parker agar at 37°C) and pH determinations were made at 2-h intervals for samples held at 37°C, at 6 to 12-h intervals for those at 22°C and at 24 to 48-h intervals for those at 4°C. Strains 521, 100-A, 196E, 505 and 473 grew sufficiently to produce enterotoxin in creams of 16 or 32% milkfat held at 37°C for 18 h or at 22°C for 52 h. Growth of strains 521, 505, 100-A, and 196-E exceeded 10^6 cells/ml in cream of 36% milkfat held at 37°C for 18 h. Strains 521 and 100-A grew to more than 10^6 cells/ml in cream of 40% milkfat. No strains grew enough at 4°C to produce enterotoxin after 5 d in any cream. Platings from plastic cream gave wide variations with Plate Count agar and Baird-Parker agar. The ELISA method was used to quantitate enterotoxin in samples where growth exceeded 10^7 *S. aureus*/ml.

Lactase-Treated Skim Milk as a Substrate for Growth and Acid Production by Mutants of Lactic Streptococci. Kamal M. Kamaly and Elmer H. Marth, *Department of Food Science and The Food Research Institute, University of Wisconsin, Madison, WI 53706.*

Three lactase-negative proteinase-negative (Lac^-Prt^-) mutants of group N streptococci, namely *Streptococcus lactis* LMO 230, *S. lactis* 25Sp and *Streptococcus cremoris* KHAI, were grown in skim milk treated with exogenous food-grade neutral lactase. Freshly steamed (30 min at ca. 100°C) skim milk was treated with 0.095 or 0.16% (v/v) lactase and incubated with constant stirring over night at 4°C. This resulted in 70 and 90%, respectively, hydrolysis of lactose. All strains of lactic streptococci grew to high populations in lactase-treated milk, and this was accompanied by gradual acid development during the fermentation. Acid production in lactase-treated milk was greater than in the control. Glucose which resulted from action of the lactase was rapidly fermented by all strains, whereas galactose either was used to a limited degree or accumulated in the medium during the fermentation. Our results suggest that Lac^-Prt^- mutants of lactic streptococci might be useful as starter cultures in lactase-treated milk.

FDA's New Milk Dairy Initiatives. Jerome J. Kozak, *Milk Safety Branch, FDA, 200 C Street SW, HFF-346, Washington, DC 20204.*

The dairy industry is entering a new era which began with last year's public health crisis. These incidents prompted a much needed review of the industry's efforts to ensure that its products are safe and wholesome. In response to the events of last year, the U.S. Food and Drug Administration (FDA) has decided to increase its surveillance in the dairy industry. The goal is to prevent generic weaknesses in the public health control system and to prevent additional disease outbreaks. Accordingly, industry and government are taking new initiatives within the framework of the National Conference on Interstate Milk Shipments (IMS) cooperative program and FDA's regulatory program. FDA is urging state regulators to conduct meetings with industry representatives to discuss disease problems with Grade A and non-grade A dairy products. States also have been requested to intensify their efforts in dairy plants and to conduct comprehensive inspections and ratings. Over the next few years, FDA will conduct intensified check-ratings in IMS pasteurization plants. These will be scheduled at least partially during "down times" to allow a more thorough inspection of the equipment.

Use of Temperature Sensitive Gel for Concentration of Bacteria of Milk. S. Maheshkumar, Richard Peterson and Sagar M. Goyal, *Department of Veterinary Diagnostic Investigation, University of Minnesota, St. Paul, MN 55108.*

Infection and disease have been associated with milk for many years. Raw unpasteurized milk, both certified and uncertified, has been found to be contaminated with human pathogenic bacteria such as *Salmonella, Yersinia, Listeria, Campylobacter* and pathogenic strains of *Escherichia coli*. Small numbers of these bacteria can remain undetected in standard bacteriological tests of milk. The present study was undertaken to determine if a temperature-sensitive gel (made from isopropylacrylamide) could be used for concentration and detection of bacteria from milk. This gel swells at 4°C, collapses at higher temperatures (ca. 50°C), and absorbs water and small-sized solutes while rejecting larger molecules such as bacteria and viruses. Using *E. coli* as a test organism and temperature-sensitive gel, a ten fold reduction in milk volume was achieved with the recovery of the test organism ranging between 35 and 4%. A pH of 5.5 was optimal for concentration of bacteria from milk. This procedure is simple and easy to perform and is inexpensive because the gel is reusable.

Evaluating Microbial Quality of Raw Milk. R.B. Maxcy and R.J. Paul, *Department of Food Science and Technology, University of Nebraska, Lincoln, NE 68583-0919.*

Commercial evaluation of the microbial quality of raw milk presents a major challenge, and new methods are burdened by being compared to imprecise presently used standard methods. Extensive comparisons in commercial and research laboratory environments were made using a method that involved direct enumeration of single cells in comparison to colony-forming units. The correlations were from 0.5 to 0.99, depending on treatment of the data. Repetition of all tests on milk from individual farms indicated that inherent variation in quality at the farm, sampling, testing, and evaluating the results showed the extreme inadequacy of the presently established methods of grading raw milk. More frequent tests with appropriate averaging would improve the likelihood of correct decisions on quality grade.

Preliminary Incubation Count (PIC) Study. Robert L. Sanders, *Milk Safety Branch, HFF-346, 200 C Street SW, FDA, Washington, DC 20204.*

The 1983 National Conference on Interstate Milk Shipments (NCIMS) recommended to accept the Preliminary Incubation (PI) Count as an alternative procedure to the Standard Plate Count (SPC) as a standard for raw milk from dairy farms. The NCIMS Executive Board delayed the effective date of this recommendation until 1986 to allow further study. FDA instituted a study, thru contacts with 11 states, to study the correlation between sanitary and production conditions and the PI and SPC results. The year-long study has now been completed and the results are being evaluated. Preliminary evaluation of the data does not favor either procedure (PI or SPC) as being a better indicator of sanitary and production conditions on dairy farms. After complete evaluation, the results will be presented to NCIMS for further consideration of the 1983 recommendations.

Lactose Intolerance and Fermented Dairy Foods. Dennis A. Savaiano, *Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108.*

Lactase-deficiency is a well recognized and measurable phenomenon which occurs in 70% of the world's population. Lactose intolerance is difficult to quantitate as it depends on an assessment of symptoms. Development of symptoms is correlated with the lactose load but may also depend on other factors, including gastric emptying, intestinal transit, simultaneous consumption of a meal, source of lactose and autodigestion of lactose by microbial β-galactosidase (β-gal). Lactose digestion is enhanced three- to four-fold in vivo by the β-gal which is a constituent of the yogurt culture. A significant portion of the β-gal survives gastric digestion and is active in the small intestine due to protection of the enzyme from gastric denaturation by an intact cell structure and by the excellent buffering capacity of yogurt. Pasteurization destroys the β-gal, eliminates the enhanced lactose digestion and reduces the tolerance to yogurt. Unfermented acidophilus milk, cultured milk and frozen yogurt do not contain significant β-gal activity. Feeding these products results in significant lactose malabsorption and intolerance symptoms.

Dairy Plant Inspection by USDA. Robert Semerad, *Dairy Grading Section Dairy Division, USDA, Washington, DC.*

A brief history of USDA plant inspection activities is outlined. The regulatory basis for such inspections is reviewed, together with discussion of inspection goals, guiding principles, and inspection techniques.

