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Dairy and Food Sanitation



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

U. S. Standards
for Cheeses

FDA Report to
the NCIMS

IAMFES Award
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PRESIDENT'S MESSAGE OCTOBER, 1985

It is my pleasure to serve as the President of your Association this year. We had a successful meeting in Nashville with over 425 registrants and good attendance at all sessions. Facilities were good, we had a varied program and our hosts did a great job. Thanks to all of you who helped with the 1985 program.

Many of you were not able to be with us, so I want to share some of the actions taken with you. Kathy Hathaway and our Association staff have had us in the black for three consecutive years. The goal is to have up to one year's budget set aside. The staff, under Kathy's leadership have done an outstanding job and they deserve our cooperation. We need to provide them with more information about affiliate activities.

Your Executive Board took action on many items during about 15 hours of discussion. Details will be in individual committee reports in next month's issue.

1. The auditor's report showed an increase of over \$40,000 in working capital.
2. Wyoming and North Dakota were both accepted as new affiliates and given a charter.
3. Steps are being taken to stop the loss of about 50 members each year. A plan is to be reviewed at the fall Executive Board meeting where topics and speakers will be considered for the 1986 program.
4. The Foundation recommended use of Sustaining Membership Funds to make additions to the annual program. The Executive Board acted to establish a graduate student paper competition. A guest lecturer with travel expenses covered to the annual meeting was also discussed.
5. All six awards were presented at the banquet. You are encouraged to present more nominees for these awards, especially the Shogren and Merit Awards. Up to two of the later may be given to members of each affiliate for outstanding effort.
6. Few suggestions were offered by the management committees of the two publications. Changes have been made in both during the last few years. One plea remains, that is a request for the submission of more articles for *Dairy and Food Sanitation*.
7. We discussed CEU's and retiree membership at length and will hopefully take action this fall. Studies will be conducted to determine both the interest among members and impact on the Association.
8. The usual resolutions of appreciation were passed along with one supporting a ban on raw milk sales by regulatory agencies. One requiring training for HTST operators and another resolution for a name change for the Association were overwhelmingly defeated.
9. Action was taken by the Executive Board to initiate more interaction with affiliates. Each affiliate should receive an annual telephone call from the Association office inquiring about activities. Also, we hope that each affiliate will designate a person to be involved with membership at both levels.

We hope to have a good program to attract you to Minneapolis, August 3-6, 1986. Now is the time to think about submitting a paper. There are usually just enough to complete the program, so we need your input.

Your Board welcomes your ideas at any time although we only meet twice a year. You may call or write the Association office in Ames, IA or myself in University Park, PA.
Respectfully submitted,

Sidney Barnard
President, IAMFES

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Dairy and Food Sanitation

CONTENTS Vol. 5 No. 10 October, 1985

PRESIDENT'S MESSAGE 369

ARTICLES

• **FDA Report to National Conference On Interstate Milk Shipments** 372
Jerome J. Kozak

• **U.S. Standards for Cheeses** 375
Dick H. Kleyn

NEWS AND EVENTS 380

- 1986 IAMFES Award Nominations Now Due
- 1985-86 ACDPI Student Essay Contest
- UDIA Holds Meeting of Listeriosis Experts
**** and more ****

1986 IAMFES MEMBERSHIP CONTEST 383

NEW PRODUCT NEWS 385

FOOD SCIENCE FACTS 386

- Food Deterioration and Spoilage Caused by Light

DAIRY QUALITY 388

- Lipolytic and Proteolytic Microorganisms and Their Enzymes - Part II

MEMBERSHIP APPLICATION FORM 390

INSTRUCTIONS FOR PREPARATION OF 391
ABSTRACTS FOR THE 1986 ANNUAL MEETING

FOOD AND ENVIRONMENTAL HAZARDS 395
TO HEALTH

ABSTRACTS OF PAPERS PRESENTED AT 397
THE 72nd ANNUAL MEETING

JFP ABSTRACTS 409

READER SERVICE PAGE 413

CALENDAR 415

NEW MEMBERS 416

FDA Report to National Conference On Interstate Milk Shipments

Jerome J. Kozak, M.P.H.

Chief, Milk Safety Branch
Food and Drug Administration
Washington, DC 20204

This paper was presented at the National Conference on Interstate Milk Shipments meeting in Lexington, Kentucky on May 14, 1985.

Some FDA goals in the future are: 1) a commitment to increase uniformity in interpreting the PMO; 2) a commitment to training; 3) a rethinking of state program evaluations, to make them easier to complete and useful for the state; 4) to build and strengthen the program such as standardization to provide uniformity; and 5) to increase communications and the sharing of information between Federal-State and also Regional offices.

It is a sincere pleasure to address this Conference. The National Conference on Interstate Milk Shipments (NCIMS) has always been one of the beacons which has lighted the way in public health and it is an honor to share and participate in such a widely respected program.

In the short time since I became Branch Chief, I have been impressed by the dedication and esprit de corps of the people who, day in, day out, make the NCIMS what it is and those whose vision the NCIMS was founded upon. Having worked at the State level for over twelve years, I am very much committed to the structure and goals of the NCIMS, and I am now proud to be part of FDA, which has consistently supported the NCIMS.

I believe that the commitment of FDA to the Conference and the desire to fulfill the Agency's obligations and support the States in their programs has never been stronger. As I am a personal advocate of states rights, it is an easy task to head an FDA program under these conditions.

An example of FDA's commitment is the fact that my entire Headquarters Branch has attended the Conference; our Division Director, our liaison in Federal-State Relations, Laboratory Staff, Training Branch staff and over 15 Regional Milk Specialists. All of this comes at a time when travel budgets are being reduced. In addition, I am pleased to report that the Milk Safety Branch is now up to full staffing.

During my first six months I spent a lot of time talking and listening, to both FDA staff and State colleagues. I believe that it is essential to listen to what is happening in the Conference and to use this information to get us where we need to go in the future.

Some of my goals as a result of this listening are:

1) A commitment to foster and increase uniformity and to work with the Conference in providing interpretations that are pragmatic, yet maintain the integrity of the intent of the PMO.

2) A commitment to training, especially in the area of new technologies and computerization.

3) A rethinking of state program evaluations to make them less of a problem to complete and to institute a new flexibility about how often we need to do them, as well as to ensure that they are useful for State purposes.

4) An intent to build and strengthen some of the basics of the program, such as standardizations as a means of increasing nationwide uniformity.

5) Increased communications and the sharing of information among not only Federal - State but also with our Regional offices.

My last two months have been a different story. I received my "baptism by fire" in Chicago and probably learned more about the milk program in two months than I would have in two years in Washington! "The Chicago Story", as I now like to refer to it, answered a number of my questions and it also raised an entirely new set of questions.

I assume that unless you were living abroad, you all know about the Salmonellosis outbreak in the Chicago area. This was the most dramatic and largest outbreak of Salmonellosis associated with food in our nation's history, and unfortunately it involved pasteurized milk. It resulted in the most intensive and comprehensive investigation involving a dairy plant ever undertaken and will be written about and talked about for many years. It will also be remembered in the annals of foodborne and milkborne disease long after we are all gone.

The unique opportunity to spearhead FDA's participation and be designated as the Agency's spokesman during this public health emergency has given me many insights into our milk program in a relatively short period of time.

It is a propitious and remarkable coincidence that this incident occurred shortly before my first address to this Conference. Because of this timing I would like to briefly summarize the facts, dispel rumors and share with you a brief summary of the Preliminary Task Force Report which will also be made available to the Conference participants. Our report was released May 7, 1985 and received extensive national coverage.

Between March 22 and mid-April, 1985, more than 15,000 culture-confirmed cases of salmonellosis occurred in northern Illinois. Eventually we implicated multiple production dates of 2% lowfat milk produced by Hillfarm Dairy as the source of the outbreak-related strain of *Salmonella typhimurium*. Because the early cases were associated only with Bluebrook 2% lowfat milk (BB 2%), the investigation initially concentrated on factors that could have influenced the production of BB 2%. During the initial part of the investigation, no single underlying cause for contamination of finished, pasteurized product was determined.

After new cases were associated with a different type of milk, Hillfarm 2% lowfat milk (HF 2%), Jewel Food Stores closed the dairy on April 9, 1985, and withdrew all fluid milk and milk products from store shelves. On April 19, the Acting Director of Public Health convened a meeting of representatives from FDA, CDC, IDPH, Jewel Food Stores, and various outside experts, to continue to investigate, in depth, the chain of events that led to product contamination by *S. typhimurium*. From this meeting the Task Force was formed.

Task Force efforts concentrated on the origin of the outbreak-related strain of *S. typhimurium*, factors that would permit *Salmonella*-contaminated raw products to get around or through the pasteurizers, and conditions that would permit the survival and/or amplification of *Salmonella* within the dairy. Members of the Task Force, plant personnel, and consultants disassembled piping and equipment for physical examination and microbiologic evaluation, and special testing procedures were initiated. Records were extensively reviewed to recreate as accurately as possible the sequence of production on the implicated days. The function of equipment was evaluated while the plant was in operation up to April 9, 1985, and afterwards, by reproducing production conditions as closely as possible. By these means, various defects were identified, the most relevant of which appeared to be the existence of a pasteurized skim milk transfer line that created a cross-connection between pasteurized and raw products.

A number of possible causes of the contamination of BB 2% and HF 2% by *Salmonella* were reviewed. Based on the observed pattern of contamination of products with *Salmonella* and the data derived during the course of the investigation, the Task Force determined that the most

likely source of the *Salmonella* was the raw milk supply. It also determined that the most likely site of introduction into the HF 2% and BB 2% was the pasteurized skim milk line leading from the pasteurized skim milk tank (including the skim milk transfer line) and the two pasteurized milk storage tanks used for the culture-positive products. Means of contamination at these sites that could not be ruled out by the available evidence included: cross-contamination of pasteurized product by commingling of raw and pasteurized milk in the skim milk transfer line; *Salmonella* present on threaded caps that are interchangeable between raw and pasteurized lines; and the intentional addition of *S. typhimurium* in the skim milk lines or pasteurized milk storage tanks. Although not eliminated as a possibility, no evidence was found which supported the intentional contamination theory.

Of the possible causes considered, the data did not support contamination of raw products to such a degree that the pasteurization process would have been overwhelmed; heat-resistant salmonellae surviving the pasteurization process; unintentional contamination by a human carrier; or contaminated packaging material.

Additional information is still being derived to confirm the most probable cause. To determine the identity of the source, intensive sampling of the raw product sources of the dairy is underway. When all data gathering and interpretation are completed, a final report will be issued.

The Task Force was made up of 19 members and eight consultants. Members were from the Illinois Department of Public Health, Food and Drug Administration, Centers for Disease Control, dairy plant personnel and private laboratory staff.

It is a positive demonstration that multi-agency personnel, private consultants, and industry can work together in a common goal without the burdensome worry over organizational lines and other bureaucratic barriers. The other unique feature is that the dairy plant personnel who were most affected were part of the Task Force and equal partners in this Task Force.

The "Chicago Story" clearly demonstrates FDA's strong commitment to support and assist the States as the lead agency in the milk area. The Commissioner's directive that we were there primarily to assist the State of Illinois in dealing with a public health emergency portends very well for the future.

The unfortunate side of the "Chicago Story" is the linking of illness with the product that all of you have worked so untiringly to make safe. During the press conference to release our Preliminary Task Force Report, I made it clear in front of national network coverage that this outbreak was in no way a reflection on the quality and integrity of our Nation's milk supply. Milk is still the safest food product in our country, and we are extremely proud of the achievements of the NCIMS.

There still is yet another side of the "Chicago Story" from which there are lessons to be learned and opportunities created as a result of this unfortunate event. The question has been asked of many of you: "Can it happen

in your State?" The answer first among ourselves has to be yes! This was considered a well-run, well-operated, clean dairy plant by our standards. The "Chicago Story" bolsters the conviction that constant vigilance is necessary. It points out the importance of basic public health activities such as milk control programs. The possibility of catastrophic illness created by such a widely consumed product has never been clearer.

Maybe there is a more important question: "Have We Become Too Comfortable?"

- "Have We Become Too Comfortable?" in that we spend time arguing or discussing insignificant items while the major areas go unnoticed? We need to focus our efforts where they count in terms of preventing illness and to rely on sound professional judgment to handle the minor issues. Resource demands almost necessitate this prioritizing.

- "Have We Become Too Comfortable?" in that we have relied on the advances in milk technology and computerization to solve our problems and be our safeguard? We need to address this issue and quickly. Training in these areas is vital for our staff and future program success.

- "Have We Become Too Comfortable?" in our review of plant designs and equipment function? The human ele-

ment must not be a forgotten factor in the examination and inspection of plants and is our primary source of preventive vigilance.

To address these concerns, I believe we need to focus our attention on dairy plants and finished products since they are the closest to the consumer. The emphasis on our raw supply and farms is not to be diminished but we need to re-examine our priorities. We need to spend more time in our plants, breaking down equipment, ensuring that the pasteurization process and our post-pasteurization handling of milk is what it's supposed to be. We need to train our staff to keep up with the advances in technology and computerization and we need to call upon all resources to help us.

Within the last few years we have seen outbreaks associated with pasteurized milk such as: Salmonella in Chicago; Yersinia in Tennessee, Mississippi and Arkansas; and Listeria in Massachusetts.

Something may be happening as a result of our advance in technology and we now need to mobilize our efforts to re-examine our priorities and our direction for the future. The challenge once again has surfaced in a different time and manner than when our nation's milk program began. As "Partners in Health", I am confident the Conference will meet the challenge.

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U.S. Standards for Cheeses¹

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There are two standards for cheeses in the United States: 1) the Standard of Identity regulated by the Food & Drug Administration and 2) the Standards for Grades regulated by the U.S. Department of Agriculture. The Standard of Identity provides that compliance with the Standard assures consumers that the product is safe. The Standards for Grades shows consumers the quality of the product they are buying, based on the rating of that product.

INTRODUCTION

Webster's dictionary defines the term "standard" as "that which is set up and established by authority as a rule for the measure of quantity, weight, extent, value, or quality." Obviously laws come into play when standards for foods are considered. Prior to the 1900's there were no federal food laws or regulations in the United States except the ones governing meat export and tea import. Thus, food companies could market foods in any way they chose, resulting oftentimes in gross adulteration and illness. For example, arsenic or boric acid was sometimes placed on the surface of meat to slow spoilage or chalk was added to watered milk to make it whiter in color. It

was also common to add chalk or plaster of paris to bread to extend dirty flour or to mix lard with butter.

In 1906, the U.S. Legislature passed two laws on the same day, namely, the Pure Food and Drug Act and the Meat Inspection Act. These laws prohibited the manufacture and sale of adulterated or misbranded foods in interstate commerce. They were under the authority of the Bureau of Chemistry of the U.S. Department of Agriculture. In 1931, the Food and Drug Administration was created to replace the Bureau of Chemistry and administer the law. In 1938, the Federal Food, Drug, and Cosmetic Act was passed, giving the FDA more power to regulate the adulteration and misbranding of drugs and foods.

The FDA was transferred from the U.S. Department of Agriculture into the Federal Security Agency during World War II; then it was relocated in the Department of Health, Education, and Welfare in 1953, this Department being renamed the Department of Health and Human Services in 1980. Meat inspection, however, remains under the jurisdiction of the U.S.D.A.

Since the early 1970's the FDA has promulgated a vast number of rules and regulations to administer the various laws. The Federal Agency in the Executive Branch promulgates a regulation through an administrative process and is given

authority to carry out the law. Regulations are necessary because Congress usually only indicates general, not specific, guidelines when passing a law.

One of the finalized regulations promulgated by the FDA is known as the "Standards of Identity Regulations." These standards define a standardized food product in terms of either how it can be made and/or what ingredients must be in it. They were developed originally in order to promote honesty and fair dealing in the interest of the consumer. Over 300 foods now have Standards of Identity, many cheeses being among them. They are found in parts 130-169 under Title 21 of the Code of Federal Regulations which is updated on April 1st of each year. Parts 130-169 may be obtained by sending a \$12 check or money order to the Superintendent of Documents, Government Printing, Washington, DC 20402.

Standards for grades of food products fall under the jurisdiction of the USDA. Grade standards have been developed for several dairy products, including some cheeses. In addition to classifying foods into various grades, the grade standards also set guidelines for plant construction, personal hygiene, food composition, and labeling. Consumers are benefitted by grading as it gives them some assurance of the quality of the product they are purchasing. Food companies

¹Presented at the Third Annual Meeting of the American Cheese Society, June 16-18, 1985.

participate in the USDA grading program on a voluntary basis and must pay for this service as grading is not required. However, grading permits the processor to put the USDA grade seal on the food package if desired.

Standards of Identity for Cheeses - In the establishment or amendment of a Standard of Identity for a given cheese, several formal steps must be followed. This process can take several years, particularly when a change in an established Standard is desired. Peanut butter serves as a good example. The original Standard required a peanut content of 95%. Then the industry petitioned to lower the content to 90% peanuts. This petition resulted in 10 years of formal hearings and over 100,000 pages of documents before the requested change was approved. Once a Standard of Identity becomes established, the manufacturer must comply with it or face penalties for failure to meet the Standard. The critical steps in the development or amendment of a Standard of Identity are summarized as follows:

1. The Commissioner of Food and Drugs may propose a standard, or any interested person may petition if the petition outlines reasonable grounds for supporting a food standard.

2. First, formal publication appears in the Federal Register as a "notice of proposed rulemaking" when the Commissioner decides the proposed standard serves the purpose of promoting honesty and fair dealing in the interest of consumers.

3. After a period for study of comments received, the Commissioner publishes in the Federal Register an order adopting, modifying or rejecting the proposed food standard and calls attention to a statutory provision which allows 30 days for anyone adversely affected to file objections and to request a public hearing.

4. When objections and requests for a hearing are received, a notice stating the order is published, otherwise in their absence a notice confirming the effective date of the ruling is published.

5. At the public hearing any per-

son having relevant evidence on the issues may testify with such testimony and documentary exhibits recorded.

6. The Commissioner weighs the evidence in the record and publishes findings of facts and rulings on the issues, generally first as a tentative order, and then, after invited exceptions are received and considered, as a final order.

7. The law allows a 90 day period, after the Commissioner's final order is published during which time any party who is adversely affected can appeal the order to a U.S. Circuit Court of Appeals. From the ruling of the Circuit Court there may be a request for review by the U.S. Supreme Court.