Effect of Microwave-Processing on Quality of Milk. G. Stearns and P.C. Vasavada, *Animal and Food Science Department, College of Agriculture, University of Wisconsin, River Falls, WI 54022.*

The effect of microwave-processing on quality and shelf-life of milk was studied. Fifty-ml samples of raw milk were exposed to 2450 M Hz microwave treatment for periods ranging from 0-90 s. Standard Plate Counts (SPC) and coliform counts of treated and untreated (control) samples were determined according to *Standard Methods for the Examination of Dairy Products* and shelf-life was determined by organoleptic evaluation. Both SPC and coliform counts decreased drastically with increased time of exposure to microwaves. Microwave treatment of 65 s resulted in near complete inactivation (>99.9%) of organisms. While the untreated raw milk was deemed unsatisfactory after 1 week of storage at 4°C, milk receiving microwave treatment of ≥35 s was of acceptable quality after 2 weeks of storage at 4°C. These preliminary data suggest that the microwave processing of milk could result in reduction of bacterial numbers and extended shelf life.

A New Test for Predicting Shelf-Life of Fluid Milk. Sita R. Tatini, *Department of Food Science and Nutrition, University of Minnesota, St. Paul, MN 55108.*

Fresh raw and pasteurized milk has a unique pleasing flavor, and this is altered during refrigerated storage due to chemical, enzymatic and microbial activities, especially from psychrotrophic bacteria. While pasteurization inactivates most psychrotrophs and natural enzymes, heat-stable enzymes from psychrotrophs survive this treatment. Post-pasteurization contamination with psychrotrophs and residual heat-stable enzymes continue to cause flavor deterioration. Many attempts have been made to come up with a rapid microbial test to reflect post-pasteurization contamination and potential keeping quality without real success. Use of gas chromatography to detect specific volatile compounds (3-6) present in fresh pasteurized milk may be useful in predicting the sell-by-date sensory status with a reliability of 95%. The application of this approach in conjunction with direct epifluorescent counting of bacteria (DEFT) for rapid detection of psychrotrophs for quality control will be discussed.

Detection of Gram Negative Bacteria in Cottage Cheese by an Impedance Technique. Nora Tsang, Ruth Firstenberg-Eden and Joseph Zindulis, *Bactomatic, Inc., PO Box 3103 Princeton, NJ 08540.*

Gram negative (-) bacterial contamination is a leading cause of spoilage in cottage cheese. These contaminants, due to their low initial number, cannot be effectively counted by the standard plate count method. Visual interference of the product in agar plates and presence of active gram-positive (+) starter cultures in high numbers further complicates the problem. An impedance test was developed to detect gram (-) contamination in cottage cheese. Two selective media, crystal violet deoxycholate broth (CDB) and modified crystal violet deoxycholate agar (MCDA), were formulated for this method. In the test procedure, one half of a container of cottage cheese was removed and replaced by the CDB to produce a 1:1 mixture. This mixture was preincubated at 21°C for 18 h. One-tenth ml of the preincubated sample was then inoculated onto 0.5 ml of MCDA. The impedance was monitored at 21°C for 24 h. This test can detect the presence of <10 CFU of gram (-) bacteria/g within 30 h. Samples with Gram (+) starter cultures at levels $\leq 10^5$ CFU/g were successfully inhibited and did not interfere with the detection of gram (-) bacteria. Since the plate count method cannot accurately enumerate $<10^2$ CFU/g of gram (-), the impedance detection times were correlated to the gram (-) bacterial concentration after preincubation, yielding a correlation coefficient of 0.93. This method is unique in its ability to detect levels of <10 gram (-) bacteria/g regardless of the level of gram (+) bacteria.

Vitamin Additions to Milk - Are They Really There? H. Michael Wehr, *Oregon Department of Agriculture, 635 Capitol Street NE, Salem, OR 97310-0110.*

Vitamin-fortified milk is an important constituent in the American diet. Assumptions are made when evaluating overall dietary intake that milk contains the specified amounts of Vitamins A and/or D. Recent studies by the Oregon Department of Agriculture and others indicate that a significant percentage of pasteurized fortified fluid milk products do not meet label statements of Vitamins A and/or D. This paper will describe the work done by the Oregon Department of Agriculture regarding the vitamin content of milk and point to a possible source of the problem.

Nutritional and Microbiological Qualities of Raw and Pasteurized Goats' Milk. J.A. Zee, P. Tirard-Collet, C. Lavigne and R.E. Simard, *Département de nutrition humaine et de consummation, Pavillon Paul-Comtois, Université Laval, Ste-Foy, Québec, Canada G1K 7P4.*

Production and distribution of goat's milk is different from the commercial dairy industry, and measures should be taken to assure its safety and purity for human consumption. Often milk is sold raw, or collected, transported and held for 5 d or more before further processing. In this 12-month study, goat milk samples were collected and analyzed for their chemical composition (protein, lipids, minerals and lactose). Milk spoil-

age due to psychrotrophic bacteria, coliforms, yeasts and molds has been studied. By appropriate hygienic measures, microbial contaminations of goats' milk was significantly reduced to acceptable level as legally required for cows' milk. However, in July and August, although the hygienic conditions and storage temperatures remained unchanged, most of the milk samples had higher than 10^5 bacteria/mL, due to a longer keeping period at the farm and higher ambient temperatures during milking. After pasteurization at 76°C for 24 s, goats' milk may be stored at 7°C for more than 21 d. Since goats' milk contains less alkaline phosphatase than raw cows' milk and the enzyme is destroyed at a lower time-temperature level than required for proper pasteurization of cows' milk, Cornell's alkaline phosphatase method was modified by increasing the sample volume and the incubation time. This allowed us to determine the adequacy of the thermal treatment as well as to detect addition of 0.25% of raw milk to pasteurized milk.

MILK: QUALITY PREMIUMS

Milk Quality Premiums. Richard C. Bender, *Mountain Empire Dairymen's Association, Inc., 12450 N. Washington, Thornton, CO 80233.*

The quality of fluid milk and dairy products starts at the farm. We at MEDA have always felt that "quality" was our best advertisement, and in a competitive milk market, milk quality gives us the edge. A pilot study started in November, 1973, in which we actually pay dairy farmers for high quality milk has now moved into the twelfth year. With a market of 65% class I utilization, the items in a quality program must be tailor-made to meet the market demands. The items chosen were Standard Plate Count (SPC), Laboratory Pasteurized Count (LPC), later changed to Preincubated Standard Plate Count (PI), Freezing Point, Antibiotics, Sediment, Wisconsin Mastitis Test (WMT), and Grade A Status/Plant Rejection. In 1985, 72% of the producers qualified for the bonus. There are six producers who have qualified every month for the past 11 years. Can a premium of 10 cents per hundred-weight coupled with generally lower milk prices keep a milk quality program going? Past record indicates the program is strong and healthy.

Quality Premiums: A Large Midwest Cooperative Experience. Thomas C. Everson, *Wisconsin Dairies Cooperative, Rt. 3, Baraboo, WI 53913.*

Quality premiums for purchase of milk that exceed the minimum quality requirements of state and federal standards have increased in value since 1976. In addition, the test criteria for qualification have been revised and upgraded with new methods and dairy product research. Wisconsin Dairies Cooperative (WDC) has experienced a steady increase in overall milk quality as a result of the quality premium program. Data will be presented to show the WDC experience with a quality premium program. New research on factors affecting milk clotting provide an insight as to the mechanisms of cheese yield improvement with high quality milk. A literature summary of research results as well as future programs will be presented.