The Federal Register, the official publication of the U.S. Government, is published Monday through Friday by the Government Printing Office. It is mailed, postage paid, to subscribers at a cost of \$1.50 per issue or \$300 per year. It is also available in microfiche at a cost of \$175 per year. It may be obtained from the Superintendent of Documents, Government Printing, Washington, DC 20402.

Presently, there are 73 cheeses possessing a U.S. Standard of Identity. They are published in the Code of Federal Regulations after meeting the critical steps for FDA approval as summarized above. The Standards of Identity for cheeses are described somewhat like a recipe as the FDA believes that this is the best way to describe varieties of cheeses.

Cheddar cheese serves as a good example to use in gaining insight on a typical Standard of Identity for cheese, the following information being drawn from the Code of Federal Regulations:

- (a) "Cheddar cheese is the food prepared from milk and other ingredients specified in this section, by the procedure set forth in paragraph (b) of this section, or by another procedure which produces a finished cheese having the same physical and chemical properties as the cheese produced when the procedure set forth in paragraph (b) of this section

is used. It contains not more than 39 percent of moisture, and its solids contain not less than 50 percent of milk fat, as determined by the methods prescribed in paragraph (c) of this section. If the milk used is not pasteurized, the cheese so made is cured at a temperature of not less than 35°F for not less than 60 days."

This section of the Standard specifies (1) the ingredients which may be used in the manufacture of cheddar cheese, (2) the required physical and chemical properties of the finished cheese, (3) the maximum moisture and minimum fat content of the solids in finished cheese, and (4) the required curing conditions for cheese made from unpasteurized milk.

- (b) "Milk, which may be pasteurized or clarified or both, and which may be warmed, is subjected to the action of harmless lactic-acid-producing bacteria, present in such milk or added thereto. Harmless artificial coloring may be added. Sufficient rennet, or other safe and suitable milk-clotting enzyme that produces equivalent curd formation, or both, with or without purified calcium chloride in a quantity not more than 0.02 percent (calculated as anhydrous calcium chloride) of the weight of the milk, is added to set the milk to a semisolid mass. The mass is so cut, stirred, and heated with continued stirring, as to promote and regulate the separation of whey and curd. The whey is drained off, and the curd is matted into a cohesive mass. The mass is cut into slabs which are so piled and handled as to promote the drainage of whey and the development of acidity. The slabs are then cut into pieces, which may be rinsed by sprinkling or pouring water over them with free and continuous drainage; but the duration of such rinsing is so limited that only the whey on the surface of such pieces is removed. The curd is salted, stirred, further drained, and pressed into forms. A harmless preparation of enzymes of animal or plant origin capable of aiding in the curing or development of flavor of cheddar cheese may be added during the pro-

cedure, in such quantity that the weight of the solids of such preparation is not more than 0.1 percent of the weight of the milk used."

This section provides details on (1) the milk which may be used in the manufacture of the cheese and (2) the means of forming the curd and completing the manufacture of the cheese. However, it must be remembered that in section (a) it was noted that another procedure could be used if it produces a finished cheese having the same physical and chemical properties as the cheese produced using the procedure set forth in this section (b). Indeed, large quantities of cheddar cheese are manufactured in the U.S. by another procedure known as the stirred curd method.

(c) "Determine moisture by the method prescribed on page 262 (15.124) [Ed. note, 10th edition, 1965, p. 247, sec. 15.157], under "Moisture-Official", and milk fat by the method prescribed on page 263 (15.131) [Ed. note, 10th edition, 1965, p. 248, sec. 15.164], under "Fat-Official," of "Official Methods of Analysis of the Association of Official Agricultural Chemists," Seventh Edition, 1950. Subtract the percent of moisture found from 100; divide the remainder into the percent milk fat found. The quotient, multiplied by 100, shall be considered to be the percent of milk fat contained in the solids.

This section specifies the means which must be used for determining the moisture and fat contents of the cheese for purposes of establishing the legality of the cheese, i.e., whether or not it meets the Standard of Identity.

(d) "Cheddar cheese in the form of slices or cuts in consumer-sized packages may contain an optional mold-inhibiting ingredient consisting of sorbic acid, potassium sorbate, sodium sorbate, or any combination of two or more of these, in an amount not to exceed 0.3 percent by weight, calculated as sorbic acid."

This section specifies the types and levels of mold inhibitors which may be used in cheddar cheese.

(e) For the purposes of this section:

1. "The word "milk" means cows milk, which may be adjusted by separating part of the fat therefrom or by adding thereto one or more of the following: Cream, skim milk, concentrated skim milk, nonfat dry milk, water in a quantity sufficient to reconstitute any concentrated skim milk or nonfat dry milk used.

2. Milk shall be deemed to have been pasteurized if it has been held at a temperature of not less than 143°F for a period of not less than 30 minutes, or for a time and at a temperature equivalent thereto in phosphatase destruction. Cheddar cheese shall be deemed not to have been made from pasteurized milk if 0.25 gm shows a phenol equivalent of more than 3 micrograms when tested by the method prescribed in paragraph (f) of this section.

3. During the cheese-making process the milk may be treated with hydrogen peroxide solution followed by addition of a suitable catalase preparation to eliminate the hydrogen peroxide. The hydrogen peroxide solution shall comply with the specifications of the United States Pharmacopeia, except that it may exceed the concentration specified therein and it does not contain added preservative. The amount of the hydrogen peroxide solution used shall be such that the weight of the hydrogen peroxide added thereby does not exceed 0.05 percent of the weight of the milk treated. The catalase preparation used shall be stable, and in potency, for eliminating added hydrogen peroxide from milk, it shall not be less than equivalent to liver-catalase preparation testing 100 Keil units per gram. It shall be either a preparation that is not a food additive within the meaning of section 201(s) of the Federal Food, Drug, and Cosmetic Act, or a preparation that is a food additive but which is used in conformity with regulations promulgated pursuant to the authority of section 409 of the act. The amount of catalase preparation used shall be such that the weight of the catalase added thereby does not exceed 20 parts per million of the weight of the milk treated."

Section (e) pertains to (1) the definition of the term "milk", (2) the definition of the term "pasteurized", and (3) the treatment of milk with hydrogen peroxide during the cheese-making process. Relative to the definition of "milk", it is interesting to speculate on the question of whether or not the Standard of Identity will be met when ultrafiltrates of milk are utilized.

Section (f) elaborates on the method used for determining whether or not a cheese was made from pasteurized milk.

(g) 1. "If cheddar cheese in sliced or cut form contains an optional mold-inhibiting ingredient as specified in paragraph (d) of this section, the label shall bear the statement "_____ added as a preservative", the blank being filled in with the common name or names of the mold-inhibiting ingredient or ingredients used; e.g., "Sorbic acid and potassium sorbate added to retard mold growth."

2. "Wherever the name of the food appears on the label so conspicuously as to be easily seen under customary conditions of purchase, the statement specified in this section, showing the optional ingredient used, shall immediately and conspicuously precede or follow such name, without intervening written, printed, or graphic matter."

This section refers to the labeling requirements if a mold inhibitor has been used, thereby assuring that the consumer will be aware of the use of such an additive when purchasing the cheese.

In summary, the Standard of Identity exemplified by that for cheddar cheese reveals that compliance with Standards does promote honesty and fair dealing on behalf of the consumer. In addition, the Standards specify the types of additives which may be used in the manufacture of cheese as well as pasteurization and ripening requirements, thus assuring the safety of the finished product.

U.S. Standards for Grades - The history and development of grade standards for dairy products has been well documented by Edward Small,

who worked for the Dairy Division, Agricultural Marketing Service, USDA for 36 years. Mr. Small retired in 1963 and then devoted considerable energy toward the publication of a book entitled "A History of USDA Standardization and Inspection and Grading Services of Manufactured Dairy Products". This book may be obtained from National and Technical Information Service, 5285 Pt. Royal Road, Springfield, VA 22161. Mr. Small made the following statement in the preface of his book: "It is fitting and proper and accurate to lay claim that no program whether of a regulatory or service function has contributed as much toward quality improvement, stability, and safety of dairy products as the Standardization, and Inspection and Grading program of USDA."

The commercialization of American agriculture resulted in the development of standards for identifying and describing farm products according to quality. The grading of a product in a consistent, meaningful way is dependent on the use of a standard. Development of a grade standard occurs when (1) it is apparent that there is a need for it, (2) there is interest and support from the industry, and (3) it can be readily used for a given product.

The development of grade standards involves the classification of all samples of a product into distinct levels or gradations of a products quality characteristics which are at and above the minimum required for identification of that product as fit for human food.

A grade standard for a cheese should reflect the quality of the raw milk from which it is made, i.e., the overall quality, product stability, and safety of the cheese is influenced greatly by the quality of the raw milk. However, faulty processing and/or storage, e.g., inadequate processing methods, lack of sanitation, improper packaging, handling, and storage will readily nullify the benefits of high quality raw materials.

The Agricultural Marketing Act of 1946 demonstrated the interest of Congress in the improvement in the

marketability of agricultural products through differentiation of products on the basis of quality. Orderly marketing is a consequence of these differentiations and the universal acceptance of the grade standards. In other words, market quotations must be associated with specific information pertaining to the quality of the product if they are to be of value as a basis for trading.

The general sequence of events occurring in the development of a grade standard is as follows:

1. A request for a standard is made by a trade or consumer group, a State Department of Agriculture or some other group.

2. The product is studied by USDA standardization specialists to determine the quality factors involved and the range of quality produced.

3. Proposed grade standards are drawn up and published in the *Federal Register* under proposed rule making. A specified time period is set to allow interested persons to study and comment on the proposal. A press release notifies industry members, consumer groups, trade organizations, State Departments of Agriculture, and others of the publication.

4. Copies of the proposed standards are sent to those who request them. All comments are considered in determining whether the standard should be issued as proposed, with amendments, or withdrawn.

5. If the standard is promulgated, it is issued in final form in the *Federal Register* with a specified effective date. A press release is issued again.

6. The grade standard becomes part of the U.S. Standard and is published under Title 7 of the Code of Federal Regulations.

Grade standards exist for the following cheeses: Cheddar, Swiss, Bulk American Cheese for Manufacturing and Monterey & Colby Cheese. The history of the development of a grade standard for these cheeses is very interesting. In the case of Cheddar cheese, the development began in 1922, was published in the *Federal Register* in 1950,

amended in 1954, and revised during the period of 1954-56.

The present revised grade standard for Cheddar cheese establishes four grades, namely, U.S. Grade AA, U.S. Grade A, U.S. Grade B, and U.S. Grade C. The grades are based on four quality factors: flavor, body and texture, finish and appearance, and color. Characteristics or defects, including intensity, of each quality factor, according to the degree of curing, are classified. The final U.S. grade is established on the basis of the lowest rating of any one of the quality characteristics present. Condensed, as well as detailed tables, are used to tabulate characteristics according to the degree of curing. A comparison of the specifications for flavor of a U.S. Grade AA vs. a U.S. Grade A cheddar cheese serves to illustrate the grading system:

U.S. Grade AA (Flavor) - Fine and highly pleasing, free from undesirable flavors and odors. May possess very slight feed flavors.

U.S. Grade A (Flavor) - Pleasing and free from undesirable flavors and odors. May possess feed, acid, and bitter flavors within limited tolerances as the cheese ages.

Tentative grade standards for Swiss cheese were proposed as official U.S. grade standards in 1951. These proposed standards were based on flavor, body, eyes and texture, finish and appearance, salt and color. Four grades were established, namely U.S. Grade A, U.S. Grade B, U.S. Grade C, and U.S. Grade D. To qualify as a U.S. Grade A Swiss cheese, the majority of eyes must be at least one-half inch in diameter. The grade standards were published in final form in the *Federal Register*, January 6, 1953, effective February 5, 1953.

Grade Standards for cheeses are used mostly at the wholesale level and only the top grades are used at the retail level. However, the USDA shield revealing the grade usually does not appear as it does for U.S. standard grades of butter as the cheeses are graded for wholesale purposes rather than for sale to consumers.

The grading of dairy products by USDA personnel has contributed greatly toward upgrading quality. These personnel often have a background in food science and have gained some training in evaluating the quality of dairy products through formalized courses. Many years of experience are usually required to become a competent judge of dairy products. An excellent reference for

this activity is the text "*Judging Dairy Products*", by Nelson and Trout.

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3. Nelson, J. and G.M. Trout. 1981. *Judging Dairy Products*, 4th Edition, AVI Publishing Co.
4. Office of the Federal Register. 1979. Code of Federal Regulations. 21 Food and Drugs, Parts 100-199.
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The Food Processors Institute presents

"ON THE LINE"

a 30-minute, dramatic treatment of good sanitation practices,
available in 16mm film or video format.

"On the Line" will be available in early October, 1985.
For additional information, contact:

The Food Processors Institute

1401 New York Ave., N.W., Suite 400 / Washington, D.C. 20005 / 202/393-0890

Nominations for '86 Awards Now Due

Awards nominations are due for the 1986 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 Archie C. Holliday, Vir. Dept. of Agric., 1100 Bank St., Room 511, Richmond, VA 23219, with information on your nominees. Present Executive Board members are not eligible for the 1986 awards.

The awards are as follows:

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

*Harold Barnum Award. This \$500 award and plaque will go to an industry representative in 1986. It is presented to a person who has shown outstanding 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 who has given outstanding service to the Association in helping fulfill its objectives.

*Shogren Award. This \$50 award and certificate will go to the affiliate organization with the best state or regional program.

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

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

Manuscripts Invited For ACDPI Student Essay Contest

Deadline for submitting papers for the 1985-'86 American Cultured Dairy Products Institute (ACDPI) - sponsored student essay contest is December 1, reports Institute Board Chairman Bill Ezell.

The annual competition, established two years ago in recognition of ACDPI's 25th anniversary - is open to college/university undergraduate students majoring in dairy and/or food science or a closely related field.

The essay (approximately ten double-spaced typewritten pages in length) should cover one of two topics related to cultured dairy products: (1) Research

needed to solve a current or anticipated problem. This may relate to any phase of cultured dairy products research such as product formulation, nutritional considerations, processing technologies, etc.; (2) Sales/Marketing ideas for current or proposed cultured dairy foods. These could include suggestions for innovative promotion programs to increase product consumption or means of enhancing the image of the dairy industry and/or its cultured products.

Winner of the contest will be provided an opportunity to present his/her paper at the Institute's Annual Conference in San Antonio this March. (All travel, food and lodging expenses will be paid by ACDPI). Additionally, the winner will receive a \$500 cash award, be given appropriate national recognition, and will have his/her paper published in the *Cultured Dairy Products Journal*.

Further information pertaining to the essay competition may be obtained from Institute Vice President/Secretary Dr. C. Bronson Lane, P.O. Box 7813, Orlando, Florida 32854. Manuscripts should be sent directly to contest chairman Dr. Charles White, Dairy Science Department, Mississippi State University, Mississippi State, Mississippi 39762 with accompanying letter (signed by a faculty member) certifying that the paper was written by the student.

3-A Committees Receive President's C-Flag

The President's Citation Program for Private Sector Initiatives recently honored the 3-A Sanitary Standards Committees with a C-Flag, a symbol that indicates "We Can" and "We Care." The program's 1,040 volunteers were recognized for their unique nationwide industry-regulatory program of sanitary standards for equipment used in processing dairy foods.

The President's Citation Program was developed to encourage the growth in voluntary service programs on the part of the businesses, trade associations and professional societies by recognizing and saluting their outstanding contributions. This is the first White House awards program to recognize corporate social responsibility, public-private partnerships, corporate philanthropy and privatization programs.

Dairy and Food Industries Supply Association (DFISA) houses 3-A Committees' secretariat. Fred J. Greiner, Executive Vice President of DFISA, says the 3-A program is a voluntary approach to safeguarding public health. "The real benefactor of 3-A standards is the American consumer. "They have the satisfaction of knowing that the dairy and food products consumed in the U.S. are the safest in the

world."

Organizations constituting 3-A are: Dairy and Food Industries Supply Association (DFISA); Dairy Industry Committee; International Association of Milk, Food and Environmental Sanitarians; and, United States Public Health Service.

For more 3-A information, contact 3-A Secretary Thomas M. Gilmore, Ph.D., 6245 Executive Boulevard, Rockville, MD 20852. 301-984-1444.

Report Shows Irradiation of Food Safe

The Food and Drug Administration is likely to approve food irradiation for a variety of purposes later this year. Whether consumers will also approve of this new technique remains uncertain.

Irradiation (the treatment of foods with ionizing radiations such as gamma rays) has been shown to be safe after a systematic, comprehensive scientific testing program, according to the report *Irradiated Foods*, published by the American Council on Science and Health (ACSH), an independent scientific organization.

Irradiation has a wide variety of uses, the ACSH report states. Among them are destruction of microorganisms in food to produce shelf-stable products similar to canned foods; inactivation of *Trichinella spiralis* (the causative agent of trichinosis) in fresh raw pork; destruction of insects in foods; inhibition of the sprouting of potatoes, onions, and garlic; and delaying the ripening of non-citrus tropical fruits.

"Irradiation has been subjected to extensive safety testing, and scientists and international health authorities are now convinced that foods processed in this way do not pose a health hazard. In some cases, they may even have health advantages. For instance, irradiation can be used to kill the food poisoning organisms, such as *Salmonella*, that are often found on raw meat and poultry," said ACSH Executive Director Dr. Elizabeth M. Whelan.

"Many consumers are very concerned about food irradiation, but I think they would be reassured if they were more thoroughly informed about the process," said ACSH Research Associate Kathleen A. Meister, author of the ACSH report.

"For instance, some people think that irradiated foods might be radioactive. But, in fact, the types and levels of radiation used to treat foods cannot induce radioactivity," Meister said.

"Some people are concerned that it might be dangerous to have a food irradiation facility in their communities," she added. "However, a food irradiation plant is no more dangerous than the

radiation therapy unit at your local hospital. It's just bigger. An irradiation facility is not a nuclear reactor; it's just a plant with a shielded area where foods would be exposed to a naturally decaying radioactive substance or machine-generated radiation.

"Food irradiation does not create new radioactive wastes," Meister said. "The only radioactive material present is the source of the radiation - usually a radioactive isotope of cobalt or cesium. No new radioactive material is generated. As for those isotopes, transporting them to and from the irradiation facility is strictly controlled by the government and quite safe. It's already being done all the time with the isotopes used by hospitals and medical products irradiation facilities, so the necessary precautions for safe transport are well understood."

The American Council on Science and Health is an independent, nonprofit consumer education organization promoting scientifically balanced evaluations of food, chemicals, the environment, and health.

To obtain a complimentary copy of the report *Irradiated Foods*, send a self-addressed, stamped (39¢ postage), business-size (#10) envelope to *Irradiated Foods Report*, ACSH, 47 Maple St., Summit, NJ 07901.

UDIA Holds Meeting Of Listeriosis Experts

Pasteurization kills *Listeria monocytogenes*, according to continuing research and yet unpublished studies being conducted by prominent scientists and regulatory experts. Dairy Research Foundation (DRF), a product/process research program of United Dairy Industry Association, coordinated and funded an August 6 meeting at the Hyatt Regency Nashville to discuss the latest research related to this organism.

DRF requested the scientific assembly to explore the current biology of *Listeria* and identify future research priorities for the dairy industry. Several group members spoke of their work on new, shorter term methods for the detection of the bacteria.

DRF Director Joseph A. O'Donnell, Ph.D., organized the group in conjunction with the 72nd Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians. A University of Wisconsin *Listeria* researcher, Elmer Marth, Ph.D., chaired the informal round table discussion.

More than 18 experts representing the dairy industry, Food and Drug Administration, Centers for Disease Control in Atlanta, University of California, University of Vermont, and University of Wisconsin attended the Listeriosis Conference.

United Dairy Industry Association, in cooperation

with National Dairy Council, is preparing a *Listeria monocytogenes* white paper on research discussed at the meeting as a dairy industry resource.

United Dairy Industry Association, the largest commodity promotion organization in the world, conducts a total promotion program for milk and milk products through the combined efforts of American Dairy Association, Dairy Research Inc., and National Dairy Council.

Dehydrated Media Catalog Available

A recently published catalog lists a wide range of dehydrated media and raw materials available from Acumedia Manufacturers, Inc. The products are available in 1, 5 and 25 pound packages. Custom formulations are also offered. Included in the catalog is a Comparative Brand Name Listing to help you order exactly what you need. Acumedia is the only manufacturer to offer COBA Agar, Extract Broth, MacConkey Agar-Plus, and an Improved Group A Selective Streptococcus Agar.

Catalog copies are available at no charge. Acumedia Manufacturers, Inc., 3651 Clipper Mill Road, Baltimore, MD. 21211.

Frozen Food Roundtable Issues Updated Code of Practices

The Frozen Food Roundtable, a group of 16 trade associations concerned with the proper handling and merchandising of frozen food, has issued an updated version of the publication, "Frozen Food Handling and Merchandising: A Code of Recommended Practices Endorsed by the Frozen Food Roundtable."

The new document supercedes the 1981 revision of the code, the Frozen Food Roundtable. Single copies of the code are available through any of the

associations which endorse and subscribe to the document. These are: the American Association of Meat Processors, the American Frozen Food Institute, the Commercial Refrigerator Manufacturers Association, the Interstate Carriers Conference, the Food Marketing Institute, the Frozen Potato Products Institute, the International Association of Refrigerated Warehouses, the National-American Wholesale Grocers Association, the National Broiler Council, the National Fisheries Institute, the National Food Brokers Association, the National Frozen Food Association, the National Frozen Pizza Institute, the National Grocers Association, the National Prepared Frozen Food Association, and the National Restaurant Association.

Sections of the code deal with foods for freezing, packaging and identification of frozen foods, warehouse equipment, warehouse handling practices, transportation, storage on retail premises, retail display, retailer handling practices, reception and storage in foodservice installations, and handling in foodservice installations. Appendices to the code cover a shipping case code symbol, a reference method for temperature measurement, and routine temperature measurement.

The document is "based on scientific evidence, expert advice, and practical experience," the Frozen Food Roundtable notes in the code's statement of purpose.

"The subjects covered in this code relate to the proper handling and merchandising of frozen foods, from raw material to the ultimate consumer," the statement of purpose says. "The endorsing trade associations are leaders in the large and still rapidly evolving frozen food industry. These associations have joined in developing these voluntary operating practices. They have done so to ensure that sound, up-to-date practices for care and handling of frozen foods can be widely disseminated without inhibiting continuing technological advances.

"The quality of frozen foods on the plate of the ultimate consumer is dependent on each and every person concerned with the numerous aspects of frozen food handling following the appropriate provisions of this code. Good practice requires understanding the need for the criteria of good handling," the statement of purpose says.

1986 MEMBERSHIP CONTEST

Dear International Association of Milk, Food and Environmental Sanitarians Member. . .

Everybody loves a contest...and as a member of the International, you know the benefits of membership and the journals. All you need to do is tell OTHERS about membership with the International.

It's that easy.

A special form is included for your convenience to make it even easier. When you run out of forms, just write this office for more. They will be mailed to you the same day the request is received. Or simply photo copy the form if you wish.

So what are the prizes you ask? When does it start? When does the contest end?

The Membership Recruitment Contest begins October 1, 1985 and ends June 30, 1986.

GRAND PRIZE FOR RECRUITING 30 MEMBERS. . .

1. Air transportation to the Annual Meeting in Minneapolis, MN.
2. Free Registration and Free Social Events at the 73rd IAMFES Annual Meeting, August 3-7, 1986 at the Radisson South, Minneapolis, MN.
3. Membership Recruiter of the Year Plaque Presented at the Annual Meeting in Minneapolis.
4. Personal recognition during the Annual Awards Banquet, with seating at the head table. If from the Minneapolis area, air transportation can be used for the 1987 Annual Meeting.

RECRUITMENT OF 20 MEMBERS. . .

1. Free Registration and Free Social Events.
2. Appreciation Certificate Presented at the Annual Meeting.

RECRUITMENT OF 10 MEMBERS. . .

1. Free IAMFES Membership for 1987 (includes Dairy and Food Sanitation).

RECRUITMENT OF 5 MEMBERS. . .

1. Bonus Bucks. . .\$10 off your membership for 1987.

ALL MEMBERS recruiting new members will be listed in the MEMBERSHIP HALL OF FAME, published in the August issue of Dairy and Food Sanitation.

Throughout the contest, updates will be published in Dairy and Food Sanitation.

You have NOTHING to lose. . .but everything to win, plus knowing you are supporting your professional association.

Please write your name on the form so that you receive credit for recruitment when they reach the International office.

Questions? Please give me a call at 1-800-525-5223 or in Iowa call 515-232-6699.

Sincerely,

Kathy R. Hathaway
Executive Manager
IAMFES, Inc.

P.S. Remember. . .June 30, 1986 is the deadline. . .so start recruiting TODAY!

IAMFES MEMBERSHIP DRIVE

Recruiter _____
City _____ State/Province _____
Country _____ Zip _____
New Member _____
Address _____
City _____ State/Province _____
Country _____ Zip _____
Phone with area code _____
Company _____
Job Title _____

Yes, I realize the benefits of membership with the International Association of Milk, Food and Environmental Sanitarians. Please accept my membership for:

- _____ Membership with Dairy and Food Sanitation — \$28
_____ Membership with both Dairy and Food Sanitation and the Journal of Food Protection — \$50
_____ Affiliation with my state/province group (dues vary with each affiliate, if you do not know your state/province dues, please contact this office)
_____ CANADA AND FOREIGN \$7 postage for 1 journal, \$14 for both journals
_____ Total Amount Due
- _____ Payment enclosed
_____ Bill me
_____ Mastercard/Visa (circle appropriate card)
- card # _____
expiration date _____
your signature _____

MAIL TODAY TO:

IAMFES
Membership Drive
P.O. Box 701
Ames, IA 50010

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



Fibre egg cartons from
Packaging Corp. of America

Fibre Egg Cartons Cut Breakage Losses

• Eggs mean about \$1 million a year to Pay-Cash of Knoxville, Tennessee. A division of Scrivner's, Inc., the nation's third largest food wholesaler, Pay-Cash ships about 38,000 dozen eggs per week to independent grocers in Tennessee, Georgia, Kentucky, Virginia and North Carolina.

Up until two years ago, about one out of every 21 of those eggs, packed in foam cartons for retail, would end up broken.

"Our breakage problem was severe," said Leo J. Matthews, director of merchandising for Pay-Cash. "It was costing us \$30,000 a year in returns alone, not counting the expenses of extra handling and paperwork."

Worse yet, added Matthews, the breakage problem cost Pay-Cash over 30% of its egg business, amounting to an annualized loss of \$325,000.

Matthews knew he had to solve the problem, so he looked to the example of other industry leaders in food wholesaling for some ideas in egg packaging. His solution - a switch to molded fibre egg cartons produced by Packaging Corporation of America.

Since switching to fibre cartons, Pay-Cash has regained all of its lost egg business and has reduced egg breakage from one out of twenty-one to one out of two thousand!

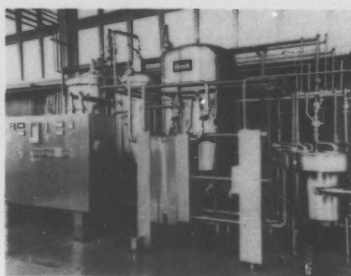
Pay-Cash has found that the switch to fibre cartons has presented no loss in merchandising capability and has met with no resistance from either retailers or consumers.

There have been other advantages, too. According to Terry Henry, Pay-Cash's director of operations, the switch to fibre cartons has improved productivity in the warehouse, since no more time has to be wasted re-packing surviving eggs.

Packaging Corporation of America, a Tenneco company, is the nation's leading manufacturer of molded fibre egg cartons and filler flats. PCA also manufactures molded produce and catering trays, berry baskets and Diamond DeLuxe disposable tableware.

For more information contact: Warren J. Hazelton, Packaging Corporation of America, 1603 Orrington Avenue, Evanston, IL 60204. 312-492-6968.

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Schmidt-Bretten
Milk Sterilization System

New Milk Sterilization System Introduced

• Richard Aust, general manager of Schmidt-Bretten, Inc. has announced the introduction of their new Milk Sterilization System for Dairies. The new system utilizes a plate heat exchanger, a separator, homogenizer, flash cooler and heater and a deaerator to provide the ideal processing of UHT milk. The Schmidt system achieves up to 96% heat recovery.

For more information contact: Schmidt-Bretten, Inc., 1612D Locust Avenue, Bohemia, NY 11716.

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ALERT End of Milking Indicator Announced

• Babson Bros. Co., builders of SURGE dairy farm equipment, announces the introduction of the Surge ALERT end of milking indicator to the product line.

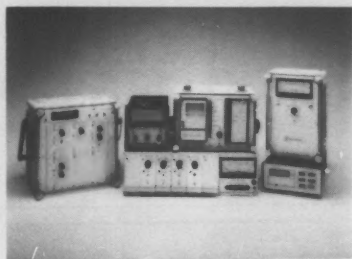
The ALERT is a lightweight end of milking signal that uses a unique infrared light beam to look through the milk hose to sense end of milk flow. There is absolutely *nothing* in the line itself to create a restriction, fluctuation or loss of vacuum. With the ALERT, there is no premature removal or shutdown of the milking machine.

Both a flashing light and a beeper indicate the end of milking so the operator knows exactly when to remove the milker. The chance of harmful overmilking is reduced with the ALERT.

The ALERT operates off a standard 24-volt pulsator and needs no extra hoses. A built-in handle makes it easy to move from cow to cow.

For additional information about the Surge ALERT end of milking indicator, contact your local Surge Dealer or Babson Bros. Co. at 2100 S. York Road, Oak Brook, IL 60521. 312-654-1600.

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Water Quality Analysis Instruments
from Capital Controls Co.

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Food Science Facts

For The Sanitarian



Robert B. Gravani
Cornell University
Ithaca, NY

Food Deterioration And Spoilage Caused By Light

Light

Almost all foods are exposed to light from natural and/or artificial sources during processing, packaging, storage, shipping and marketing. The exposure of foods to light can result in the deterioration or photodegradation of these products. This photodegradation usually occurs in food constituents such as pigments, fats, proteins, and vitamins resulting in discoloration, off-flavor development and vitamin losses. The subject of light induced changes is quite complex and will be discussed in two issues of *Food Science Facts*.

Light is a form of radiant energy that is usually described by a term called wavelength. The light that we can see (visible light) is only a very small part of the vast spectrum of electromagnetic energy. This spectrum includes:

- Gamma Rays
- X Rays
- Ultraviolet Rays
- Visible Light
- Infrared Rays
- Radiowaves

Most problems that occur in foods are caused by light in the visible and ultraviolet ranges.

In the past, most light-induced changes in food were caused by sunlight. The development of incandescent lights added only a few problems because these lamps emit low amounts of ultraviolet light. Innovations in marketing have led to the merchandising of foods in transparent and translucent packaging under high intensity fluorescent lights. This situation can result in the photodegradation of food constituents.

Sources of Light

Foods are exposed to several sources of light in their production and marketing. Some common light sources and their locations are shown in Table 1.

TABLE 1. *Common light sources and their locations.*

Light Source	Usual Location
Sunlight	Outdoors, Store Fronts, Windows and Skylights
Incandescent Fluorescent Lamps	Coolers, Storage Facilities, Food Processing Areas, Display Cases, Food Preparation Areas

Incandescent lamps (regular light bulbs) have a metal filament that is heated to a glowing point. Fluorescent lights give off light when ultraviolet rays (resulting from the passage of electricity through a mercury vapor) strike certain materials called phosphors. These substances then give off visible light.

Foods are also exposed to other sources of light in the food industry. They include:

1. Germicidal lamps used in walk-in coolers, food holding rooms, bakeries, and other areas to reduce bacterial and mold counts, and

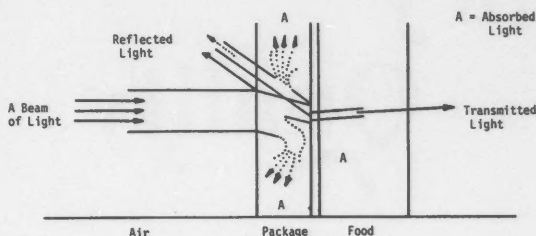
2. "Black lights" used to detect the presence of insects, rodent excreta and other kinds of contamination in foods.

When light strikes a package of food a number of things happen. The light is: (See Fig. 1)

1. Reflected off the surface of the package;
2. Absorbed by the packaging material;
3. Scattered and absorbed by the food; and
4. Transmitted through the food.

The light that is absorbed by the food can cause deteriorative reactions of the food constituents. In most solid foods, the light only penetrates the outer layer of

Figure 1. The diagram below shows this sequence of events.



the product and photodegradation occurs in this surface layer. Discoloration on the surface of foods can certainly affect consumer acceptance of these products.

In liquid foods, light penetration can be greater and with mixing of the products due to agitation, larger portions of food constituents may be deteriorated.

The light sensitivity of a food depends on many factors including the:

1. Light source strength and type of light that it emits;
2. Distance of the light source from the food;
3. Length of exposure;
4. Optical properties of the packaging material;
5. Oxygen concentration of the food; and
6. The temperature

Light induced changes in food usually begin in one of two ways:

1. Light is absorbed by a component in the product that will directly undergo chemical reaction.

2. One component in a food causes some other component to undergo reaction because of light.

The deterioration of foods can occur when "light sensitive" constituents, like those shown in Table 2, are exposed to light.

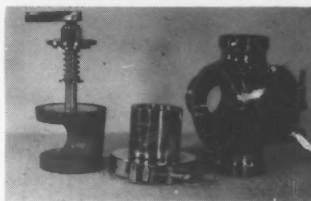
TABLE 2.

<i>Nutrients</i>	<i>Amino Acids</i>
Vitamin A	Tryptophan
Vitamin B ₁₂	Phenylalanine
Vitamin D	Tyrosine
Folic Acid	Histidine
Vitamin K	
Pyridoxine	<i>Pigments</i>
Riboflavin	Anthocyanins
Vitamin E	Carotenoids
	Chlorophylls
	Myoglobin
<i>Lipids</i>	Hemoglobin
Unsaturated Fatty Acids	
Phospholipids	

The next *Food Science Facts* will discuss light induced changes that occur in a variety of foods and how they can be prevented.

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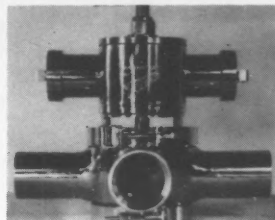


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Dairy Quality

by Darrell Bigalke, Food & Dairy Quality Mgmt., Inc., St. Paul, MN

Lipolytic and Proteolytic Microorganisms and Their Enzymes

Part II

Last month's *Dairy Quality* pointed out that microorganisms capable of growth at refrigeration temperatures have a detrimental effect on the quality of dairy products. The newsletter pointed out that enzymes produced by these microorganisms were capable of breaking down milk fats, proteins, and carbohydrates; thus resulting in product defects. This month's article discusses specific changes in dairy products caused by psychrotrophic microorganisms and their enzymes. The article also points out some control considerations for psychrotrophic bacteria and their enzymes that will influence dairy product defects.

The two major groups of enzymes produced by psychrotrophic organisms that are most detrimental to dairy product quality are proteases and lipases. A recent review by Cousin (2) points out that literature contains several reports of psychrotrophic microorganisms isolated from milk and dairy products that have shown lipolytic and/or proteolytic activity. Psychrotrophic microorganisms and their enzymes provide three areas of concern when considering the production of quality dairy products. First, the growth of psychrotrophic organisms in raw milk may cause a breakdown of milk fat and protein resulting in undesirable flavors. In addition proteolytic activities will hydrolyze milk proteins resulting in reduced cheese yields. Secondly, psychrotrophic growth in raw milk can result in production of heat-stable enzymes (1) capable of producing quality defects in stored dairy products. Thirdly, contamination and growth of psychrotrophic organisms in dairy products will result in biochemical changes producing a negative effect on consumer acceptance.

Proteolytic activity by psychrotrophic organisms or their enzymes is first noticeable by changes in product flavors denoted by "lacks freshness" or "stale" defects. With prolonged storage and enzymatic activity, dairy products can become fruity flavored, bitter, or putrid as the result of enzymatic breakdown of milk proteins. In

addition, with prolonged hydrolysis of milk proteins, a clotting defect can result in fluid milk products. White and Marshall (6) observed that psychrotrophic proteases were responsible for significant proteolysis in cottage cheese and cheddar cheese made from milk inoculated with psychrotrophic bacteria.

Recent studies (3,4) have pointed out that psychrotrophic microbial growth in raw milk can result in drastic reductions of cheese yields. The reduced yields are primarily due to the hydrolysis of casein resulting in increased soluble solids in whey.