Milk Quality Premiums. Paul A. Nierman, *Mid-America Dairymen, Inc., 1265 Grey Fox Road, Arden Hills, MN 55112.*

The Northern Division of Mid-America Dairymen, Inc., has consistently, over the past decade, been quality-conscious and steered toward a program providing incentives to producers of high quality milk. Our current percentage of producers obtaining quality premium ranges from 30% to 50% of all producers. We have seven increments of premium standards, and our current analysis shows a gradual but steady improvement in somatic cell counts. It has been our objective to provide an incentive for producers to do a top-notch job of producing quality milk. This, in turn, provides their operations with higher milk production, less incidences of mastitis, and provides greater returns for a gain in their net profit.

MOLDS AND MYCOTOXINS

Mold Growth and Mycotoxin Production in Binagol, A Philippine Dessert Product. Lutgarda S. Palomar and Lloyd B. Bullerman, *Department of Food Science and Technology, University of Nebraska, Lincoln, NE 68583-0919.*

Binagol, a Philippine dessert delicacy, and its major components of taro and taro plus coconut milk were compared to rice as substrates for mold growth a-nd mycotoxin production. Rice and taro had similar proximate compositions, but Binagol had lower protein and higher fat contents. Rice supported less mold mycelial growth than Binagol, taro or taro plus coconut milk, but supported higher amounts of aflatoxin production per mg of mycelia. Aflatoxin produced in Binagol diffused throughout the product. In general, rice supported significantly more aflatoxin, ochratoxin A, and penicillic acid production than did Binagol. Significantly higher amounts of all of these toxins were produced at 25 than at 15°C. In contrast, patulin production was higher in Binagol than rice, and it was produced in higher amounts at 15 than at 25°C. Three *Aspergillus parasiticus* cultures used in the study generally produced similar amounts of aflatoxin regardless of the substrate.

Aflatoxin Production by and Growth of *Aspergillus parasiticus* in a Medium Containing Potassium Chloride or a Mixture of Potassium Chloride and Sodium Chloride. Gulam Rusul, Fathy E. El-Gazzar and Elmer H. Marth, *Department of Food Science and The Food Research Institute, University of Wisconsin, Madison, WI 53706.*

Twenty-five milliliters of glucose-yeast-salt medium containing 0, 2, 4, 6, 8 or 10% KCl or a mixture of NaCl and KCl (0:0, 1.5:0.5, 3.25:0.75, 4.75:1.25, 6.5:1.5 or 8:2) was inoculated to contain approximately 10^6 conidia of *Aspergillus parasiticus* NRRL 2999 and then incubated at 28°C for 10 d.

Amounts of aflatoxin produced were determined using reversed-phase High Performance Liquid Chromatography (HPLC). The percentage of inhibitory effect caused by the additive was used to make relative comparisons between treatments and control. Overall, increasing the concentration of KCl or the mixture of NaCl and KCl inhibited aflatoxin production, but generally increasing the concentration of KCl or the mixture of NaCl and KCl increased the average rate of net dry weight of mycelium throughout the incubation period except in the medium with a 2% mixture of NaCl and KCl where it was less than in the control and other treatments. Furthermore, the mixture of NaCl and KCl was markedly more inhibitory to growth in the medium containing 4, 6, 8 or 10% than was KCl alone at the same concentrations. This was also true for production of aflatoxins B_1 and G_1.

Control of Mold and Indoor Air Quality. Andrew J. Streifel, *University of Minnesota, Boynton Health Services, Room W-140, 410 Church Street, S.E., Minneapolis, MN 55455.*

In 1979 indoor air quality at the University of Minnesota Hospitals became an important issue with bone marrow transplant (BMT) patients becoming infected with common airborne thermotolerant fungi. Volumetric air sampling using Andersen sieve cascade impactors and inhibitory mold agar revealed a mean thermotolerant fungal count of 167 cfu/m^3, range 4.2 - 1415. In-room HEPA filters reduced the ambient fungal levels to <10 cfu/m^3. A corresponding decrease in disease was also noted prompting on-going air quality surveillance, in and around the BMT unit. Since 1983 high volume slit samplers (3.5 m^3/sample) have been used for assessing airborne fungal concentrations. Noteworthy since then has been the observation of fungal burst phenomena due to a variety of indoor/outdoor disturbances such as building demolition, construction activity, landscaping, wet wood, and cleaning procedures. These observations have led to initiation of control measures including dilution ventilation, window seals, sturdy barrier construction during renovation projects, controlled airflow, cleaning and temp./humidity control. In one instance, a moldy sink generated >500,000 cfu of *Penicillium* sp./h. These fungal bursts can affect mold sensitive individuals, including those with allergies. Current energy conservation practices can exasperate many of indoor air quality parameters due to a decrease in net air/changes.

Quantitation of Growth of Mold on Cheese. Ahmed E. Yousef and Elmer H. Marth, *Department of Food Science and The Food Research Institute, University of Wisconsin, Madison, WI 53706.*

This study was based on the fact that mold grows radially at a constant rate on solid media. Natural cheeses were sliced under aseptic conditions, and slices were placed in sterile petri plates. A spore suspension of mold was inoculated at the center of the cheese slice and plates were covered. The radius of the mold colony was monitored, and the rate of radial growth was calculated by regression analysis. Cheeses tested were mild Cheddar, aged Cheddar, aged smoked Cheddar and brick. Molds grown on cheese were *Aspergillus parasiticus* or *Penicillium camemberti (caseicolum)*. Results indicate that aged Cheddar was the most inhibitory to growth of mold, whereas brick cheese was the least inhibitory. *A. parasiticus* generally grew faster on cheeses than did *P. camemberti*. Another experiment was done wherein process rather than natural cheese was tested. Generally molds grew slower on process cheese than on natural cheeses. Several concentrations of sorbic acid were added to cheese during processing. Results indicate that delay in germination of spores and rate of radial growth were functions of the concentration of sorbate.

PROCESSING FACILITIES - CLEANING AND SANITIZING

Dairy Equipment Cleaning and Sanitizing Update. Dennis Birchard, *H.B. Fuller Co., Monarch Division, 3900 N.E. Jackson Street, Minneapolis, MN 55421.*

Proper design is a must to achieve good sanitation results. The old preliminary incubation test, which is now being used more frequently, is highlighting poor sanitation procedures. Some of the causes of high preliminary incubation counts are listed. Complete cleaning programs for pipelines and bulk tanks stress proper cleaning functions, such as pre-rinse, wash, post-rinse and acid rinse. Each function is made up of time, temperature, concentration and mechanical action. Poor results show development of films which are identified, the cause of the films are listed with removal and prevention recommendations. The continued battle with films has led to development of polymeric compounds which, when added to chlorinated alkaline formulations, give increased chlorine stability with greater soil-dispersing capabilities. It also has been shown that there is a greater ability to chelate and disperse iron present in the water supply, which is one of the most common causes for film build-ups in farm systems.

Assuring Integrity of Pasteurized Product Via Process Piping System Design. Dale A. Seiberling, *Seiberling Associates, Inc., Roscoe, IL 61073.*

Recent incidents in Massachusetts, Illinois and California have caused concern about the capability of the nation's dairies to produce a high-quality product guaranteed safe from a public health point-of-view. The welded pipeline, air-operated valve and automatic CIP system have come to be considered "old-hat" by people at many different levels of responsibility in many companies. As a result, the piping installations originally designed and installed by "system-oriented specialists" have since been modified to accomplish operations not provided for in the original design. Some of today's innovative solutions to current problems may create a bigger problem in the future. A CIP cleanable piping system, whether simple or complex in nature, provides many opportunities for mistakes of omission or commission. Long-term problems can best be prevented by starting a project with a proper plan. Then, following installation, "as installed" drawings should be prepared and updated for all sub-

sequent modifications and should be on file in the plant and with the responsible regulatory agency. Control of the piping system's performance begins with the drawings, but must further include attention to the proper installation of air-operated valves, air piping and control logic. Special consideration must be given to the elimination of "dead-ends" and "cross-connections." A constant effort must be made during the design, installation and subsequent operation and modification of the system to ensure that CIP means Clean-In-Place, rather than Clean-In-Part.