When lipolytic psychrotrophic microorganisms or their enzymes are present in dairy products, rancid flavors and odors usually will occur. Lipase will hydrolyze milk fat (triglycerides) into glycerol and free fatty acids. Free fatty acids are responsible for the rancid flavors and also contribute to bitter flavors in milk and cheese products. There are two sources of lipase enzymes in raw milk: microbial lipases and lipase secreted as the result of lactation. Unfortunately psychrotrophic lipases can be heat-stable, capable of producing quality defects in pasteurized stored milk and dairy products.

Psychrotrophic microorganisms are also capable of producing acid, and/or gas, and pigmentation in many dairy products. While the occurrence of lipolytic and proteolytic defects are much more common, the dairy processor should also monitor dairy products for these possible defects.

The intent of these two articles is to point out the need to establish two elements of a good quality control program that are often overlooked. First, there is a need to establish specifications for ingredients and monitor raw milk to assure conformance to specifications. Secondly, to point out the need for sensory evaluation of stored finished products. With prolonged shelf-life requirements, the need for maximizing cheese yields, and with the potential market for UHT products; there is an increasing need to establish strict raw milk specifications and monitor conformance to specifications. In this regard the following specifications are suggested:

1. Temperature Specifications and Control. Milk-receiving specifications of 45F or lower should be established and enforced. Milk should be cooled to 38F or

less when received at the processing plant.

2. Raw milk storage times need to be controlled. Research (5) has pointed out that peak proteolysis occurs during early log phase. Therefore, milk should be processed prior to microbial growth reaching the log phase. For this reason farm pickup should occur at a maximum of every other day, and milk should be processed within 24 hours after it has been received at the processing plant.

3. Raw milk specifications systems should also include effective farm monitoring programs. Effective sanitation of milk production facilities is required to control contaminants of microorganisms capable of producing lipolytic and proteolytic enzymes.

4. Microbial specifications for raw milk should be based upon a direct or indirect psychrotrophic bacteria count. In this regard Preliminary Incubation (P.I.) has become popular. The P.I. counts of less than 100,000 should be maintained.

5. Sensory evaluation of ingredients and stored dairy products must be conducted by trained personnel. Training of personnel must include instruction on mechanisms and causes of product defects.

In summary, it is important to realize that for the production of quality dairy products, controlling psychrotrophic contamination and growth is essential. It is also important to realize that the enzymatic activities of these organisms are responsible for the quality defects and that the enzymatic activity can occur without viable microorganisms.

- (1) Adams, P.M., J.T. Barach, and M.L. Speck, 1975. Heat Resistant Proteases in Milk by Psychrotrophic Bacteria of Dairy Origin. *J. Dairy Science*, 58(6):822-834.
- (2) Cousin, M.A., 1982. Presence and Activity of Psychrotrophic Microorganisms in Milk and Dairy Products: A Review. *J. Food Prot.*, 45(2):172-207.
- (3) Cousin, M.A. and E. H. Marth, 1977. Cottage Cheese and Yogurt Manufactured from Milk Precultured with Psychrotrophic Bacteria. *Cultured Dairy Prod. J.* 12(2):15-18,30.
- (4) Hicks, C.L., M. Allauddin, B.E. Langlois and J. O'Leary, 1982. Psychrotrophic Bacteria Reduce Cheese Yields. *J. Food Prot.* 45(4):331-334.
- (5) Juffs, H.S., A.C. Hayward, and H.W. Doelle, 1968. Growth and Proteinase Production in *Pseudomonas* spp. Cultivated Under Various Conditions of Temperature and Nutrition. *J. Dairy Res.*, 35:385-393.
- (6) White, C.H., and R.T. Marshall, 1973. Reduction of Shelf-Life of Dairy Products by Heat-Stable Protease from *Pseudomonas fluorescence*. p. 26. *J. Dairy Science*, 56(7):849-853.



N.M.C.

NATIONAL MASTITIS COUNCIL

Segregation and Culling Are Part of Mastitis Control

It is essential that cows with clinical mastitis be segregated from the milk herd, said Tom Fuhrmann, an Arizona veterinarian who recently joined the management team of United Dairymen of Arizona, a dairy cooperative headquartered in Tempe. He presented the information at the annual meeting of the National Mastitis Council.

He said that justification for a separate mastitis pen is based on three principles:

1. minimizing transfer of mastitis organisms from infected to uninfected cows.
2. optimizing observation and treatment of individual mastitic cows.
3. reducing the risk of antibiotic contamination of bulk tank milk.

"Cow segregation is mandatory in the face of a mycoplasma or severe staphylococcal infection," Fuhrmann said. "Mastitis cows always should be milked last and never mixed with fresh cows."

Culling chronic mastitic cows is a necessary part of a mastitis control program. Intelligent culling requires that a record system identifying cows with chronic mastitis be kept. Even the high producing cow may be marginally profitable when it can be determined that a significant volume of her milk is not salable because of mastitis therapy.

Culling cows with chronic mastitis will:

- remove a reservoir of contamination from the uninfected cows in the herd
- eliminate a marginally profitable cow whose productivity is permanently reduced due to development of irreparable scar tissue in the udder
- reduce management, labor and treatment costs

Fuhrmann summed up his presentation by saying that the herd health approach to mastitis control works by defining the components of a control program, then implementing that program through the efforts of the personnel working on the dairy. He emphasized the need to monitor and motivate the activities of dairy managers, herdsmen, milkers and other personnel in their dairy roles in carrying out the program of mastitis control.

"Very simply," said Fuhrmann, "mastitis is a disease of people that shows up in cows."

For information on mastitis or the National Mastitis Council, contact the National Mastitis Council, 1840 Wilson Blvd., Arlington, VA 22201.

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IRRADIATING FOODS

In a world of growing diverse methods of food processing, such as ultrapasteurizing, microwaving, and ultraviolet lighting, a new state of the art processing of foods is currently being developed: Irradiation, or using radiation sources to increase the shelf life of foods. The process itself does not involve the atomic nuclei of food molecules. Therefore, foods exposed to the radiation sources, at the level proposed, will become no more radioactive than a person would when passing through an airport x-ray machine.

It is estimated that there are currently 110 cobalt-60 gamma irradiation facilities throughout the world today. These plants are used primarily for medical product sterilization and vaccine production. Less than ten percent of these facilities are used for preserving food. Twenty-two countries today currently irradiate food for sprout inhibition, insect disinfestation, shelf life extension (radurization) by eliminating or reducing the number of pathogenic bacteria and sterilization (radappertization). In the United States, foods processed using radiation sources are for export only. The only exceptions are spices, which have been approved for irradiation at doses up to one megarad (10kGy-Kilogray) since July, 1983. This was in response to a petition submitted to the Food and Drug Administration in July 1980, by Radiation Technology, Inc. of Rockaway, NJ. Radiation technology is one of the leading pioneers in the processing of irradiated foods, as well as medical product sterilization and other cosmetic procedures such as glass colorations.

Worldwide, the maximum recommended safe dosage of gamma irradiation for all foods is 10kGy. This recommendation was adopted in 1979 by the Codex Alimentarius Commission from research done by a Joint Expert Committee on Food Irradiation composed of the International Atomic Energy Association, the United Nations, World Health Organization, and the Food and Agricultural Organization. However, the FDA has approved only the limited use of radiation to process foods, at this dosage, for the disinfection of microbes on spices.

On February 4, 1984, the Federal Register contained an updated proposal by the FDA allowing for the use of cobalt 60 and cesium 137 gamma radiation to irradiate fresh fruits and vegetables at doses not to exceed 100 kilorads (1KGy) to inhibit their growth and maturation and to disinfest these foods of insects. It is also proposing an increase in the current regulatory maximum dosage for spice irradiation from 10kGy to 30KGy.

If made into law, this would open the doors of a multi-million dollar food processing industry that has been bidding for its approval since 1958, when Congress interceded in President Eisenhower's "Atoms for Peace" program, referring to irradiation as an additive as opposed to a process or treatment of foods. As a result of this intercession, extensive animal studies had to be done to determine whether irradiated food produces any toxicological side effects before approval could be granted by FDA.

The greatest stumbling block in approving this procedure has been the unique radiolytic products (URP) or unique chemical changes in proteins and fats that occur as a result of exposing foods to radiation. Like standard heating, canning, and pasteurizing processes, irradiating foods causes certain chemical changes in foods. In irradiation, these chemical changes are due to gamma rays dislodging molecules in foods forming unstable free radicals that quickly restabilize themselves into radiolytic compounds (RP). The number of RPs produced is closely related to the amount of water in a particular food and the amount

of radiation dosage received. The greater the water content of a food, the greater number of hydroxy ions radicals formed which combine with other ions to form stable radiolytic products. Unlike standard heat processing, pasteurizing, etc., however, zapping foods with radiation also produces certain unique radiolytic products (URPs) or variants of proteins and fats that are not found in non-irradiated foods. It is these URPs that have scientists concerned.

A substantial amount of animal studies have been done by the U.S. Army Natick Program, FDA, and USDA, to determine what levels of radiation dosage would produce the least number of URPs that would not constitute any toxicological hazards. From these studies, FDA is currently proposing that a maximum dosage of not greater than 1kGy will require no further toxicological testing with regards to the effects of the URPs formed. Furthermore, spices irradiated at dosages up to 30kGy will also require no further toxicological studies because they compose only a fraction of the overall diet (.01%) and contain little or no water. Therefore, they produce fewer RPs and URPs than a food irradiated at just 1kGy that comprises a more substantial percentage of the diet and has a greater water content.

Nutritional deficiencies also occur in certain irradiated foods, as does standard heat and pasteurizing processes. If these deficiencies are substantial, FDA will require vitamin supplements added.

Organoleptic changes may occur in some food such as subtle taste, texture, and color changes. FDA considers these changes aesthetic and is not concerned, however, industry will have strong incentives to produce a product that has limited changes in order to not scare off potential customers.

Labeling of irradiated food products is a major debating issue brought out in the Federal Register. Currently, all irradiated food products, retail and wholesale, are required to be labeled "treated with ionizing or gamma or electron-irradiation." FDA is currently proposing changing the regulation so that labeling will be required on wholesale bulk foods alone, as the labeling on a retail level would limit the use of irradiation to those that have already been shown to be safe. Also, the labeling itself may scare away potential customers. An independent nationwide poll of 2,000 shoppers indicated that 98% would purchase a product with increased shelf life; however, only 50% would try pre-packaged irradiated meats, fish, and poultry. The poll found that it may be easier to sell fresh and irradiated produce than prepackaged meats, etc., as the latter involves an intellectual decision as opposed to a sensory decision and that labeling the product "irradiated" would affect the consumer's decision.

Currently, sterilized (radappertized) diets are being used by the shuttle astronauts, in hospital diets overseas, and on sailing voyages. These foods, if kept in air tight pouches, may be stored at room temperature indefinitely.

If the FDA does approve the widespread use of radiation for processing foods, the potentials are great. One quarter of the world's food supply that is currently lost to spoilage can be saved, thus reducing world hunger. Environmental benefits are the replacement of Ethylene Oxide and Thylene Dibromide for insect disinfestation. Economically, irradiation consumes approximately one-fifth of the energy required to heat foods and one-half of the energy to fumigate, for an overall energy savings of two thirds.

Patrick Brown in *The Bell Ringer*, Vol. II, No. 1. Environmental News Digest, Mar-Apr, 1985.

THE CASE FOR IRRADIATION

- Food irradiation is safe.
- Food irradiation can be an effective alternative to some chemical fumigants.
- Food irradiation keeps most food fresher longer.
- Food irradiation can make food safer by destroying microorganisms that can cause food poisoning and parasites that can cause disease.
- Food irradiation improves the export potential for many foods.
- Food irradiation can improve world food supplies by eliminating much of the waste caused by spoilage.
- For many applications, food irradiation is a better process at comparable cost.

Coalition for Food Irradiation
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Environmental News Digest, Mar-Apr, 1985

LEAD IN IMPORTED POTTERY

"Pretty to look at, but dangerous to use." So warns FDA regarding imported handmade ceramic products used to hold food. Recent tests by the agency's Seattle office revealed a lead hazard from some ceramic pottery from Mexico.

Pottery with lead glazes is suitable for ornamental purposes, but it poses a hazard when used for food preparation, storage or service, FDA says. In contact with food, especially acid foods such as fruit and vegetable juices, the lead from improperly fired glazes can dissolve into the food and be consumed.

Lead poisoning produces a wide range of confusing symptoms, including constipation, diarrhea, high blood pressure, low blood pressure, sleep disturbances, nausea, dizziness, muscle weakness, body pain, trembling and tiredness.

Children experience disorders typical of minimal brain dysfunction, such as restlessness, short attention span, impulsive behavior, and difficulties with visual-motor coordination.

The hazardous Mexican pottery tested in Seattle apparently was produced by native craftsmen using centuries-old, primitive techniques in homemade kilns. Such products typically are purchased at roadside stands and shops and at urban marketplaces

by tourists. They also are available from art fairs and import and gift shops in the United States. No reports of injury have been received.

Hazardous levels of lead were found in 1979 in some pottery imported from Italy. In one case reported to FDA a couple suffered debilitating symptoms and had extensive medical expenses for two years before their lead poisoning from the Italian pottery was properly diagnosed.

FDA advises consumers to examine their collections of mugs and dinnerware and any handmade or unusual pottery or other ceramic containers and to use for holding foods only those items they can be sure are free of lead. Lead-free products commonly have labels or stickers that say so. FDA Consumer, June, 1985.

There have been some changes in FDA's *Center for Veterinary Medicine*. The functions of the Office of Voluntary Compliance; the Office of Human Food Safety's functions have been transferred to the Office of Surveillance and Compliance; the Office of Human Food Safety's functions have been moved to the Office of New Animal Drug Evaluation (formerly the Office of Scientific Evaluation). The Office of Research has been renamed the Office of Science (FR March 12). FDA Consumer, June 1985.

There was clear evidence that *propylene oxide* causes cancer in mice and some evidence that it causes cancer in rats in a study conducted by the Department of Health and Human Services' National Toxicology Program. The volatile, colorless liquid is used in making polyurethane foams and in sterilizing a variety of materials, such as plastic medical instruments and foodstuffs (FR March 26). FDA Consumer, June 1985.

The Pharmaceutical Manufacturers Association has published a catalog, titled "Sources," that lists some 400 information materials produced by pharmaceutical companies on medicines and health that are available to the public. Single copies of the catalog can be obtained from the Pharmaceutical Manufacturers Association, 1100 Fifteenth Street, N.W., Washington, D.C. 20005; 202-835-3400. FDA Consumer, June 1985.

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

Nashville, Tennessee, August 4-8, 1985

Abstracts of most papers given at the 72nd Annual Meeting of the IAMFES appear on this and the following pages. The complete text of many of the papers will appear in future issues of the *Journal of Food Protection or Dairy and Food Sanitation*.

CONTRIBUTED PAPERS

The How and Why of Dairy Farm Inspections. Sidney E. Barnard and William H. Folwell, *Departments of Foods Science and Agricultural Communications*; and George M. Deer, *The Pennsylvania Department of Agriculture, The Pennsylvania State University, 8 Borland Laboratory, University Park, PA 16802*.

Five check ratings fell below 90 in northeastern states in 1983. This prompted dairy cooperatives to ask what could be done to help. After preparing a rough draft of a script of dairy farm inspection, field service directors were asked to review as there are variations in requirements among states. A Pennsylvania rating officer reviewed the script and spent 4 d taking pictures with us. The result is a 120-slide set with 15-min cassette tape and script. It will fit the need in any state where most farms are under the Interstate Milk Shippers Program. It was developed to show to farm youth and adults. Emphasis is on clean cows and facilities and following proper procedures. Because of its simplicity and brevity, it can be shown at local meeting of farmers by field staff or county Extension Agents. The list and description of 20-slide sets with cassette tapes will be available.

Control of Trichinosis by Low-Dose Irradiation of Pork. R. J. Brake, K. D. Murrell, E. E. Ray, J. D. Thomas, B. A. Muggenberg, J. S. Sivinski, *Los Alamos National Laboratory; U.S.D.A. Animal Parasitology Institute; New Mexico State University, Las Cruces, NM; Inhalation Toxicology Research Institute; and CH2M Hill*.

The underlying reason for concern about trichinosis is the absence of an inspection program to detect the presence of infective larvae in fresh pork in the United States, even though the prevalence rate of infected swine has markedly decreased over the past 30 years. Gamma

irradiation of *Trichinella spiralis* - infected pork with a dose of 15 to 30 krad renders the parasite sexually sterile and blocks maturation of ingested larvae in the host gut. Irradiation of freshly slaughtered (prerigor) hog carcasses indicate that larvae distributed throughout the skeletal muscles have essentially identical radiosensitivities. Neither the age of the encysted muscle larvae nor the oxygen tension in the meat significantly affected the radiosensitivity. Holding of meat after irradiation leads to little, if any, recovery of trichina viability. The data indicate that 30 krad cesium-137 gamma radiation can be delivered to split market weight hog carcasses with acceptable uniformity, and that such a dose can provide a substantial margin of safety for human consumption of heavily infected meat.

Microbiological and Sensory Tests of Beef Treated with Volatile Fatty Acids. M. Bell, R. T. Marshall and M. E. Anderson, *University of Missouri, Food Science & Nutrition, Columbia, MO 65211*.

Small cubes of the semimembranosus and adductor muscles of beef were inoculated with 2×10^8 CFU/cm² of *Salmonella typhimurium*, *Shigella sonnei*, *Yersinia enterocolitica*, *Escherichia coli*, *Pseudomonas aeruginosa* or *Streptococcus faecalis*. Exposure of the meat by dipping in 1.2% acetic acid for 10 s reduced average numbers of these bacteria recoverable by 65%. *E. coli* was the most resistant, losing 46% of its viable cells. It was possible to replace one-half the acetic acid with 0.046% formic acid without loss in effectiveness. Antimicrobial effects of the treatment increased at a decreasing rate with time. Color of the meat was slightly affected by dipping in 1.2% acetic acid, but color was unaffected ($P < .05$) by dipping for 10 s in a solution of 0.6% acetic and 0.046% formic acids. Hunter Color Difference meter readings failed to show differences in effects of dipping meat in distilled water, 0.6% and 1.2% acetic acid or 0.6% acetic and 0.046% formic acids. A triangle sensory test failed to show differences in flavor between baked

ground beef treated with 1.2% acetic acid or 0.6% acetic and 0.046% formic acids vs. untreated baked ground beef.

Rapid Test for Identification and Measurement of all Antibiotics in Milk. Stanley E. Charm, Mark Cleveland, and Kirsten Smith, *Penicillin Assays, Inc., 36 Franklin Street, Malden, MA 02148.*

Charm Test II can identify and measure residues of any antibiotic family allowed in milk (except bacitracin). The test for all drugs simultaneously requires about 15 min while for individual families from 8 to 12 min. The principle of the test is a microbial receptor sequential or competitive assay (U.S. Patent 4,239,852).

A Rapid Field Test for the Detection of Beta-Lactum (6 Minute), Chloramphenicol (8 Minute) and Sulfonamide (7 Minute) Residues in Milk. Stanley E. Charm, Richard Leary, Kirsten Smith, Mark Cleveland and Robert Salter, *Penicillin Assays, Inc., 36 Franklin Street, Malden, MA 02148.*

It has been possible to modify the Charm Test to permit testing in a milk tanker or at the farm and to extend the number of antibiotic families that can be identified and detected in milk. A test system fitting into a case 14" x 12" x 6" adapted to 12 volts so that it may be operated directly from the lighter in a tanker or automobile, is now available. The speed of the test is sufficiently rapid that drivers may test milk before pick up. The Field Test[®] differs from the standard Charm Test[®] in that it replaces the centrifuge and uses a smaller milk sample (1.5 ml instead of 5 ml).

Influence of Ground Beef Storage Conditions on the Bioluminometric Estimation of Microbial Populations. F. K. Cook, P. R. Knox, and M. D. Pierson, *Department of Food Science and Technology, Virginia Polytechnic Institute and State University, Blacksburg VA 24061.*

A bioluminometric method was used to determine microbial ATP in ground beef stored aerobically and anaerobically at 2 and 10°C. Filtration of sample homogenates followed by treatment with somatic ATP-releasing reagent and ATPase were used to remove interference by non-microbial ATP, and bioluminescence was measured after addition of bacterial extractant and luciferin/luciferase reagents. For all samples, correlations (r^2) of 0.94, 0.92 and 0.90 were obtained when microbial ATP values were compared with total aerobic plate counts, total anaerobic plate counts and *Lactobacillus* counts, respectively. Regression curve coefficients were

used to estimate microbial numbers per gram of meat, given the concentration of microbial ATP in each sample. Estimated aerobic counts were within ± 0.50 log unit of corresponding plate counts for 86% of the beef samples and within ± 0.75 log unit for 94% of the samples. Ground beef stored at 2 and 10°C had estimated counts within ± 0.50 log unit of plate counts for 78% and 94% of the samples, respectively. In general, estimated counts were more accurate for beef with 10^5 cfu/g, although close agreement was obtained with ground beef samples over the entire range of 10^4 to 10^9 cfu/g. Results indicate that the bioluminometric ATP assay can be used to accurately estimate microbial numbers in ground beef. Although a single standard curve may be used to estimate bacterial counts, better estimates may be obtained by using separate curves for each storage temperature.

The Hydrophobic Properties of *Clostridium Perfringens* Spores. S. E. Craven and L. C. Blankenship, Richard B. Russell, *Agricultural Research Center, USDA-ARS, PO Box 5677, Athens, GA.*

An investigation of the hydrophobic surface properties of *Clostridium perfringens* spores was prompted by evidence that suggests activation of germination occurs at a hydrophobic site and that the germination system may be located in the coat region of the spore. The hydrophobicity of spores in an aqueous suspension was determined by their affinity for the hydrophobic solvent toluene. Increasing portions of dormant spores, but not vegetative cells, were removed from the aqueous phase by increasing amounts of toluene. Spore coat preparations were much more hydrophobic than spores divested of their coats. The hydrophobic characteristics may be related to certain functions of the spore coat region.

Ratios of Calcium and Sodium to Other Nutrients in Dairy Products. B. J. Demott, *Department of Food Technology and Science, The University of Tennessee, PO Box 1071, Knoxville, TN 37901.*

Ratios of calcium to sodium in fluid milks are about 2.4; in low sodium milk, 50.5; and in Swiss cheese, 3.7. Low ratios are found in cottage cheese, 0.14; and imitation milk, 0.41. The Recommended Dietary Allowance ratio for males 23-50 years of age is 0.72 to 0.24. The mg Ca/g protein in fluid milks is about 36. High ratios are found in hard cheeses, about 25; and in orange sherbet, 48.21. Low ratios are found in cottage cheese, 4.8, and in dry curd cottage cheese, 1.85. The RDA ratio is 14.3. The mg Ca/kcal in fluid milks is about 2.6; about 2.0 in hard cheeses; less than 1.0 in cottage cheeses; and the RDA ratio is 0.30. The mg Na/g protein is about 15 in fluid milks. High ratios are found in American processed cheese food, 60.6, and in American process pas-

teurized cheese spread, 82.0. Cottage cheese has a ratio of 33, dry curd cottage cheese, 0.75 and the RDA ratio is 19 to 59. The mg Na/kcal is about 1.0 in fluid milks; 5.64 in lowfat cottage cheese; 0.15 in dry curd cottage cheese; 0.03 in low sodium milk and the RDA ratio is 0.41 to 1.22. The mg protein/kcal in fluid milk items is about 70; lowfat cottage cheese, 172; dry curd cottage cheese, 203; Yogurt made with added NFDM, 102; orange sherbet, 8.0; and the RDA ratio is 20.74. Experimental products containing less sodium have different ratios.

Bacteriophage Control of Beef Spoilage. G. Gordon Greer, *Agriculture Canada, Research Station, Lacombe, Alberta, Canada, TOC 1S0.*

The effects of bacteriophages upon the growth of spoilage pseudomonads and the retail case life of beef were evaluated. In an aqueous extract of homogenized beef muscle, bacteriophages produced a dose-dependent inhibition of bacterial growth for up to 4 d at 7°C. Homologous bacteriophages were also found to produce a 3-log reduction in bacterial numbers when applied to the surface of inoculated beef under conditions of retail display. Consequently, the onset of surface discoloration was delayed and the case-life of bacteriophage-treated beef was two-fold greater than that observed for samples inoculated with bacteria only. Beef retail case life was directly correlated with the concentration of added bacteriophage within the range of 10^4 to 10^8 p.f.u./ml and initial bacterial loads of 10^4 pseudomonads/cm² of steak surface. These findings suggest bacteriophages may provide a practical method for the biological control of meat spoilage.

Microbiological Quality of Bulk Versus Packaged Foods in Retail Markets. J. W. Hastings and L. B. Bulterman, *Department of Food Science and Technology, University of Nebraska-Lincoln, Lincoln, NE 68583.*

A microbiological survey was done on 20 foods available as pre-packaged and in bulk from a supermarket and a health food store. The foods were examined for total standard plate counts, coagulase (+) staphylococcal counts, coliform counts, yeast and mold counts, and aflatoxigenic mold counts. Bulk foods from the health food store consistently gave the lowest total bacterial counts by relative cumulative frequency (RCF) calculations at < 2500 per g of 80%, compared to pre-packaged (70%) and bulk (65%) foods from supermarkets. Supermarket bulk foods contained fewer coagulase (+) staphylococci than the other foods tested with an RCF at <100 per g of 85%, compared to only 75% for both the health food store bulk foods and the supermarket pre-packaged commodities. Health food bulk commodities also contained

the least total fungi with an RCF value at <500 per g of 85%, compared to those of both supermarket products (70%). Supermarket pre-packaged foods displayed the highest quality regarding total coliforms with an RCF at <25 per g of 95% in contrast to only 75% for bulk health foods and 60% for bulk supermarket foods. There were no real differences in the proportionate levels of aflatoxigenic molds found in the three food types tested.

Comparative Shelf-Life of Thawed Frozen Lobster Tails From Various Sources. John A. Koburger and Mary L. Miller, *Food Science and Human Nutrition Department, University of Florida, Gainesville, FL 32611.*

Thawed Florida and South African lobster tails were stored on ice and evaluated over a 12-d period for chemical, microbial and sensory changes. Soluble tyrosine levels, while increasing during storage, were of little predictive value as to the quality of the product. Aerobic plate counts increased rapidly and reached levels of 10^6 by the 6th day of storage. Sensory evaluations showed a marked decrease in acceptability of Florida tails following 5 d, whereas, acceptability of South African tails did not decline as rapidly. Strong ammoniacal odors and extensive black-spotting were the most obvious sensory changes occurring during storage.

A Survey for the Incidence of *Listeria Monocytogenes* in Raw Milk. Joseph Lovett, David W. Francis, Jan M. Hunt, and Ronald G. Crawford, *Division of Microbiology, Food and Drug Administration, Cincinnati, OH 45226.*

In a recent outbreak of listeriosis with a mortality rate of 30%, milk was the incriminated vehicle. To determine the incidence of *Listeria monocytogenes* in raw milk, farm-bulk-tank milk samples supplied by a milk marketing organization, which serves several hundred farms in Northern and Central Kentucky, Southwest Ohio and Southeast Indiana, were analyzed by the following procedure. Twenty-five milliliters of milk was incubated in 225-ml of enrichment broth (EB) composed of Trypticase soy broth supplemented with 0.6% yeast extract, 15 mg/l acriflavin HC1, 50 mg/l naladixic acid and 50 mg/l cycloheximide. After 24 and 48 h at 30°C, EB culture was streaked onto McBride agar. Additionally, 1 ml of EB culture was added to 9 ml of 0.5% KOH, vortexed briefly and streaked onto McBride agar. After 48 h at 35°C, suspect colonies were confirmed by morphology, staining reaction, biochemical reactions and serology, and were tested for pathogenicity in the infant mouse. Organisms confirmed as *L. monocytogenes* were isolated from 10% of the farm-bulk-tank milk samples analyzed. Serotypes 1, 4 and nontyping strains were found. Of the samples confirmed as *L. monocytogenes* by serology and

biochemical reaction, half were pathogenic for infant mice when inoculated at the level of 10^2 and observed for 7 d.

Influence of Sample Reconstitution on the Recovery of *Salmonellae* From Low-Moisture Dairy Foods. Paul L. Poelma, Clyde R. Wilson, and Wallace H. Andrews, *U.S. Food and Drug Administration, Division of Microbiology, HFF-234, 200 C St., S.W., Washington, DC 20204.*

Recovery of *Salmonella* spp. from dry whole milk, lactic casein, non-instantized nonfat dry milk, rennet casein and sodium caseinate was compared by rapid and slow methods of sample rehydration. For the rapid method, a 25-g sample was blended or swirled with 225 ml of the appropriate preenrichment medium. After 60 min, the flask contents were adjusted to a pH of 6.8 and incubated at 35°C. For the slow method, a 25-g sample was gently added to 225 ml of the appropriate preenrichment medium, allowed to soak undisturbed for 60 min at room temperature, and then incubated at 35°C. Equal or enhanced recovery of *Salmonella* spp. with the soak method, relative to the rapid methods of sample rehydration, was observed for all samples except sodium caseinate. Swirling was the optimal procedure for preparing samples of sodium caseinate. Examination of dry whole milk and non-instantized nonfat dry milk by the soak method should be limited to 25-g amounts, since analysis of 100-g and 375-g composites by this method resulted in incomplete wetting of the samples. Composites of lactic and rennet casein weighing up to 375 g, however, can be examined by the soak method without resulting in any loss of analytical sensitivity.

Effects of an Automatic Backflush System on Milk Iodine Levels. T. Wyatt Smith and Stephen B. Spencer, *University of California, Animal Science Extension, Davis, CA 95616 and The Pennsylvania State University, 8 Borland Laboratory, University Park, PA 16802.*

A study was conducted to determine the effects of an automatic iodine backflushing system on milk iodine levels. Milking machine clawpieces were divided into left and right halves with each having a milk outlet. The right side of the unit was backflushed while the left side served as the control. An iodide electrode was used to determine milk iodide levels in samples collected from the milk of each udder half. Analysis of iodine concentrations in milk samples collected after liners and milk transport hoses had been in use for 1000 cow milkings revealed a significant difference ($P < .01$) of iodine in milk from backflushed udder halves. Mean iodine levels were 243 μg of iodine per liter of milk from the control udder halves and 486 μg per liter from backflushed halves. When new

milk hoses and teatcup liners were placed in use, milk iodine concentrations were equal from control and backflushed halves for the first cow milked. Thereafter, iodine concentrations increased in milk from backflushed halves as compared to control halves. Results suggest this increase was due to absorption of iodine into the milk transport hoses and subsequent release in milk as it passed through the hoses.

Survival of Hepatitis A Virus (HAV) in Creme Filled Cookies. M. D. Sobsey, D. A. Wait and K. Werner, *School of Public Health, University of North Carolina, Chapel Hill, NC 27514.*

Hepatitis A continues to be one of the most important foodborne viral diseases. Although fecally contaminated bivalve molluscan shellfish are the most frequent food vehicles of hepatitis A, outbreaks due to consumption of fecally contaminated baked goods, such as whipped cream cake and glazed donuts have occurred. Because of concerns about fecal contamination of the creme filling of cookies caused by food handlers infected with hepatitis A, survival of HAV in creme-filled cookies was studied. The filling of creme sandwich and sugar wafer cookies was contaminated with about 3×10^5 infectious units of HAV. Replicate cookies were stored at 21, 35, and 49°C for 60 d, and they were periodically sampled, processed and assayed to determine surviving HAV as a function of time. After 3 d, HAV survival in both types of cookies averaged 34, 14, and 4.4% at 21, 35, and 49°C, respectively. After 60 d, HAV survival in both types of cookies averaged only 0.09, 0.085, and 0.0085% at 21, 35, and 49°C respectively. These results suggest that HAV will persist in contaminated cookies stored for short periods of a few days. However, little HAV will remain in contaminated cookies after long-term (e.g. 2 months) storage. Compared to other enteroviruses, HAV appears to be unusually resistant to high temperatures.

Ability to Sequester Transferrin-Iron as an Indicator of Virulence in *Vibrio Vulnificus*. G. N. Stelma, Jr., A. L. Reyes, and C. H. Johnson, *Division of Microbiology, Food and Drug Administration, Cincinnati, OH 45226.*

The capacity of virulent *Vibrio vulnificus* strains to sequester iron from highly saturated serum transferrin was evaluated for ability to assess virulence in vitro. Virulent and avirulent isolates were tested for production of phenolate siderophore, utilization of iron from saturated human transferrin, and ability to grow in normal rabbit serum. The virulent isolates were consistently positive in all three tests; however, some of them required induction of siderophore synthesis before they grew in the rabbit

serum. Some avirulent isolates were negative in all three tests, whereas others were positive in two or more. Avirulent isolates that were positive for transferrin-iron utilization are missing some other critical virulence factors. Our observations suggest that ability to sequester iron from highly saturated transferrin is necessary but not sufficient for virulence since that ability was also found in some avirulent strains. A reliable in vitro system will probably require testing for multiple virulence factors.

Toxicity of Molds Isolated from Moldy Surplus Commodity Cheeses. W. Y. J. Tsai and L. B. Bullerman, *Department of Food Science & Technology, University of Nebraska-Lincoln, Lincoln, NE 68583.*

Samples of moldy processed American cheese, Cheddar cheese, cream cheese substitute, and mixed moldy trimmings were obtained from surplus commodity food distribution programs in Nebraska and examined for molds and mycotoxins. Molds were isolated as pure cultures, identified and tested for the ability to produce several known mycotoxins. The only genus found in all of the moldy cheese samples was *Penicillium*. Specific species included *P. roqueforti*, *P. cyclopium*, *P. viridicatum*, and *P. crustosum*. These were the major species isolated. A total of 260 isolates were screened for mycotoxin production, using potato dextrose agar (PDA) and rice powder-corn steep agar. Mycotoxin production was further confirmed and quantified with potato dextrose broth (PDB) and yeast-extract sucrose (YES) broth. Less than 10% of the mold isolates produced a known mycotoxin in laboratory media. Patulin was the main mycotoxin found, with penicillic acid and ochratoxin occurring only occasionally. Patulin has been reported to be unstable in cheese stored at 5 and 25°C for various periods. Thus the potential hazards associated with the mold growth on these surplus cheeses would appear to be slight. Acute toxicity and mutagenicity tests of extracts of the mold isolates grown on cheese will also be reported. The chicken embryo test was used for acute toxicity testing, and the Ames test was used to study mutagenicity.

Estimation of the Total Number of Aerobic Bacteria in Ice Cream. J. Zindulis, N. Tsang, and S. Semuta, *Bactomatic, Inc., P.O. Box 3103, Princeton, NJ 08540.*

Total bacterial plate counts in ice cream provide an index of quality for this product, but they are laborious and require 2 d before results are available. A simple automated impedance test for ice cream was devised to provide information similar to that obtained by the Standard Plate Count, but within a single working day. In development of the method, the mesophilic count in ice

cream was found to reflect the total count. The correlation between the log of the mesophilic count (24 h, 37°C) and the log of the total count (48 h, 32°C) was 0.93 ($n = 33$). For the impedimetric method, 10 g of ice cream was diluted 1:10 in a diluent (0.1% peptone and 0.1% sodium chloride), and the capacitance component of impedance was monitored at 35°C. No bacteriological medium was necessary. Samples with a range in cell number from 10^0 to 10^8 CFU/g were tested impedimetrically and compared with a 48-h agar plate count at 32°C ($r = 0.92$, $n = 87$). Ice cream samples with greater than 10^4 CFU/g were identified within 5.2 h. Neither flavor differences (chocolate, strawberry, vanilla) nor manufacturer's brand (5 tested) affected results. The impedance test provided a simple and fast alternative to conventional methods for estimation of the total bacterial count in ice cream.

INVITED PAPERS

Raising Fluid Milk Composition Standards. John B. Adams, *National Milk Producers Federation, Arlington, VA.*

Interest in raising fluid milk standards has not abated. Among producer group and organizations, there is a growing recognition that a greater degree of uniformity must be achieved in interstate commerce for composition of milk solids in fluid milk products. Current Federal standards of identity have failed to provide such uniformity. A petition has been filed with FDA by NMPF to amend current fluid milk standards to bring about a new structure for fluid milk standards which would provide for a uniform level of total milk solids in all fluid milk products.