Designing Pipeline Systems for Cleaning. Stephen B. Spencer, *The Pennsylvania State University, University Park, PA 16802.*

Most of us are familiar with the old standby criteria for cleaning -- TIME, TEMPERATURE AND CONCENTRATION. A few people will recall that a minimum velocity of 5 f per second was suggested for cleaning lines in dairy plants. This guideline applies to a full flooded wash system and does not apply to the air-water system used in farm pipelines. There are few, if any, basic guidelines for the design of the farm pipeline system and trial and error methods are employed. The vacuum pump furnishes the energy for cleaning the farm pipeline. In practice, it may sometimes require a larger pump for cleaning than for milking. A suggested guideline for pump capacity related to pipe diameter is as follows:

PIPE DIAMETER	CFM (ASME)
1.5 inches	25
2.0 inches	40
2.5 inches	50
3.0 inches	60

In the event that two wash lines empty into the receiver during wash, the above values would be doubled. Single-run configurations are cleaned more reliably than double-run (double-entry) layouts. Air injectors are essential on large pipelines such as 2.5 and 3-inch diameter and long 2 in. lines. Continuous air bleeds are satisfactory on small systems. No optimum air to water ratios have been established. Distribution of the wash solution among units and between the units and pipeline can be a serious problem unless the system is properly designed. Each system must be engineered to milk properly as well as to properly clean.

High Quality Water System Disinfection. Andrew J. Streifel, *University of Minnesota, Boynton Health Service, Room W-140, 410 Church Street, S.E., Minneapolis, MN 55455.*

Since 1972 we have monitored the bacteriological quality of a kidney dialysis water treatment system (DWTS) at the University Hospitals. Municipal water (MW) is pretreated then processed by a reverse osmosis (RO) device which distributes water through glass piping to the dialysis machines. Water samples are processed according to standard methods using membrane (.45 μ) techniques. Samples are incubated at 35°C and scored at 72 h. Use of continuous disinfection with MW chloramines (3 ppm) for the DWTS and heat disinfection of the dialysis equipment maintained water bacteria levels at <10 cfu/ml from 1975-1982. RO membrane degeneration due to pH and toxicity of chloramines to red blood cells prompted a change to a chlorine-sensitive, pH tolerant (3-11) thin film composite RO membrane. A UV light was substituted for chloramines as a disinfectant. A 4% solution of formaldehyde (HCHO) was used for disinfection. The noxious quality of HCHO proved unsatisfactory. A dilution of stabilized 4.5% peracetic acid (PA) at 700ppm was used in the WDS while 4% HCHO was used for the RO. Thus far PA demonstrates effective reduction of bacteria in the WDS. However, the RO machine is inadequately disinfected when using the 4% HCHO. The RO recontaminates the distribution system when rinsed. Usage of PA for the cleaning and disinfection of RO equipment and WDS is a promising, relatively non-toxic substitute for certain water treatment systems.

Bacterial Attachment: It's Importance in Cleaning and Sanitizing. Edmund A. Zottola, *Department of Food Science and Nutrition, 1334 Eckles Avenue, University of Minnesota, St. Paul, MN 55108.*

It has been established, through the use of scanning electron microscopy, that certain species of *Pseudomonas* can produce thread-like appendages called fimbrae that attach the bacterial cell to food and food contact surfaces. In the cleaning and sanitization of food processing equipment, it is critical that these attached microbes be removed or they will grow and contaminate products that pass through the equipment. Research done in our laboratory has shown that the microbes attach to the food-contact surface within minutes of coming in contact with the surface. Once attached, they grow profusely and form microcolonies. The effect of cleaning and sanitizing food-contact surfaces on these attached microcolonies will be discussed.

SALMONELLA AND SALMONELLOSIS

Identification, Disinfection and Quality Control Intervention of *Salmonella typhimurium* in the Shrimp Industry. Melvin N. Kramer, *Environmental Health Associates Ltd., 2406 Sugarcone Road, Baltimore, MD 21209.*

In the Fall of 1983, a review of the sanitary practices and procedures, as well as physical structure and equipment of a medium-sized shrimp processing plant located on the Caribbean side of Colombia, South America commenced. This plant receives shrimp on the dock, directly from the boats in a frozen state (frozen on the boat), defrosts, sizes, packages, and freezes the shrimp for export primarily to the United States and Japan. Sanitary inspections laboratory surveillance of environmental samples from the plant and of the finished product were undertaken. This was primarily due to a previously identified *Salmonella* problem, which resulted in the detention of a conch shipment for *Salmonella* by the U.S. Food and Drug Administration processed in this plant. It was of concern, to the firm's management, that the *Salmonella* problem could be present either in the plant, and/or in the shrimp, which was their major

product and be of significant economic impact. In the course of the inspection and laboratory surveillance of both the environment in the plant and of the product itself, *Salmonella typhimurium* was identified. Of most interest, was the finding that we were able to recover the *Salmonella* from the sanitizing tank, with chlorine utilized as the bactericidal agent. We performed disinfection studies and learned that the plant strain of *S. typhimurium* could be grown in 200 ppm of chlorine, as well as in other disinfectants; namely, iodine and quaternary ammonium compounds. It was discovered that by reducing the pH of the disinfectant, primarily the chlorine, a much more satisfactory bactericidal action could be obtained without affecting the taste, color, or texture of the shrimp. This combination of chlorine and acetic acid or ascorbate is acceptable under the Food, Drug and Cosmetic Act for additives.

A Rapid and Easy-To-Use Test for Detection of *Salmonella* in Milk and Food. N. Robert Ward, John P. DesRosier and Jay Stemmler, *BioControl Systems, Inc., 21414 68th Avenue South, Kent, WA 98032.*

A test kit has been developed for detection of *Salmonella* in milk and food that provides a negative screen for most samples in 24 h. This test utilizes specific *Salmonella* flagellar antibodies that react to produce a distinct and easy-to-read band of immobilized cells in a gel. Before using the test kit, overnight enrichment is done using nonselective broth for processed products and selective tetrathionate broth for non-processed products. After enrichment, two procedural steps are required to do the test: transfer of 0.1 ml of the enriched sample into the test unit and addition of *Salmonella* flagellar antibodies. The units are incubated at 35°C for 8 h and then observed for presence of an immuno-immobilization band indicating a positive test for *Salmonella*. Parallel studies with the AOAC/BAM standard culture method using highly contaminated meat and artifically contaminated raw and dry milk samples have shown that the test is reliable with a low false-positive (2%) and false-negative (1%) rate.

Salmonellosis - The Problem. Edmund A. Zottola, *Department of Food Science and Nutrition, 1334 Eckles Avenue, University of Minnesota, St. Paul, MN 55108.*

Salmonellosis is one of the more common types of foodborne infections affecting consumers in the United States today. Several recent widespread outbreaks of salmonellosis have once again called our attention to the problem. In this presentation basic information related to salmonellosis and the microbes that cause this foodborne infection will be described and discussed. The paper will not focus on recent outbreaks, as these will be discussed by others in the symposium. Common and unusual food sources of salmonellae will be described. Methods for the prevention and control of the spread of salmonellosis will be discussed.