William W. Coleman, *Minnesota Department of Agriculture, 90 W. Plato Blvd., St. Paul, MN 55107.*

There are a number of concerns to be addressed with the issue of raising fluid milk standards. They involve industry as well as state and federal governmental agencies. The major question seems to be if the current standard is too low, what should it be and how do we adjust it? This involves a number of issues: 1. FDA's interest in changing the current standards. 2. What is being done to determine current composition of fluid milks? 3. Are current standards being enforced? 4. Will increasing the solids standard really reduce surpluses? 5. Component pricing as part of the Milk Marketing Administration Orders. 6. State versus Federal in the establishment of standards.

William C. Tinklepaugh, *Milk Industry Foundation/International Association of Ice Cream Mfgs.*, 888 16th St NW, Washington, DC 20006.

1. Consumers would pay higher prices - Adoption of higher standards would increase ingredient costs and raise the price of milk by: whole milk, 4-5 cents per gallon; lowfat milk, 13-17 cents per gallon; nonfat milk, 6-8 cents per gallon. 2. Milk consumption would fall substantially - beverage milk consumption would probably decrease by about 1-1/2% annually or about 800 million pounds a year. 3. Nutritional improvement negligible - a comparison of the nutrient profile of milks now available with those that would result from new standards shows no nutritionally significant gain. 4. Cow's milk could not be sold as "milk" - most of the milk produced by the nation's dairy herds could not be marketed to consumers as milk without the addition of more solids under the proposed changes. 5. Higher standards would not solve surplus problem - reduced consumption of milk could very well increase the existing milk surplus. Present surplus stocks of nonfat dry milk could not be used for fortification since they do not meet current Grade A standards for this purpose. 6. States adopting higher standards by state law subject to legal challenge - The courts could be faced with the question of whether a state's effective prohibition of the sale of milk complying with the federal standards but below the higher state standard would constitute an unconstitutional burden on interstate commerce. 7. California standards not the answer - California's beverage milk sales are not the highest in the country. Twelve markets, accounting for 26% of fluid milk sales in federal order areas exceed the per capita sales level of California.

E. T. McGarahan, *Office of Nutrition and Food Sciences, CFSAN, FDA, 200 C Street SW, Washington, DC 20204.*

The U.S. Food and Drug Administration proposed and finalized standards for milk, lowfat milk and skim milk on December 5, 1974. Since that time, on several occasions, interest has been shown by Federal and State legislatures as well as by some members of the dairy industry to amend the minimum milk solids-not-fat content by increasing the established minimum levels. On several occasions FDA has been asked by members of Congress to comment on such a proposal and has responded negatively. Currently FDA is objectively reviewing a petition submitted by the National Milk Producers Federation that would increase the minimum levels of milk solids-not-fat.

The 3-A Story. Henry V. Atherton, *University of Vermont, Burlington, VT 05405.*

The 3-A Sanitary Standards Program is a cooperative voluntary effort to develop and use recommended standards in designing dairy equipment so that the cleanability of this equipment will be assured. Standards are formulated and accepted by the manufacturers and users of this equipment and by the regulatory agencies responsible for the sanitary quality and safety of all dairy foods. The 3-A concept was conceived in the 1920s as a desirable way to overcome regional and personal differences in the design of dairy equipment by developing uniform sanitary criteria which would be acceptable to the three critical groups affected by these standards. Momentum for such a program increased greatly after World War II. Today, the 3-A Sanitary Standards are widely accepted as the best possible and most current recommendations available to the modern dairy industry. Foreign dairy equipment manufacturers as well as equipment manufacturers and processors in related food industries here and abroad are showing increasing interest in adapting the 3-A Sanitary Standards concept to their specific operations.

Rancid Flavors of Milk - Causes and Prevention. Sidney E. Barnard, *The Pennsylvania State University, 8 Borland Laboratory, University Park, PA 16802.*

Rancid flavor has become the most common and most objectionable flavor of whole milk during the last 10 years. It is without doubt a primary reason for declining consumption and the shift to lowfat milk. Monthly tasting of load and farm samples is necessary to identify and correct the problems. Once correction is achieved, the program must be continued or rancidity returns in pasteurized regular milk. This soapy, bitter, sour-like taste starts in raw milk and intensifies until milk is heat-treated to destroy most of the lipase enzyme. The origin is usually a few farms in a supply. Correction can be achieved as the panel will outline. Holding raw milk 48 h or more after collection from farms virtually assures rancidity. Acid Degree Values are used to substantiate our tasting. Values above 1.0 indicate action is needed on loads or individual farm samples.

Eugene T. Wolff, *Cornell University, Department of Food Science, 10 Stocking Hall, Ithaca, NY 14853.*

The incidence of rancid flavors in milk has increased in recent years. This is in part due to abuses introduced by some milk handling practices. Excessive agitation and foaming of raw milk is a primary cause of the increase in rancid flavors. The following are some additional causes: 1. Temperature activation. 2. Stage of lactation. 3. High psychrotrophic bacteria counts a. in the raw milk, b. post-pasteurization contamination. Each of these causes will be covered with a discussion of the means of lowering or maintaining acceptable rancidity values in a market milk supply.

Jim Reeder, MD and VA Milk Producers Assn, Inc., P.O. Box 9154, Rosslyn Station, Arlington, VA 22209.

The quality of our Fluid and Manufactured Dairy Products starts at the farm. Most quality defects that are present in milk at the farm cannot be removed by subsequent processing. Many rancid milk problems can be traced to situations which exist on the farm. As you are aware, rancidity, can be quantitated by an objective chemical measurement called the Acid Degree Value. ADV testing has been a part of our quality assurance program since 1974. One of the criteria of our quality premium program is an ADV of 1.0 or less. A case history will be presented showing that success can be achieved by utilizing the cooperative field service, along with help from other persons within the industry, such as equipment representatives and extension personnel.

William B. Hastings, *Inter-State Milk Producers Cooperative, 1225 Industrial Hwy, P.O. Box 127, Southampton, PA 18966.*

Raw milk rancidity has been a continuous problem in our system. According to Penn State University Extension Service personnel, who are continuously checking store samples of milk throughout our State for flavor, temperature, bacterial and fat tests, their findings show a rapid increase in flavor problems from rancidity in the last several years. Our field staff has worked on problem areas and our findings show the following items as causes of rancidity on dairy farms: 1. pipeline risers and long milk hoses, 2. pipeline air leaks, worn gaskets, loose couplings, 3. milk pump shaft seals worn, 4. milk pump running starved, 5. milker claw air bleeds too large, 6. slugging of milk in pipeline, due to too many units on one slope, 7. inflation slippage, insufficient vacuum and malfunctioning of vacuum regulator, 8. tygon hose transfer station, float ball not sealing due to poor conditions - outlet nipple having been damaged, 9. sputniks, excess air used to empty container into the bulk tank, 10. bulk tank - excessive agitation, 11. bulk tank - flow of milk not down sides to eliminate splash, 12. cows milked too long, especially during base making period. When our staff found problems in any area above and had it corrected, the soapy-bitter flavor was reduced and most all cases had an A.D.V. below .8. Our success stories, show what can be done. It takes commitment, action and time. Our pride and desire to provide consumers with good quality and flavor are reasons for correcting rancidity problems. When you are aware of such a problem at the farm level, take the necessary action. It will pay off in increased milk consumption, even though you may not see these results.

Screening Loads of Milk for Quality. Franklin R. Ballet, *Dairylea Cooperative, 831 James Street, Syracuse, NY 13203.*

Loads of milk have been screened for quality for many years. It used to be only a smell and temperature check at the manhole, just like in the days of 10 gallon cans. Then the acidity tester and examination of a smear of milk under the microscope were added. Now milk should be tasted and a sample taken for fat, cryoscope, antibiotics and flavor checking in the laboratory. Using results of all of these tests permit you to make a judgement as to whether to accept or reject a load. When done daily as recommended, you have a check on all incoming raw milk. This leads to better quality milk and dairy products for consumers.

John J. Althaus, *Milk Marketing Inc., 8257 Dow Circle, Strongsville, OH 44136.*

It is of highest priority that each plant receiving direct ship raw milk follow a daily program of monitoring the quality of raw milk receipts. A program of screening is not complete until *prompt* notification of field service of loads or producers not meeting quality screening requirements. Immediate follow-up by field service is the key to reducing problems. Milk at farm level must be resampled same day or by next morning for microscopic examination before permitting scheduled pick-up. The key to a successful screening program is being able to obtain a representative sample which will add credibility to results obtained. Two reliable methods are the agitated plant load sample or driver last stop sample. Provisions should be made to provide for more stringent requirements when necessary. The following are some of the minimum requirements which must be included in a successful screening program: (1) visual inspection at tank manhole, (2) smell for off odors, (3) milk temperature below 40°, (4) microscopic examination, (5) check for inhibitors and antibiotics, (6) cryoscope freezing point.

William A. Brown, *Florida Department of Agriculture and Consumer Services, Division of Dairy Industry, 3125 Conner Blvd., Tallahassee, FL 32301.*

During the late summer and fall months of each year, Florida becomes a deficit State in production of milk. To meet the demands of the market, it becomes necessary to import raw milk from points outside the jurisdiction of the Florida Department of Agriculture and Consumer Services. To assure the citizens of Florida a quality supply of milk, the Department has set up laboratories at the State line to test all incoming milk to see that the product meets the minimum requirements of the Grade "A" Pasteurized Milk Ordinance.

Ray Koeppel, *Heritage Farms Dairy, 1100 New Salem Highway, Murfreesboro, TN 37130.*

The basic criteria established for screening raw milk at Heritage Farms are intended to insure receipt of the highest quality raw milk by the most efficient and thorough means. To achieve that goal, every load of raw milk is measured against standards for temperature, acidity, presence of antibiotic, added water, bacteria count, appearance and odor. This analysis is completed in 20-30 minutes.

Problems Associated with Applying Sewage Sludge to Cropland. Robert Bastian, *U.S. Environmental Protection Agency, Office of Municipal Pollution Control (WH-595), 401 M St. SW, Washington, DC 20450.*

In an effort to help fulfill the country's commitment to reducing water pollution, many communities have either built new municipal wastewater treatment plants or upgraded previously existing treatment facilities. The production of an increasing volume of sewage sludge is a direct result of the success achieved by these facilities in reducing the amounts of organic matter and nutrients discharged into our Nation's waterways. An increasing interest in recycling sewage sludge by applying it to cropland as a soil amendment and source of organic fertilizer has occurred as many of the traditional methods of sludge disposal have become environmentally constrained or politically unacceptable, or simply too expensive for many communities to afford. At the same time more and more farmers are showing an interest in using sewage sludge as a means of decreasing fertilizer costs and improving the soil, while maintaining high yields. However, as with all sludge management practices, there are potential problems that must be considered when applying sewage sludge to cropland. A number of these potential problems will be described along with some of the steps being taken by various State and Federal agencies to help assure that proper land application procedures are followed, while at the same time encouraging such beneficial uses of this residual of our municipal water pollution control facilities.

AFDO/FDA Model Food Salvage Code - An Approach to the Problem. Irving Bell, *Division of Consumer Health Protection, Kentucky Department for Health Services, 275 East Main Street, Frankfort, KY 40621.*

There are some 1,000 food salvage operations in the United States selling food that other wholesalers and retailers won't. Investigations by the General Accounting Office in 1974 and 1978 revealed potentially unfit food being sold by such outlets, mislabeling and improper labeling, ineffective reconditioning methods, and insanitary storage conditions. Many of the same conditions exist today. The AFDO/FDA Model Food Salvage Code provides an approach to the problem. The requirements of the code and how it can be used will be reviewed.

A New and Better Service - Computerized Regulatory Records. William W. Coleman, *Minnesota Department of Agriculture, 90 West Plato Blvd., St. Paul, MN 55107.*

There have always been differences and misunderstandings between regulatory agencies and industry. Many of these stem from the information on official records and other information relating to scheduling, licensing, inspections, and enforcement. While a computer will not solve all these concerns, there are a number of new benefits and services such a regulatory system can offer the dairy industry: 1. The complete official producer history for as much as 2 years. 2. The exact location of all facilities. 3. An accurate flagging of any items found in violation and the action that was taken. 4. Establishment of inspection work loads and due dates. 5. Information needed for federal or state marketing order. 6. Information needed for F.D.A. and U.S.D.A. compliance. 7. Bulk hauler ratings and areas of concern. 8. An accurate check for annual billings. 9. Mailing lists; both specific and general. 10. Summary data of yearly services provided. As regulatory agencies computerize, it will mean better and more accurate records, a saving in time and effort, and closer ties with industry. This should improve understanding and lead to more uniform enforcement.

Environmental Health Data Processing - It Works. Dudley J. Conner, Anita Travis, *Department for Health Services, Division of Consumer Health Protection, 275 E. Main Street, Frankfort, KY 40621.*

In 1978, the Food and Sanitation Branch of the Kentucky Department for Health Services implemented the Sanitation Program Information Formulator (SPIF) System, which was developed by the Food and Drug Administration. As a result of experience with the SPIF System, an environmental health management information system has been developed and implemented for all environmental programs. This system provides site-specific information for local units and aggregate data for state office use on a statewide basis. Reports for management and for individual environmentalists are generated, which facilitates program planning and evaluation in all environmental health areas of responsibility.

The Challenge of '86 Lowering Somatic Cell Counts to Below One Million. William L. Crist and Robert J. Harmon, *University of Kentucky, Animal Science Department, Lexington, KY 40546.*

On July 1, 1986 the actionable level for somatic cell (leucocyte) count (SCC) will be lowered from 1.5 million to 1 million. For many dairymen, this reduction in somatic cell count standards will pose no problem, for others

it will be a real threat. A survey of grade A milk sanitation personnel in each state was conducted in October 1984. The 40 responding states had an average estimated bulk tank SCC of 600,000 and average 122 herd samples with SCC 51×10^6 (highest having 1152). Four states reported estimates of over 500 herds and 13 states reported over 100 herds with samples having SCC over 1×10^6 . Dairymen having high SCC herds need to improve their mastitis control procedures and should evaluate their present mastitis control program to determine where improvement can be made. Six months to 1 year may be required to lower bulk tank SCC after implementing improved mastitis control procedures. Information is available through the National Mastitis Council and the Cooperative Extension Service as well as other sources to assist in evaluating a dairyman's mastitis control program.

Public Health Aspects of Low Dose Irradiation for Meats and Poultry Products. Ronald Engel, *U.S. Department of Agriculture, Food Safety & Inspection Service, 300 12th Street, SW, Room 402-Annex, Washington, DC 20250.*

As part of its responsibility for ensuring that meat and poultry products are safe and wholesome, the Food Safety and Inspection Service (FSIS) is currently considering the implications of food irradiation for meat and poultry production. The process uses ionizing radiation at various dose levels to disinfect and preserve foods by destroying pathogens and disrupting organic processes that lead to food decay, premature spoilage, and waste, thereby prolonging shelflife. Commercial irradiation in the United States is limited to only a few agricultural products, but numerous research studies have demonstrated the relative safety and efficacy of irradiation, and 28 countries now permit use of food irradiation at doses up to 1000 Krad. Public health implications for irradiation (<1000 Krad) in the meat industry include: 1) reduction of foodborne *Salmonella*, which would reduce the frequency of salmonellosis; 2) irradiation of pork to control trichinosis and toxoplasmosis; 3) reduction of parasites such as tapeworm in beef, and 4) reduction of nitrite used in processed meat products for protection against botulism. Irradiation cannot be considered a panacea, but its potential for enhancing public health protection may well bring it to the forefront of discussion and regulatory policy in the near future.

Bulk Merchandising of Food. Tom Gable, *National Sanitation Foundation, PO Box 1468, Ann Arbor, MI 48106.*

Bulk food marketing - the return of an old concept! Providing customers with food products from bulk is

growing in popularity among customers and marketers. Viewed as possessing a nostalgic appeal, it affords flexibility in selecting the quantity of food and is perceived to be lower in cost. Despite these advantages, the regulatory sector is concerned about the potential contamination by the customer. He has direct contact with the food and in fact, is a party to the packaging process. Unlike protection afforded by commercial packaging, bulk food offers the potential for person-to-person transfer of contaminants. In some instances, there may be even greater hazard of contamination, as many bulk foods are not washed, peeled, shelled, or processed by the consumer. The three basic public health concerns for bulk food merchandising are: spread of communicable disease; contamination of food (intentional and unintentional); and foodborne illness. These hazards can be addressed through prohibition of self-service of potentially hazardous foods; proper food protection practices; and equipment design. NSF can effectively address equipment design and construction where its credibility and effectiveness are established.

A National Food Protection Examination. R. B. Gravano, *Institute of Food Science, Stocking Hall, Cornell University, Ithaca, NY.*

During the Second National Conference for Food Protection, several white papers addressed the education and training of consumers, professionals and non-professionals, in the food industry and regulatory agency inspectors and sanitarians. One subject that generated a great deal of interest was Food Service Manager Training/Certification programs. The Educational Testing Service (ETS) of Princeton, New Jersey, is currently developing a National Food Protection Certification Examination for foodservice managers. With the assistance of educators, state and federal regulatory officials, and industry representatives, ETS is writing a 60-question multiple-choice examination. The test will seek to determine an individual's knowledge of food storage and preservation, handling, preparation, and sanitation.

James L. Brown, Director, *Technical Services and Public Health & Safety, National Restaurant Association.*

Foodservice inspection programs have traditionally focused on a fixed number of inspections per year. However, the number may vary depending on the sanitation level of a specific foodservice establishment. In an attempt to overcome food protection problems which may arise during daily operation, training programs and tests have been developed in many areas to provide the foodservice manager with information needed to protect the consuming public. Foodservice is safer today than at any time in history, largely because of the cooperative effort

of the industry and local health officers to meet local code requirements. Local health officers are best informed of the problems and health needs of the community. Therefore, NRA believes training programs and tests should be administered at the local level. The Food and Drug Administration's Retail Food Protection Branch has initiated the development of a national test for food managers. The test will be funded and administered by the Center for Occupational and Professional Assessment (COPA) of the Educational Testing Service (ETS), Princeton, New Jersey. The National Restaurant Association has objected to the FDA's plans to certify foodservice managers on the basis of this national test. The proposed test has disadvantages which may outweigh its advantages. (1) The test is a challenge type test, which may be taken without prior training. (2) Training programs where provided, may require modification to fit the needs of the test rather than the known needs of the local jurisdiction. (3) The test will be given at selected sites on a periodic basis, requiring operators to travel to the site(s) on dates specified at cost to the individual or operation. It has not been demonstrated that development of a national food manager's test is necessary. Will the development of the national test increase the level of food protection and sanitation to the public? Will the program be cost-effective to either the agencies involved or the industry? Until such time as these and similar questions can be answered in the affirmative, the National Restaurant Association believes that development of the national test should be terminated and the issue of training programs and tests should continue to be managed at the local level.