The Illinois Milkborne Salmonellosis Outbreak. Damien A. Gabis, *Silliker Laboratories, Inc., 1304 Halsted Street, Chicago Heights, IL 60411.*

In March-April 1985 16,284 cases of salmonellosis occurred in northern Illinois and surrouding states. Two-percent lowfat milk processed on March 20, 30, and April 8 by one dairy in the Chicago area was implicated as the source of *Salmonella typhimurium*. A Task Force of state and federal government personnel, dairy plant representatives, and private consultants investigated the causes of the outbreak. Salmonellae were isolated from milk, but all equipment and environmental samples were found negative. A multi-agency government team did not find the outbreak-related strain in samples of raw milk from collection points that had shipped milk to the dairy. Evidence indicates that contamination of the pasteurized skim milk blending line was the direct source of salmonellae in the milk. It is probable that contamination/growth of salmonellae occurred in a skim milk transfer line which constituted a cross-connection between the raw and pasteurized lines. The remote source of the salmonellae has not been determined. There was no evidence that intentional contamination occurred.

***Salmonella* in Cheddar Cheese - Recent Experiences in Canada.** David Collins-Thompson and D.S. Wood, *Departments of Environmental Biology/Food Science, University of Guelph, Guelph, Ontario, Canada N1G 2W1.*

Public health authorities in Oxford, Middlesex and Elgin Counties, Ontario, seized raw milk Cheddar cheese due to presence of *Salmonella muenster*. Investigations by these units and the University of Guelph traced the source of *Salmonella* to one particular milk supplier shipping to a cheese factory. Analysis of milk samples from a herd of 35 cattle revealed only one cow shedding *S. muenster* directly into the milk (ca. 200 CFU/ml). Eleven of 181 vats of cheese, produced at the factory between May and October 1982, were positive for *Salmonella* at the curd stage. Only 2 vats of the finished raw milk Cheddar, however, were positive. One lot of *Salmonella*-positive cheese was still positive after the legally required 60-d holding period and remained so for 125 d. Environmental sampling from local rivers near the cheese plants revealed several sources of *S. muenster*. Plasmid profiles and antibiotic resistant studies of these strains of *Salmonella* indicated several different patterns. No one source of the *S. muenster* could be attributed to the cheese contaminant.

Methods for the Isolation and Identification of *Salmonella* From Foods: Recent Developments. Russell S. Flowers, *Silliker Laboratories, Inc., 1304 Halsted Street, Chicago Heights, IL 60411.*

Conventional culture methods for detection of *Salmonella* in foods generally require 4 or more days to obtain negative results. There has been considerable interest in development of rapid methods to screen foods for *Salmonella*. Over the years, numerous methods for rapid detection of *Salmonella* have been proposed. However, most have gained little acceptance due to

problems with specificity and/or sensitivity. Recent advances in genetic engineering and immunology have allowed development of DNA hybridization assays and enzyme immunoassays employing monoclonal antibodies which appear to overcome problems of specificity and sensitivity associated with earlier methods. These new methods appear to be as productive as the conventional culture method for detection of *Salmonella* in foods and are highly specific. Using these methods, food samples can be analyzed for *Salmonella* within 40-48 h, provided the assay results are negative. Positive assays must be confirmed by conventional culture methods.

SEAFOOD

Seafood Poisoning. Marleen M. Wekell, *Seafood Product Research Center, US FDA, Seattle, WA 98174.*

There are many toxins that may be present in marine fisheries products such as paralytic shellfish poisoning (PSP), tetrodotoxin (TTX), scrombroid toxin, ciguatera toxin and many others. Marine toxins include some of the most potent toxins known. For most, no antidote exists and usually toxicity is unaffected by cooking. Chemical structures of compounds determined are unusual with often no terrestrial counterparts. Symptoms of intoxication and epidemiology of human illness caused by these compounds, foods implicated, etiology of illness, regulations and detection methods for some of the more common marine toxins will be discussed.

Quality and Safety of Seafood. Lawrence E. Wyatt, Ranzell Nickelson II and Gunnar Finne, *Applied Microbiological Services, Inc., PO Box 10280, College Station, TX 77840.*

Consumption and concerns are both increasing for seafood products. Per capita annual consumption for seafood products has exceeded 14 lb. for the first time. Diet-conscious consumers are placing more and more demand on the market for fresh, wholesome, lowfat, high polyunsaturated, and high Omega-3 fatty acid seafood products. At the same time, concerns for the quality and safety of seafood products are fueled by issues like: (*a*) use of sodium bisulfite for the prevention of black spot in shrimp, (*b*) use of vacuum packaging to extend shelf-life and potential problems created with *Clostridium botulinum*, (*c*) demand on imports from "block listed" countries, and (*d*) the Norwalk virus as related to raw shellfish safety. This presentation will address the current situation in seafood consumption as related to quality and safety.

WASTE TREATMENT

Groundwater Contamination: The Rosemount Story. Fay M. Thompson, *University of Minnesota, 410 Church Street, S.E., Minneapolis, MN 55455.*

Between 1960 and 1974 the University of Minnesota disposed of waste chemicals from its laboratories in a pit on a remote piece of land near Rosemount, MN, 20 miles south of the Twin Cities. The wastes were burned each time a load was brought for disposal. In 1971, the potential of groundwater contamination was investigated by installing seven groundwater monitoring wells around the burning pit. No contaminants were detected in any of the wells. In 1984, an investigation into a groundwater pollution problem near a refinery some distance from the burning pit led to discovery of low levels of chloroform contamination, which was most likely attributable to the burning pit even though it was 2 and 1/2 miles distant. Considerable further investigation led to the discovery of a large (several square miles) area of contamination, encompassing about 30 families using groundwater for their water supply. The levels of chloroform contamination found ranged from 0.1 to 15 ppb. Since the EPA recommended criterion for chloroform in private wells is 1.9 ppb, the University was asked to provide bottled water to the affected residents. (The municipal drinking water standard for chloroform is 100 ppb. This anomaly will be discussed.) Several options for providing an alternative water supply to the affected parties are being considered. Three that will be described and evaluated here are activated carbon filtration, new wells in a deeper aquifer, and a central community water supply. Cost and effectiveness comparisons will be presented.

Technology and Direction of the Hazardous Waste Industry: An Insider's View. George Vander Velde and George Nassos, *Chemical Waste Management, Inc., Riverdale Technical Center, 150 West 137th Street, Riverdale, IL 60627.*

The Resource Conservation and Recovery Act Amendments of 1984 has provisions which dramatically alter methods and procedures for disposal of chemical and industrial waste in the United States. The Amendments formulate the policy which dictates the transfer of disposal from traditional land disposal methods to alternative technologies. The shift in disposal practices will be toward both additional recycling and thermal treatment. While the Amendments have a large and future effect on both industrial and governmental generators of waste, the impact is not fully understood. Incineration capacity for chemical and industrial waste is diminishing at a time when demand is increasing exponentially. At the same time, the ability to permit either new incineration capacity or new technologies to destruct these wastes has been virtually stalemated. This paper discusses the issue of incineration in the US today from the perspective of the waste disposal industry. It discusses the regulatory framework, the technology of thermal destruction, the needs for additional capacity and the factors which are compounding the problems of waste disposal and destruction.

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Abstracts of papers in the October Journal of Food Protection

To receive the* Journal of Food Protection *in its entirety each month call 1-800-525-5223, ext. A or 515-232-6699, ext. A in Iowa.