C. J. Terek, *Educational Testing Service, 307 College Road East, Princeton, NJ 08541.*

The Food Protection certification program is designed to certify persons in food preparation, serving and dispensing establishments who have ongoing on-site responsibility for protecting the consumer from foodborne illness. Certification candidates are required to demonstrate job-related knowledge through performance on a multiple-choice test. Test content, which was identified by committees of regulators, educators, trainers and various food industry trade association representatives, is appropriate regardless of type of training or size and location of jurisdiction. The test is administered monthly at major test sites and on demand at DANTE military sites. The test fee, which is paid by the candidate or his/her sponsor, covers administration scoring and reporting of results. Those passing the test receive a certificate and their name is listed in a National Registry kept by Educational Testing Service. Failing candidates receive a score report with diagnostics indicating areas of strength and weakness.

W. Joel Simpson, *Dobbs International Services, 5100 Poplar Avenue, Memphis, TN 38137.*

Proponents of the National Certification Examination say that it will improve food protection and decrease cost of training. Opposing views hold that it will not achieve its stated intentions but will prove detrimental to a cooperative approach to the advancement of food protection. This paper will examine the issue of the national test, briefly touching on views of such antagonists as FDA, NRA and ETS. One company's attitude toward the merits of this test - or the lack thereof - will be presented, with emphasis on a cost-benefit approach.

J. Carroll Sellers, *U.S. Food and Drug Administration, 297 Plus Park Blvd., Nashville, TN 37217.*

This program, initiated by FDA in response to requests from state and local regulatory agencies, will be funded and administered by the Educational Testing Service, Princeton, N.J. It will be a nationally standardized job-related test for retail food industry managers covering knowledge of critical tasks related to food protection and sanitation. We in FDA support the test because we believe it will improve the focus and effectiveness of food sanitation training programs nationally; it may reduce regulatory costs; and will not significantly increase industry costs. FDA is not federally mandating the test and has no plans to do so. It is intended for managers and not for entry-level employees and will not preempt training and testing done by state and local officials.

HACCP For Food Service. John Guzewich, *Food Protection Section, New York State Department of Health, Room 421, Tower Building, Empire State Plaza, Albany, NY 12237.*

A review of foodborne disease outbreak data compiled by the Centers for Disease Control since 1966, and by New York State's Foodborne Disease Surveillance Program since 1980, has shown little change in important features: 1) the same agents predominate, *Salmonella*, *Staphylococcus aureus* and *Clostridium perfringens*, 2) the same major vehicles continue to transmit the agents: roast beef, ham and turkey, 3) food service establishments are the most commonly reported public place of mishandling, and 4) (a) improper cooling, (b) lapse of a day or more between preparation and serving, (c) improper hot storage, (d) infected food handler, (e) inadequate reheating are the contributing factors most commonly reported in foodborne outbreaks. The repetitive nature of these data suggest that current foodservice regulatory programs are not having sufficient impact on controlling these factors. The hazard analysis critical control point approach provides a system to focus on controlling the foodborne disease features identified by disease surveillance. HACCP in food service begins with a risk assessment to identify high-risk establishments. Preparation of high risk potentially hazardous foods in these estab-

lishments is then observed and evaluated to identify opportunities for bacterial contamination and/or survival and/or growth. Critical control points are identified. Monitoring points to prevent contamination, survival and growth are established, tailored to that foodservice establishment. Subsequent regulatory inspections focus on effectiveness of the establishments monitoring of their critical control points. Routine foodservice establishment inspections focus on the HACCP principals and control points.

Current Status of Tamper Evident Packaging For Foods. J. H. Hotchkiss and R. B. Gravini, *Institute of Food Science, Stocking Hall, Cornell University, Ithaca, NY 14853.*

Five in-store surveys were conducted to quantify, on a product-by-product basis, the type of packaging currently used for foods, and to assign a relative rating on the degree of protection against tampering afforded to each product by its package. Food product categories were also ranked according to their overall susceptibility to tampering. The survey results indicated that: 1. if current FDA regulations for the tamper evident protection of OTC drugs were extended to packaged foods only a very small fraction of products on the market today would meet those requirements, 2. more than one-half of current food packages could meet the FDA regulations for OTC drugs by the addition of a label statement; for the remaining products substantial changes in packaging would be necessary, 3. the following products can be opened and reclosed without detection and are most vulnerable to food product tampering: fruit juices and drinks, dairy spread, other dairy products, condiments/dressings, flavorings, preserved fruits and vegetables, sugars and preserves, Oriental foods, gourmet foods.

Nonprotein Nitrogen (NPN) Factors Influencing and Implications to the Dairy Industry. V. S. Packard, *Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Ave., St. Paul, MN 55108.*

Nonprotein nitrogen (NPN) consists of a variety of nitrogen-containing compounds found in milk. Level of NPN in milk varies both seasonally and by regions, mainly due to differences in feeding practices. NPN is measured in the Kjeldahl analysis of milk protein. In turn, the Kjeldahl analysis is used as the reference procedure for calibrating and adjusting protein readings in infrared testing devices. For this reason, variations in NPN content become a source of variability in infrared analysis of both protein and solids-not-fat. Presence and variation in content of NPN in milk has implications, therefore, in analytical accuracy as related to milk purchase and dairy cow breeding programs, and also in calculations used to estimate yield of cheese.

Computerization of Dairy Regulatory Records. Kirmon C. Smith, *Texas Department of Health, Division of Milk and Dairy Products, 1100 West 49th Street, Austin, TX 78756.*

Raw milk laboratory results are entered into data systems programs which categorize, analyze, and perform evaluative functions for determining enforcement actions. This basic system provides a direct mailing to each dairy notifying it of laboratory results. This data are also categorized with previous laboratory analysis of each procedure so that the analytical and evaluative function can be performed. Formats are developed for inputting dairy farm inspections, milk plant inspections, water supply tests, and milk sediment testing. Besides providing a complete "picture" of each producer and/or plant milk analysis and physical inspection results, these programs provide spontaneous results for answering special inquiries or constructing reports of assorted data necessary to complete the routine monthly reports and, most importantly, to comply with departmental regulations and the Pasteurized Milk Ordinance.

Foodborne Viruses. Mark D. Sobsey, *Department of Environmental Sciences and Engineering, School of Public Health, University of North Carolina, Chapel Hill, NC 27514.*

The role of viruses in foodborne illness is reviewed and current issues and developments are highlighted. The importance of certain enteric viruses, such as hepatitis A virus (HAV), Norwalk virus and other small, round gastroenteritis viruses is documented by reviewing foodborne outbreaks of viral disease in the United States. Sources and mechanisms of foodborne viral contamination are considered, and the food categories most likely to serve as vehicles of viruses are discussed. The important role of bivalve molluscan shellfish as the major vehicles of foodborne viruses is examined, and recent information on detection and persistence of HAV and other enteric viruses in bivalve mollusks is presented. Finally, strategies for better control of foodborne virus contamination are presented.

The Regulatory Position on Irradiation of Foods: Labeling, Control and Public Health Considerations. Clyde Takeguchi, *FDA, Washington, DC.*

In 1980, the Food and Drug Administration announced the availability of the report of the Bureau of Foods Irradiated Foods Committee. This report subsequently led to the publication of an Advance Notice of Proposed Rulemaking which described a course of action for regulating the use of radiation for treatment of food. The advance notice has been followed by the publication of a proposal and the issuance of separate regulations in response to petitions. The current status of the agency's actions concerning radiation of food will be discussed.

Modern Microbiological Procedures for Dairy Products. Sita Tatini, *University of Minnesota, St. Paul, MN.*

Significant progress has been made within the past 5 years in the areas of development of rapid and/or automated methods for monitoring microbes in milk and dairy products. These methods include direct microscopic counting of epifluorescent colonies of microbes (DEFT), which takes only 25 min for obtaining the results with a detection limit of 1×10^3 bacteria/ml, measurement of electrical impedance within 4-8 h for estimating standard plate count (SPC) or psychrotrophic bacteria count (PBC) within 24 h, both counts of 1×10^5 /ml. Though instrumentation is expensive, since large number of samples (1000/day) can be analyzed, cost per test may be reasonable. Estimation of gram - negative bacterial ATP (via enzymatic assay) generated under selective growth conditions, is another approach that yields rapid results that may be useful in detection of low level post pasteurization contamination and possible estimation of keeping quality of refrigerated fluid milk within 24 h. Microbial growth products (pyruvate, thermonuclease) that can be measured rapidly (1-4 h) may be useful in estimating SPC and thus hygienic quality or potential presence of staphylococcal enterotoxins in dairy products. Bioprobes that detect specific pathogens as salmonellae via DNA-DNA hybridization or binding of specific antibodies to toxins of *Staphylococcus aureus*, which are being developed, would save considerable time in obtaining results. Gas chromatographic profiles of volatile compounds in milk may provide a rapid detection tool to predict shelf life or sell-by-date for milk on the day of processing.

Mistakes by the Food Industry Can Be Expensive.

Ewen C. D. Todd, *Bureau of Microbial Hazards, Food, Directorate, Health Protection Branch, Health and Welfare Canada, Banting Research Centre Tunney's Pasture, Ottawa, Ontario K1A 0L2.*

Direct costs relating to 17 foodborne outbreaks and 3 non-illness related recalls where 12 different types of processed foods, e.g., milk, cheese, canned meat and fish had been mishandled amounted to over \$578 million (in 1983 values) with individual problem costs ranging from \$83,000 to \$165 million and a median average cost per case of \$34,362. Some indirect costs were also determined; these included the value of pain, grief, suffering and death and of loss of housepersons' productivity and leisure time. The economic impact of a processed food problem is greater than for a foodservice one, though the latter occurs more frequently. The costs associated with foods that have resulted in more severe types of illnesses, such as botulism or typhoid, invariably are high, not only

because of medical expenses but also because health control agencies perceive that risks for the population are high and public recalls must be made. Often this type of problem can involve a whole industry, e.g., the processing and marketing of canned corned beef, salmon or tuna where economic losses have measured \$150 million or more.

Microbiological Criteria for Foods, Where Are We Now? H. Michael Wehr, *Oregon Department of Agriculture, 635 Capitol St. NE, Salem, OR 97302* and John Silliker, *Silliker Laboratories, Carson, CA.*

The use of microbiological criteria to assess food safety and quality has been an area of continuing interest and controversy. Concern has arisen regarding the use of microbiological standards or guidelines by government agencies in regulating food products. To help resolve questions concerning the utilization of microbiological criteria, an expert committee was established within the National Academy of Sciences National Research Council to assess the proper role of microbiological standards and guidelines. This symposium will review the committee's report and the perspective of federal and state agencies and industry representatives on the report, and will present their comments on the future use of microbiological criteria to assess and regulate food products.

FDA Perspective. R. B. Read, Jr., Washington, DC, *Division of Microbiology, Food and Drug Administration, 200 C Street SW, Washington, DC 20204.*

Among other things, the FDA is responsible for inspection of 63,000 food processing and storage facilities in the United States as well as for 500,000 lots of products that are imported annually and are subject to the FD&C Act. Obviously, objective indicators of wholesomeness are essential for making judgements as to whether these products are adulterated. We believe that microbiological criteria can be useful as one indicator of wholesomeness. One of the major recommendations of the subcommittee on Microbiological Criteria of the National Academy of Sciences is that the FDA should take the initiative to form, along with the Army Natick Research and Development Center, the National Marine Fisheries Service and the USDA, an *ad hoc* Commission on Microbiological Criteria for Foods. Membership would consist of representatives from the four Federal agencies, State and municipal food regulatory agencies, the food industry, and academia. The Commission's objective would be to develop microbiological criteria for various foods and to recommend that the appropriate Federal agency promulgate regulations embodying the recommended criteria. We have endorsed this recommendation and are in the process of forming the Commission.

Abstracts of papers in the October Journal of Food Protection

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Microbial Decontamination of Calf Carcasses by Lactic Acid Sprays, Caspar H. J. Woolthuis and Frans J. M. Smulders, Department of the Science of Food of Animal Origin, Section Hygiene, Faculty of Veterinary Medicine, The University of Utrecht, P.O. Box 80175, 3508 TD Utrecht, The Netherlands

J. Food Prot. 48:832-837

Six experiments were done with a total of 73 veal calves. Two pilot experiments were concerned to determine the maximal concentrations of lactic acid sprays that were acceptable in terms of fat cover color score and flavor score of lean Longissimus muscle. These pilot experiments indicated that concentrations up to 1.25% (vol/vol) of L-lactic acid did not produce unacceptable discoloration, and concentrations up to 2.00% (vol/vol) were not significantly different from controls in terms of flavor. In four additional experiments, the bactericidal properties of 1.25% L-lactic acid sprays were quantified. When measured 24 h postmortem, aerobic colony counts (3 d, 30°C) were reduced by 0.8 and 1.3 log₁₀ CFU/cm² on breast and perineum, respectively. *Enterobacteriaceae* counts, that were approximately 1.8 log₁₀ CFU/cm² initially, were reduced below their limit of detection (<1.3 log₁₀ CFU/cm²) as a result of lactic acid treatment. All tests for *Salmonella* were negative. Few, if any, *Lactobacillaceae* were isolated both in treatment and control groups.

Immediate and Delayed Microbiological Effects of Lactic Acid Decontamination of Calf Carcasses - Influence on Conventionally Boned Versus Hot-Boned and Vacuum-Packaged Cuts, Frans J. M. Smulders and Caspar H. J. Woolthuis, Department of Science of Food of Animal Origin, Section Hygiene, Faculty of Veterinary Medicine, The University of Utrecht, P.O. Box 80175, 3508 TD Utrecht, The Netherlands

J. Food Prot. 48:838-847

Three experiments involving a total of 114 calves were done. The first two experiments, conducted under simulated export conditions, monitored the immediate and delayed microbiological effects of decontamination with 1.25% (vol/vol) L-lactic acid on calf carcasses as well as the effects of an additional treatment with 2.00% (vol/vol) L-lactic acid and vacuum-packaging on hot-boned veal cuts. In a third experiment, data from

these investigations were tested under actual export conditions and were found to be similar. As a result of 1.25% (vol/vol) L-lactic acid treatment, aerobic colony counts (3 d at 30°C and 5 d at 17°C) were reduced by 0.8 log₁₀ CFU as compared with initial counts of approximately 3.0 log₁₀ CFU/cm² on control carcasses. However, the reduction increased to 1.3 log₁₀ CFU at 14 d postmortem, indicating some delayed effect of lactic acid. The percentage of samples positive for *Enterobacteriaceae* was reduced from 50% to approximately 10% which corresponded with a mean reduction of 0.3 log₁₀ CFU/cm². Vacuum-packaging virtually completely inhibited growth of bacteria, yeasts and molds on hot-boned cuts, but 1 wk after breaking the counts reached values similar to controls. When measured 7 d postmortem, lactic acid treatment combined with vacuum-packaging was significantly more effective in reducing aerobic colony counts than vacuum-packaging alone. At 14 d postmortem, this was still the case for cuts that had been subjected to an additional decontamination with 2.00% (vol/vol) L-lactic acid immediately before vacuum-packaging. The *Enterobacteriaceae* colony count of hot-boned vacuum-packaged cuts remained under its limit of detection of 1.3 log₁₀ CFU as a result of lactic acid decontamination. *Lactobacillaceae* colony counts were extremely low in all treatment groups. No salmonellae were isolated from any sample, indicating that marked progress has been made in controlling *Salmonella* contamination of veal in The Netherlands. This was accomplished by having separate fattening and slaughter lines and markedly improving slaughter house practices.

Computing a Minimum Public Health Sterilizing Value for Food with pH Values from 4.6 to 6.0, Irving J. Pflug, Theron E. Odlaug and Ronald Christensen, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, Minnesota 55108

J. Food Prot. 48:848-850

A model was developed for adjusting the minimum public health sterilization F-value of foods with pH values from 4.6 to 6.0 based on the *Clostridium botulinum* spore heat resistance data of Zezones and Hutchings (6). Starting with the maximum pH of the product, this model was used to calculate the F_{250°F} value equivalent to an F_{250°F} value of 3.0 min. The model yielded an F_{250°F} value of 2.0 min when the pH was 5.3 and 1.2 min when the pH was 4.6.

Use of Preservatives to Delay Toxin Formation by *Clostridium botulinum* (Type B, Strain Okra) in Vacuum-Packaged, Cooked Potatoes, S. Notermans, J. Dufrenne and M. J. H. Keybets, Laboratory for Water and Food Microbiology, National Institute of Public Health and Environmental Hygiene, P.O. Box 1, 3720 BA Bilthoven, The Netherlands and Institute for Storage and Processing of Agricultural Produce (IBVL), P.O. Box 18, 6700 AA Wageningen, The Netherlands

J. Food Prot. 48:851-855

Storage at temperatures below 4°C prevents growth and toxin production by *Clostridium botulinum* in vacuum-packed, cooked potatoes. The use of preservatives as an additional, built-in safety factor has been investigated. Dipping potatoes in a solution of ascorbic and citric acid before vacuum-packing and cooking (95°C for 50 min) inhibited growth and toxin production by proteolytic *C. botulinum* type B at an incubation temperature of 15°C for 70 d and at 20°C for at least 14 d. This preservative treatment also resulted in an organoleptically acceptable product with a prolonged shelf life. Risk analysis showed that the presence of *C. botulinum* in vacuum-packed, cooked potatoes may be expected, i.e., one spore in each 1585 kg of product. A preservative treatment with a combination of ascorbic and citric acid will limit the public health risk even if the potato product is accidentally stored for a short time at a temperature higher than 4°C.