Method to Isolate *Escherichia coli* 0157:H7 from Food, Richard A. Szabo, Ewen C. D. Todd and André Jean, Bureau of Microbial Hazards, Health Protection Branch, Health and Welfare Canada, Tunney's Pasture, Ottawa, Ontario, Canada K1A 0L2

J. Food Prot. 49:768-772

A medium for direct overnight isolation of hemorrhagic colitis (HC) strains of *Escherichia coli* from foods has been developed. It is a direct plating medium incorporating tryptophan (as tryptone), sorbitol, an indicator dye and a fluorogenic substrate for diagnostic purposes. Sodium chloride is included to raise the upper temperature limit for growth and a bile salt concentration lower than that usual for *E. coli* media but still inhibitory to non-enteric organisms is used. Colonies of HC strains grown overnight at 44.5°C on membrane filters placed on the medium are blue. Subsequent indole staining of the membranes yields red positive colonies. Replicate colonies are confirmed serologically. In contrast, *E. coli* Type I colonies are yellow and give apparently negative indole reactions. Recovery of HC organisms from artificially contaminated ground beef is ≥90%.

ICMSF Methods Studies. XVI. Comparison of Salt Polymyxin Broth with Glucose Salt Teepol Broth for Enumerating *Vibrio parahaemolyticus* in Naturally Contaminated Samples, P. Sakazaki, H. Pivnick, G. Jarvis, M. Goddard, Y. Asakawa, G. Barrow, L. Beuchat, R. Colwell, T. Gleeson, R. Gray, H. Nakanishi, S. Sakai, S. Stavric, K. Takizawa, K. Tamura, R. Twedt, C. Vanderzant and P. West, National Institute of Health, 10-35 Kamiosaki 2-chome, Shinagawa-ku, Tokyo, Japan; Department of National Health and Welfare, Tunney's Pasture, Ottawa, Canada, K1A 0L2; Shizuoka Public Health Laboratory, 3-6-2 Takajo-Cho, Shizuoka 420, Japan; PHLS Center for Applied Microbiology and Research, Porton Down, Salisbury, Wiltshire, SP4 OJG, England; University of Georgia College of Agriculture, Experiment, Georgia 30212; University of Maryland, College Park, Maryland 20742; University of Delaware, Newark, Delaware 19711; Public Health Research Institute of Kobe, 6, 4 chome, Minatojima-Nakamachi, Chuo-ku, Kobe 650, Japan; Tokyo Metropolitan Institute of Public Health, 3-24-1 Hyakunin-Cho, Shinjuku-ku, Tokyo 160, Japan; Public Health Laboratory of Kanagawa Prefecture, 52-2 Kakao-Cho, Asahi-ku, Yokohama 241, Japan; Food and Drug Administration, Cincinnati, Ohio 45226; and Texas A&M University, College Station, Texas 77843

J. Food Prot. 49:773-780

Two media, glucose salt teepol broth (GSTB) and salt polymyxin broth (SPB), were compared for their efficacy in enumerating *Vibrio parahaemolyticus* in naturally contaminated samples using the most probable number (MPN) procedure. Eleven laboratories in four countries participated, six of them using two analysts. One hundred ninety-six of 335 samples were found to contain *V. parahaemolyticus*. Neither enrichment medium was superior, and both media appeared necessary to prevent false-negative results. There was a high (52.5%) percentage of MPN patterns that were improbable with respect to Poisson distribution in those MPN tubes that yielded *V. parahaemolyticus*. Suspect colonies that developed on thiosulfate citrate bile salts sucrose (TCBS) plates streaked from GSTB were confirmed (1,438/1,929 = 75%) about as frequently as when streaked from SPB (2,155/3,038 = 71%).

Aflatoxin Residues in Milk of Dairy Cows after Ingestion of Naturally Contaminated Grain, R. A. Frobish, B. D. Bradley, D. D. Wagner, P. E. Long-Bradley and H. Hairston, Division of Veterinary Medical Research, Center for Veterinary Medicine, Food and Drug Administration, Beltsville, Maryland 20705

J. Food Prot. 49:781-785

Thirty-two lactating Holstein cows, blocked according to level of milk production, were fed cottonseed meal contaminated with aflatoxin B_1 (AFB_1) (0, 94, 241 and 500 μg/kg) as 20% of their ration (equivalent to 0, 20, 48 and 104 μg/kg in complete feed). Within 12 h, aflatoxin M_1 (AFM_1) appeared in the milk of all cows receiving contaminated feed. The mean AFM_1 concentrations in the milk approached steady-state conditions (0.35, 0.63 and 1.61 μg/L for treatments of 20, 48 and 104 μg AFB_1/kg, respectively) at 24 h and returned to the Food and Drug Administration action level of 0.5 μg/L or lower within 24 h after removal of the contaminated feed. The ratio of AFB_1 in the feed to AFM_1 in the milk averaged 66:1. The mean percent of daily AFB_1 intake that was transferred to AFM_1 was 1.74. This value was unaffected by the concentration of AFB_1 in the feed (1.89, 1.55 and 1.81% transferred for treatments of 20, 48 and 104 μg AFB_1/kg, respectively). Although increased milk production had no effect on the concentration of AFM_1 in the milk, it had a positive effect ($P \leq 0.01$) on the percent of AFB_1 intake transferred to AFM_1 (2.14 vs 1.35%). In a second trial, 16 additional cows were fed either naturally contaminated cottonseed meal or corn (44 and 49 μg/kg, respectively, on a complete feed basis). The percent of AFB_1 intake secreted as AFM_1 was affected ($P \leq 0.02$) by the source of contamination (1.73 vs. 1.32% for the cottonseed meal and corn treatments, respectively). The AFM_1 concentrations in the milk were not significantly different ($P > 0.05$).

Detection of Mold in Food by Enzyme-Linked Immunosorbent Assay, S. Notermans, C. J. Heuvelman, H. P. Van Egmond, W. E. Paulsch and J. R. Besling, National Institute of Public Health and Environmental Hygiene, P.O. Box 1, 3720 BA Bilthoven, The Netherlands and Food Inspection Service, Baan 7, 3011 CD Rotterdam, The Netherlands

J. Food Prot. 49:786-791

Evaluation of the enzyme-linked immunosorbent assay (ELISA) for detecting a mold-specific, heat-stable and water-soluble antigen demonstrated the potential of the method for detecting molds in food products. The mold antigen, as produced by *Penicillium* spp. and *Aspergillus* spp., was present in all food samples containing aflatoxin B_1. The amount of mold antigen present in the test samples was related in each case to the aflatoxin B_1 content. Experiments done with samples artificially inoculated with mycotoxin-producing molds revealed that mold contamination could be detected by ELISA at a very early stage. The minimum detectable amount of mold mycelium for three different species of *Penicillium* was 38 ng/g of sample.

Application of ELISA to Retail Survey of Aflatoxin B_1 in Peanut Butter, Bhanu P. Ram, L. Patrick Hart, Richard J. Cole and James J. Pestka, Department of Food Science and Human Nutrition of Botany and Plant Pathology, Michigan State University, East Lansing, Michigan 48824 and National Peanut Research Laboratory, United States Department of Agriculture, Agricultural Research Service, Dawson, Georgia 31742

J. Food Prot. 49:792-795

A simple procedure was devised for the routine screening of aflatoxin B_1 (AFB_1) in peanut butter using enzyme-linked immunosorbent assay (ELISA). Peanut butter samples (5 g) were artificially contaminated with AFB_1 and extracted by blending with 25 ml of 55% methanol and 10 ml of hexane. The extract was filtered and aqueous filtrate analyzed by a direct competitive ELISA. Recovery of AFB_1 added to peanut butter samples ranged from 85 to 112%, with an average inter-well coefficient of variation of 18.4%. The inter-assay coefficient of variation was 22.7%. Using this procedure, only 3 of 63 commercial samples of peanut butter had detectable levels (>5.0 μg/kg) of AFB_1.

Penicillin Distribution During Cheese Manufacture and Membrane Treatment of Whey, Theodore Cayle, Jules H. Guth, John T. Hynes, Eugene P. Kolen and Maxine L. Stern, Kraft, Inc., Technology Center, 801 Waukegan Road, Glenview, Illinois 60025

J. Food Prot. 49:796-798

Milk containing 0.005 U of benzyl ^{14}C-penicillin G was used to make Cheddar cheese, and the whey was subsequently treated with ultrafiltration (UF) and reverse osmosis (RO). The distribution of labelled penicillin was monitored throughout milk and whey processing. The antibiotic concentrated in the moisture phases. Eight-six percent was recovered from the whey fraction, and approximately 12% from the cheese. Similar distribution patterns were detected for the whey UF permeate and retentate; 84% of the penicillin was in the permeate, and 19% remained in the retentate. The balance of penicillin was recovered primarily in the RO retentate fraction.

Distribution and Effects of Aflatoxin in Chicken Tissues After Feeding Radiolabeled (^{14}C) Aflatoxin B_1, W. I. Obioha, H. M. Stahr and A. A. Kraft, Department of Food Technology and Veterinary Diagnostic Laboratory, Iowa State University, Ames, Iowa 50011

J. Food Prot. 49:799-805

The effects of single oral administration of 1 mg of ^{14}C-aflatoxin B_1 to 3-wk-old chickens and 10 mg of non-radioactive aflatoxin to 6-wk-old chickens were determined. Analyses were made of the distribution of ^{14}C in the blood, organs, tissues and feces. No toxic effects were observed on chickens fed 1 mg of aflatoxin B_1 during 72 h but those fed 10 mg of non-radioactive aflatoxin exhibited both altered physical signs and pathological findings. Both the ^{14}C-aflatoxin studies and chemical analyses for the parent compound indicated that most of the aflatoxin was excreted in the feces within 48 h and of the amount retained, most was found in the liver.

Effect of Carbon Dioxide on Growth-Rates of Selected Microorganisms Isolated from Black Drum (*Pogonias cromis*), Michel Lannelongue and Gunnar Finne, Procter and Gamble International, Brussels, Belgium and Seafood Technology Section, Department of Animal Science, Texas A&M University, College Station, Texas 77843

J. Food Prot. 49:806-810

The effect of carbon dioxide (25-100%)-enriched atmospheres on growth rates of a coryneform bacterium, *Micrococcus varians,* a *Vibrio* sp., a *Moraxella* sp. and *Pseudomonas fluorescens* growing on trypticase soy agar at 4 and 25°C was investigated. Growth rates were determined by measuring the rate of increase in the diameter of colonies on plates packed in laminated plastic pouches containing the CO_2-enriched environments. Carbon dioxide caused a significant decrease in the growth rates of all the organisms and the inhibitory effect was greatly enhanced by low temperatures. At 25°C, the gram-positive organisms were more resistant to CO_2 than the gram-negative organisms, while at 4°C none of the organisms grew in 25% CO_2, the lowest concentration tested. When exposed to air after being incubated in CO_2-enriched environments, the organisms in most instances grew at normal rates indicating limited residual effect of CO_2. The effect of temperature on relative CO_2 inhibition was investigated in detail for the *Moraxella* sp. and *P. fluorescens*. In an atmosphere containing 25% CO_2 in air at 20°C both organisms showed approximately 25% inhibition as compared to growth in air at the same temperature, while at 10°C *P. fluorescens* was completely inhibited and the *Moraxella* sp. showed 95% inhibition.

Comparison of Antibiotic-Containing Media and Media Supplemented with Dichloran and Rose Bengal for Isolation and Enumeration of Fungi in Spices, Joanna H. Rogers and Philip S. Guarino, Corporate Quality Laboratories, McCormick & Co., Inc., 11104 McCormick Road, Hunt Valley, Maryland 21031

J. Food Prot. 49:815-817

Yeast and mold counts of various spice products were determined using Dichloran Rose Bengal agar, Phytone Yeast Extract agar with added Dichloran and Rose Bengal, and Antibiotic Plate Count agar. Media containing the added Dichloran and Rose Bengal proved superior to media without Dichloran and Rose Bengal in controlling mold overgrowth, and promoting distinct colony morphology. Results were obtained 2 d earlier using Phytone Yeast Extract agar with added Dichloran and Rose Bengal.

Comparative Thermal Resistance of Human and Simian Rotaviruses Assayed on Cells Grown in a Serum-Free Medium, Dale J. Van Donsel, James T. Peeler and Edward P. Larkin, Virology Branch, Division of Microbiology, Center for Food Safety and Applied Nutrition, Food and Drug Administration, Cincinnati, Ohio 45226

J. Food Prot. 49:818-821

Thermal resistance of the Wa strain of human rotavirus was compared with that of SA-11 simian rotavirus in a plaque assay with MA-104 cells grown in conventional cell culture medium supplemented with filtrate from reconstituted and acid-precipitated nonfat dry milk. Both viruses produced two-component survival curves at 56 and 60°C. Average D-values (min) for the Wa human virus were 306.3 at 56°C, 47.8 at 60°C, 12.3 at 62.8°C and 2.4 at 65°C, with a z-value of 4.33°C. For the SA-11 simian virus, the average D-values were 890.5 at 56°C, with a z-value of 4.35°C. These values indicate that low levels of rotavirus should be inactivated by pasteurization processes.

Determination of Bacterial ATP in Milk — The Influence of Adenosine Triphosphate-Hydrolyzing Enzymes from Somatic Cells and *Psuedomonas fluorescens,* W. C. Botha, H. Lück and P. J. Jooste, Animal and Dairy Science Research Institute, Irene 1675, South Africa and Department of Dairy Science, University of the Orange Free State, Bloemfontein 9300, South Africa

J. Food Prot. 49:822-825

Presence and origin of adenosine triphosphate (ATP) hydrolyzing enzymes in milk and their effect on the ATP assay were determined. Somatic cells, when present in large numbers, produced sufficient enzyme to hydrolyze extracted ATP. This was illustrated by the relationship which existed between ATPase activity and somatic cell counts (polynominal correlation coefficient (R) = 0,82; n = 39). A highly significant relationship [linear correlation coefficient (r) = 0,91; number of observations (n) = 81] was found between the count of a *Pseudomonas fluorescens* strain and the resultant ATPase activity. This activity, however, did not appear to influence the ATP assay, the enzymes being produced in the late exponential phase and early stationary phase of growth. At this stage the psychrotrophic counts had reached a level of 1×10^8 CFU/ml which could result in off flavors in the milk. Researchers encountering high somatic cell counts in milk are advised to interpret the results of the ATP assay with care.

Food Animal Residue Avoidance Databank (FARAD): An Automated Pharmacologic Databank for Drug and Chemical Residue Avoidance, J. Edmond Riviere, Arthur L. Craigmill and Stephen F. Sundlof, Laboratory of Toxicokinetics, School of Veterinary Medicine, North Carolina State University, Raleigh, North Carolina 27606; Veterinary Extension, University of California, Davis, California 95616; and Department of Physiological Sciences, College of Veterinary Medicine, University of Florida, Gainesville, Florida 32611

J. Food Prot. 49:826-830

The Food Animal Residue Avoidance Databank (FARAD) is a comprehensive computerized databank of regulatory and pharmacologic information useful for mitigation of drug and chemical residue problems in food-producing animals. For drugs, the databank contains information on proprietory products, labelled indications for use, and approved withdrawal and milk discard times. For drugs and chemicals, data are available on physiochemical properties of the chemical or generic drug, on tissue, egg and milk tolerances of these compounds, and on their pharmacokinetic behavior. This latter category is the most unique aspect of FARAD as it involves an extensive statistical analysis of published data, which results in estimates of the rates of depletion of these compounds in target animal species. These data have not been previously available. All data in FARAD are linked to specific sources which are listed in a citation file. Finally, resources produced as a result of USDA Residue Avoidance Program projects are listed in the database. Access to the databank is available at three regional access centers in California (916-752-7507), Illinois (217-333-3611) and Florida (904-392-4085), while the databank is maintained at a data analysis and support center in North Carolina. FARAD presently contains over 7,000 records with information on 250 compounds, and is supported by the USDA-Extension Service's Residue Avoidance Program.

Calendar

1986

October 14-17, IN-STORE TRAINING-MANAGEMENT SECTION, Manhattan, Kansas. Contact Donna Mosburg at (913) 537-4750 or write: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

October 15-18, NATIONAL FROZEN FOOD CONVENTION AND EXPOSITION, to be held at Bally's in Las Vegas, Nevada. For additional information, contact the National Frozen Food Association at (717) 534-1601 or the American Frozen Food Institute at (703) 821-0770.

October 20-22, ADVANCED SANITATION PROGRAM, Alexandria, Virginia. Contact Shirley Grunder at (913) 537-4750 or write: Shirley Grunder, Sanitation Education Department, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

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

October 21-23, WORKSHOP IN FOOD FLAVOR, University of Minnesota, St. Paul, MN. For more information contact Phyllis Jenks, Office of Special Programs, 405 Coffey Hall, University of Minnesota, St. Paul, MN 55108 (612) 625-2722; or Gary Reineccius, course coordinator, Department of Food Science and Nutrition, University of Minnesota, St. Paul, MN 55108 (612) 624-3201.

October 27-29, DISTRIBUTION INFORMATION SYSTEMS, Manhattan, Kansas. Contact Donna Mosburg at (913) 537-4750 or write: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

October 27-29, 1986 INTERNATIONAL WHEY CONFERENCE, sponsored jointly by the Whey Institute and the International Dairy Federation, O'Hare Marriott Hotel, Chicago, IL. For more information contact: Conference Secretariat, Whey Products Institute, 130 North Franklin Street, Chicago, IL 312-782-5455.

October 28-29, MISSOURI DAIRY FIELDMEN'S AND SANITARIAN'S EDUCATIONAL CONFERENCE, at the Holiday Inn West in Columbia, MO. Contact R. T. Marshall, Eckles Hall, University of Missouri, Columbia, MO 65211 (314) 882-7355.

November 1-5, AMERICAN ASSOCIATION OF CEREAL CHEMISTS ANNUAL MEETING to be held at the Opryland Hotel, Nashville, TN. For more information contact Raymond J. Tarleton, Exec. Vice President, AACC, 3340 Pilot Knob Road, St. Paul, MN 55121.

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

November 2-6, SANITATION MANAGEMENT CONFERENCE AND EXPOSITION, to be held at the Safari Conference Center Resort, Scottsdale, Arizona. For more information contact: Environmental Management Association's national executive office at 1019 Highland Ave., Largo, FL 33540. 813-586-5710.

November 6, FOOD MICROBIOLOGY UPDATE, Inn at the Park, Anaheim, CA. For more information contact Kathryn J. Boor,Food Science and Technology, University of California, Davis, CA 95616. (916) 752-1478.

November 20, WESTERN NEW YORK IFT SYMPOSIUM, Rapid Microbiological Methods, Rochester, NY. For more information contact Donald L. Downing, Cornell University - NYSAES, Geneva, NY 14456, (315) 787-2273.

December 11-12, 7TH ANNUAL UNIVERSITY OF WISCONSIN-RIVER FALLS FOOD MICROBIOLOGY SYMPOSIUM. For more information contact Dr. P. C. Vasavada, Food Science Department, University of Wisconsin, River Falls, WI 54022; telephone (715) 425-3150.

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February 5-7, FOOD ADDITIVES, THE CHANGING CLIMATE? 1ST INTERNATIONAL CONGRESS, to be held at the Hilton Hotel, Vienna, Austria. For more information contact Secretariat of the Food Additives, The Changing Climate, 1st International Congress, 30 Deane Way, Ruislip, Middlesex HA4 8SX, England.

February 11-12, DAIRY AND FOOD INDUSTRY CONFERENCE: THE OHIO STATE UNIVERSITY. For information contact John Lindamood, Department of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH 43210-1097

February 19, WESTERN NEW YORK IFT SYMPOSIUM, Pest Management and Sanitation, Rochester, NY. For more information contact Donald L. Downing, Cornell University - NYSAES, Geneva, NY 14456, (315) 787-2273.

February 23-25, ABC RESEARCH, 13TH ANNUAL TECHNICAL SEMINAR. For more information contact Sara Jo Atwell, ABC Research Corporation, 3437 S.W. 24th Avenue, Gainesville, Florida 32607, Phone: 904-372-0436.

February 23-25, KAMFES 1987 EDUCATIONAL CONFERENCE to be held at the Louisville, Kentucky Executive Inn. For more information contact Bland Doris, 711 Cottonwood Drive, Bowling Green, KY 42101.

March 10-12, WESTERN NEW YORK IFT SYMPOSIUM, Freezing Technology, Geneva, NY. For more information contact Donald L. Downing, Cornell University - NYSAES, Geneva, NY 14456, (315) 787-2273.

March 23-27, MID-WEST WORKSHOP IN MILK AND FOOD SANITATION, The Ohio State University. For information, contact John Lindamood, Department of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH 43210-1097.

March 26, WESTERN NEW YORK IFT SYMPOSIUM, Better Process Control School Refresher, Rochester, NY. For more information contact Donald L. Downing, Cornell University - NYSAES, Geneva, NY 14456, (315) 787-2273.

March 31 - April 1, WESTERN FOOD INDUSTRY CONFERENCE, to be held at the University of California, Davis, CA. For more information contact: Robert Pearl, Conference Chairman, 916-752-0980 or Shirley Rexroat, Conference Coordinator, Department of Food Science and Technology, University of California, Davis, CA 95616.

April 7-8, WESTERN NEW YORK IFT SYMPOSIUM, Wine Industry Workshop, Rochester, NY. For more information contact Donald L. Downing, Cornell University - NYSAES, Geneva, NY 14456, (315) 787-2273.

May 11-14, WESTERN NEW YORK IFT SYMPOSIUM, Better Process Control School, Rochester, NY. For more information contact Donald L. Downing, Cornell University - NYSAES, Geneva, NY 11456, (315) 787-2273.

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

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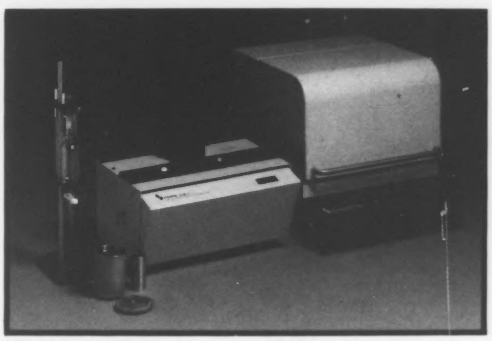

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