Helium Leak Test for Micron-Sized Holes in Canned Foods, James E. Gilchrist, Ulysses S. Rhea, Roger W. Dickerson and Jephtha E. Campbell, U.S. Food and Drug Administration, 1090 Tusculum Avenue, Cincinnati, Ohio 45226

J. Food Prot. 48:856-860

A helium leak test for canned foods was developed to provide a more sensitive method than existing ones and to reduce dependence on operator judgment for detecting leaking cans. The test forced helium through holes into cans filled with foods. Can headspace gas was sampled, and the helium content was measured by gas chromatography. An approximately linear ($r = 0.81$) relationship existed between the helium content of the headspace and the hole size in the can. The method detected holes as small as 1 μm in diameter (the smallest hole tested). Measurements of direct holes and dented seam holes in metal cans indicated that most holes tested smaller upon retesting. However, some seam openings did become larger. Some holes closed completely, probably as a result of clogging by particles. Cans with direct holes of known size were processed in a canning retort, and the cooling water was inoculated with ca. 10^6 bacteria/ml. Cans with holes greater than 5 μm became contaminated as exhibited by gas production during incubation at 37°C. The described helium test was compared with two modified conventional leak tests. When comparing cans with direct holes of known size, there was no difference between the methods. However, when comparing cans with leaks caused by dented seams, the helium test was found to be the most sensitive method for detecting leaks in cans of food. In order of their sensitivity, the tests for leaking cans were the helium test, the modified fluorescent dye test, and the modified vacuum test.

Properties of Frankfurters Processed with Different Levels of Sodium Bicarbonate, Peter J. Bechtel, Floyd K. McKeith, Scott E. Martin, Edward J. Basgall and Jan E. Novakofski, Departments of Animal Sciences, Food Science and Veterinary Biosciences, University of Illinois, Urbana, Illinois 61801

J. Food Prot. 48:861-864

The effect of substituting sodium bicarbonate for sodium chloride in frankfurters was evaluated using chemical and sensory criteria. Frankfurters were formulated and prepared using one of three treatments: (a) 2% sodium chloride control, (b) 1% sodium bicarbonate and 1% sodium chloride or (c) 2% sodium bicarbonate. Substitution of sodium bicarbonate raised the pH from 6.0 to 7.5 and 8.2 (treatments a, b and c, respectively). Percent free water decreased with sodium bicarbonate substitution from 41.3 to 31.7 and 21.6. Sodium bicarbonate substitution did not significantly affect Warner-Bratzler shear force values or sensory determination of moistness or tenderness. However, sensory evaluations of texture and mouthfeel and off-flavor intensity were less desirable with increased sodium bicarbonate content. Visual evaluations indicated that substitution of sodium bicarbonate for sodium chloride resulted in frankfurters having a darker brown color. Scanning electron microscopic evaluation of frankfurters did not show evidence of major structural differences. Frankfurters in vacuum-packaged bags were stored for up to 30 d in a 4°C lighted retail case. Total plate counts were not significantly different between treatments on days 0, 15 or 30 of storage. These results indicate a potential use of sodium bicarbonate to alter pH and percent free water of emulsified meat products; however, some sensory properties are diminished when sodium chloride is replaced with sodium bicarbonate.

Factors Affecting the Microbiological Quality of Burgos and Villalón Cheeses at the Retail Level, F. J. Chavarrí, J. A. Nuñez, L. Bautista and M. Nuñez, Departamento de Bioquímica y Microbiología, Instituto Nacional de Investigaciones Agrarias, Apartado 8111, Madrid 28040, Spain

J. Food Prot. 48:865-869

One hundred forty-four samples of Burgos and Villalón cheeses collected during April and July 1983 from retail outlets in Madrid, Spain, were analyzed for microbiological quality. Geometric mean counts were 6.8×10^5 staphylococci/g, 1.0×10^5 coliforms/g and 7.9×10^3 yeasts/g for Burgos cheese, whereas the respective mean counts for Villalón cheese were 1.4×10^6 /g, 8.7×10^4 /g and 1.9×10^4 /g. Coagulase-positive staphylococci represented in April and July, 7.9 and 42.2%, respectively, of the isolates from egg-yolk tellurite glycine agar plates. Fecal coliforms accounted for 5.6 and 26.9% of the isolates from violet red bile agar plates in April and July, respectively. Presence of alkaline phosphatase activity in cheese was not significantly related to numbers of staphylococci or coliforms and should only be regarded as a presumptive test. The use of pH values or total counts as indicators of the microbiological quality of Burgos and Villalón cheeses is also discussed.

Evaluation of Millipore Swab-Membrane Filter Kits, J. A. Devenish, B. W. Ciebin and M. H. Brodsky, Ontario Ministry of Health, Laboratory Services Branch, Box 9000, Terminal A, Toronto, Ontario, Canada M5W 1R5

J. Food Prot. 48:870-874

A laboratory performance evaluation was done on the Millipore Total-Count (TC) and SPC swab-membrane filter kits which are designed to monitor sanitary conditions on food contact surfaces and eating utensils. Hand-shaking was as effective as vortexing for dislodging bacteria from the cotton swab in vials of Millipore buffer, but bacteria were unstable in the Millipore buffer even when refrigerated at 4°C. These results indicate that the Millipore swab-membrane filter kits could be used by public health officials but both swabbing and sampling should be completed in the field and the samplers returned to the laboratory for incubation, enumeration and proper disposal. Compared to the standard pour plate, recovery of unstressed *Escherichia coli* cells by the TC sampler was accurate provided not more than 125 colonies were on the membrane filter of the sampler. In comparing the two kits for recovery of stressed bacteria, the Millipore TC sampler was able to recover chlorine-stressed but not heat-stressed cells, whereas the opposite results were obtained with the SPC sampler. Hence, the availability of two different Millipore kits, neither of which recovers all types of stressed bacterial cells, indicates the need for designing a newer media formulation that could accomplish this effectively using just one sampler. Once these criteria have been met, the Millipore swab-membrane filter kit could replace the more tedious and time-consuming standard method currently used for monitoring sanitary conditions related to public health.

Effect of Temperature and Suspending Vehicle on Survival of *Vibrio parahaemolyticus* and *Vibrio vulnificus*, B. K. Boutin, A. L. Reyes, J. T. Peeler and R. M. Twedt, Division of Microbiology, Food and Drug Administration, 1090 Tusculum Avenue, Cincinnati, Ohio 45226

J. Food Prot. 48:875-878

Four strains of *Vibrio vulnificus* and two strains of *Vibrio parahaemolyticus* from clinical and environmental sources were examined for their ability to survive storage at 4 and -20°C in shrimp homogenate and at -80°C in shrimp homogenate, fetal bovine serum and dimethyl sulfoxide. Cell counts declined with time at 4 and -20°C but they remained stable after freezing at -80°C. Dimethyl sulfoxide was the superior menstruum at -80°C because it protected against freezing lethality.

Effect of Normal Microflora on Survival of *Salmonella typhimurium* Inoculated into Hydroponic Nutrient Solution, Eve C. Riser, Joseph Grabowski and Edward P. Glen, Environmental Research Laboratory, Tucson International Airport, Tucson, Arizona 85706

J. Food Prot. 48:879-882

Salmonella typhimurium (ATCC 14028) was inoculated into nutrient solution collected from a hydroponic lettuce farm. The objective was to determine the effect of the presence or absence of the normal microflora of the nutrient solution on growth and persistence of *Salmonella*. In the unsterilized nutrient solution, *Salmonella* did not exceed 10^4 CFU ml⁻¹, even when introduced at that concentration in the presence of a starting total aerobic count of 10^3 CFU ml⁻¹ for the normal flora. Growth of *Salmonella* appeared to be suppressed, while that of the normal flora was unaffected and reached the usual level of 10^5 - 10^6 CFU ml⁻¹ by 24 h. The normal microflora apparently restricted growth of *Salmonella*, and by 48 h after its introduction, *Salmonella* counts were decreasing. *Salmonella* inoculated into filter-sterilized nutrient solution grew rapidly to as high as 10^8 CFU ml⁻¹, demonstrating that the nutrient solution contained the elements necessary to promote exponential growth of the bacterium. However, the fact that these levels were not achieved in the presence of other organisms, strongly suggests that *Salmonella* could not compete favorably with the normal flora of the hydroponic system.

Microbiological Profiles of Egyptian Raw Vegetables and Salads, M. J. Saddik, M. R. El-Sherbeeny and Frank L. Bryan, Nutrition Institute, Ministry of Health, Cairo, Egypt and U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Atlanta, Georgia 30333

J. Food Prot. 48:883-886

Two hundred-fifty samples of raw vegetables and salads that were collected from hotels, restaurants, small foodservice shops, markets and street vendors in Egypt were tested for *Salmonella*, *Shigella* and aerobic colony (30°C) count. Thirty-six of these samples were tested for *Staphylococcus aureus*. *Salmonella* was isolated from two samples of green leafy vegetables (greens) and one sample of mixed salad that most likely contained greens. *Shigellae* were isolated from one sample of greens, one sample of parsley, and three samples of mixed salads. Most samples of raw vegetables and salads were at either room or outside temperature just before sampling. Eighty percent of the samples had aerobic colony counts of more than 10^6 CFU/g. Three of 36 samples contained ca. 1×10^3 *S. aureus*/g.

Incidence and Cost of Foodborne Diarrheal Disease in the United States, Douglas L. Archer and John E. Kvenberg, Division of Microbiology, Food and Drug Administration, Washington, DC 20204

J. Food Prot. 48:887-894

An estimated 68.7 to 275 million cases of diarrheal disease episodes from all causes occur annually in the United States, representing an average of 0.29 to 1.1 cases per person per year. The total number of cases of foodborne origin and subsequent person-to-person transfer was estimated to be at least 24 million and perhaps as many as 81 million or more cases per year. Updating previously published patient cost estimates, including lost wages as well as direct medical costs, the average estimate-based value for food-associated illness falls between \$40 and \$164 billion per year. Indirect costs to the economy may equal or even double these direct patient-related costs. Scientifically established chronic sequellae to diarrheal disease further increase the total economic burden but cannot be estimated from available data. Other associated clinical problems that are likely to be related to acute diarrheal episodes would further increase costs.

Manganese and Lactic Acid Bacteria, M. Raccach, Division of Agriculture, Arizona State University, Tempe, Arizona 85287

J. Food Prot. 48:895-898

Manganese (Mn), in trace quantities, is essential for growth and metabolic activities of lactic acid bacteria (LAB). The requirement for Mn has a certain degree of specificity and cannot be completely replaced by other metals. Frozen storage of LAB, species/subspecies, type of fermentable carbohydrate, interaction with other ions and chloride salts affect the extent of stimulation by Mn of LAB. Some applications of the stimulation by Mn of LAB are a bioassay for determination of this metal and its use as an aid in lactic acid fermentation of meat and plant foods. The biological effects of Mn are associated with structure/activation of enzymes, especially those involved in use of carbohydrates. Mn was also found to detoxify the superoxide radical, which is harmful to the bacterial cell, and to stabilize subcellular entities.

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October 1-2, SOUTH DAKOTA STATE DAIRY ASSOCIATION CONVENTION to be held at the Ramada Inn, Sioux Falls, So. Dakota. For more information contact: Shirley W. Seas, Ex Secretary, Dairy Science Dept., So. Dakota State University, Brookings, SD 57007.

October 1-3, STORAGE LIVES OF CHILLED AND FROZEN FISH AND FISH PRODUCTS, to be held at The Conference Centre, University of Aberdeen, Aberdeen, Scotland. For more information contact: IIR Conference Organiser, Torry Research Station, PO Box 31, 135 Abbey Road, Aberdeen AB9 8DG, UK.

October 1-4, BETTER PROCESS CONTROL SCHOOL, to be held at the University of Nebraska-Lincoln. For more information contact: Michael Liewen, University of Nebraska-Lincoln, 134 Filley Hall, Lincoln, NE 68583. 402-472-2814.

October 2-4, WORKSHOP IN FOOD FLAVOR: DEVELOPMENT, MANUFACTURE AND USE, to be held at the University of Minnesota, St. Paul, MN. For more information contact: Joanne Parsons, Office of Special Programs, 405 Coffey Hall, 1420 Eckles Avenue, University of Minnesota, St. Paul, MN 55108. 612-373-0725.

October 4-10, THE ENVIRONMENTAL MANAGEMENT ASSOCIATION, and its subsidiaries will hold its 28th annual National Educational Conferences and Exposition at the Holiday Inn Surfside Conference Center, Clearwater Beach, FL. For more information contact: Jean M. Day, EMA, 1019 Highland Ave., Largo, FL 33540. 813-586-5710.

October 5-9, DFISA FOOD & DAIRY EXPO '85, to be held at the Georgia World Congress Center, Atlanta, GA. For more information contact: Bruce L. D'Agostino, Director, Public Relations, Dairy and Food Industries Supply Assoc., Inc., 6245 Executive Boulevard, Rockville, MD 20852-3938. 301-984-1444, Telex: 908706.

October 7-9, BIOTECHNOLOGY IN THE FOOD PROCESSING INDUSTRY, sponsored by the Department of Food Science and Nutrition, University of Minnesota. To be held at the University Radisson Hotel, Minneapolis, Minnesota. For more information contact: Lynette Marten, 405 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108. 612-373-0725.

October 7-9, IN-STORE BAKERY 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 8-9, SEMINAR ON NEW DAIRY PRODUCTS VIA NEW TECHNOLOGY, jointly sponsored by USNAC and IDF, Georgia World Congress Center, Atlanta. For more information contact: Harold Wainess, Secretary, U. S. National Committee of IDF (USNAC), 464 Central Avenue, Northfield, IL 60093. 312-446-2402.

October 14-18, ADVANCED BAKERY PRODUCTION, to be held in Manhattan, KS. For more information contact: Mrs. Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502. Register by Phone: Call Donna at 913-537-4750 or 1-800-633-5137.

October 16-17, FOOD PROCESSING PEST MANAGEMENT CONFERENCE. For more information contact: Office of Special Programs, 405 Coffey Hall, 1420 Eckles Avenue, University of Minnesota, St. Paul 55108.

October 16-17, IOWA ENVIRONMENTAL HEALTH ASSOCIATION MEETING, to be held at the Starlite Village, Ames, IA. For more information contact: Derward Hansen, RR 3, Box 26, Exira, IA 50076. 712-268-2798.

October 21-23, STABILITY AND QUALITY CONTROL WORKSHOP, to be held in Palo Alto, CA. For more information contact: Tragon Corporation, 365 Convention Way, Redwood City, CA 94063. 415-365-1833.

October 21-23, COOKIE-CRACKER TECHNOLOGY FOR ALLIED AND NON-PRODUCTION PERSONNEL, Manhattan, Kansas. Contact Bev Martin at 913-537-4750 or write: Bev Martin, Research Department, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

October 21-26, 69TH ANNUAL SESSIONS OF THE INTERNATIONAL DAIRY FEDERATION AUCKLAND, NEW ZEALAND. For more information contact: H. Wainess, Secretary, U. S. National Committee of the IDF (USNAC), 464 Central Avenue, Northfield, IL 60093. 312-446-2402.

October 22-23, CALIFORNIA ASSOCIATION OF DAIRY AND MILK SANITARIANS ANNUAL CONFERENCE, to be held at the Clarion Hotel, 401 East Millbrae Avenue, Millbrae, California. For more information contact: Richard C. Harrell, Executive Sect/Treas, 1554 West 120th Street, Los Angeles, CA 90047.

October 21-25, 69TH ANNUAL SESSIONS OF THE INTERNATIONAL DAIRY FEDERATION, to be held in Auckland, New Zealand. For more information contact: H. Wainess, Secretary, U.S. National Committee of the IDF (USNAC), 464 Central Avenue, Northfield, IL 60093. 312-446-2402.

October 24, FOCUS ON FOOD SYMPOSIUM VI; ASSURING MEAT WHOLE-SOMENESS, to be held in Manhattan, Kansas. For more information contact: Dr. David Schafer, Department of Animal Sciences and Industry, 913-532-6134. Or contact Dr. Karen Penner, Extension Home Economics, Kansas State University, Manhattan, KS. 913-532-5773.

October 28-30, PCO RECERTIFICATION, to be held in Manhattan, KS. For more information contact: Shirley Grunder, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502. 913-537-4750.

October 28 - November 1, PRE-MIX SEMINAR, to be held in Manhattan, KS. For more

information contact: Mrs. Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 55402. 913-537-4750.

October 28 - November 8, COOKIE TECHNOLOGY, Manhattan, Kansas. Contact Bev Martin at 913-537-4750 or write: Bev Martin, Research Department, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

November 5-7, TECHNOLOGY OF BAKING, to be held in Las Vegas, NV. For more information contact: Mrs. Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502. 913-537-4750.

November 6, SANITATION THRU DESIGN, Las Vegas. Contact Shirley Grunder at 913-537-4750 or write: Shirley Grunder, Sanitation Education Department, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

November 11-15, CRACKER PRODUCTION COURSE, Manhattan, Kansas. Contact Bev Martin at 913-537-4750 or write: Bev Martin, Research Department, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

November 13-15, GUM CHEMISTRY AND TECHNOLOGY IN THE FOOD INDUSTRY, to be held at the Holiday Inn, Chicago City Centre in Chicago, IL. For more information contact: Raymond J. Tarleton, 3340 Pilot Knob Road, St. Paul, MN. 612-454-7250.

November 20, UNIVERSITY OF MARYLAND'S 41ST ANNUAL DAIRY TECHNOLOGY CONFERENCE, University of Maryland, Center of Adult Education - Room 1123, University Blvd. at Adelphi Road, College Park, MA. For more information contact: Dr. James T. Marshall, Department of Animal Sciences, University of Maryland, College Park, MA. 20742. 301-454-7843.

December 2-4, TECHNOLOGY OF TORTILLAS, Manhattan, Kansas. Contact Donna Mosburg at 913-537-4750 or write: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

1986

January 14-16, 11TH ANNUAL MEETING TROPICAL AND SUBTROPICAL FISHERIES TECHNOLOGISTS, to be held at Holiday Inn, International Airport, Tampa, FL. For more information contact: John Koburger, 449 Food Science Building, University of Florida, Gainesville, FL 32611. 904-392-1991.

February 5-6, FOOD PROCESSORS' SANITATION WORKSHOP, Presented by the University of California Cooperative Extension, Food Processors' Sanitation Association, and Golden Gate Chapter of the Environmental Management Association, along with representatives of various food trade associations. For

more information contact: Kathryn Boor, Food Science and Technology, University of California, Davis, CA 95616. 916-752-1478.

February 24-26, 12TH ANNUAL TECHNICAL SEMINAR, to be held at the Holiday-Inn University Center, Gainesville, FL. For more information contact: ABC Research Corporation, 3437 SW 24th Avenue, Gainesville, FL.

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

April 29-May 1, WORKSHOP ON TRACE ANALYSIS OF FOODS. For more informa-

tion contact: G. Reineccius, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108. 612-373-1438.

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

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

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

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

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

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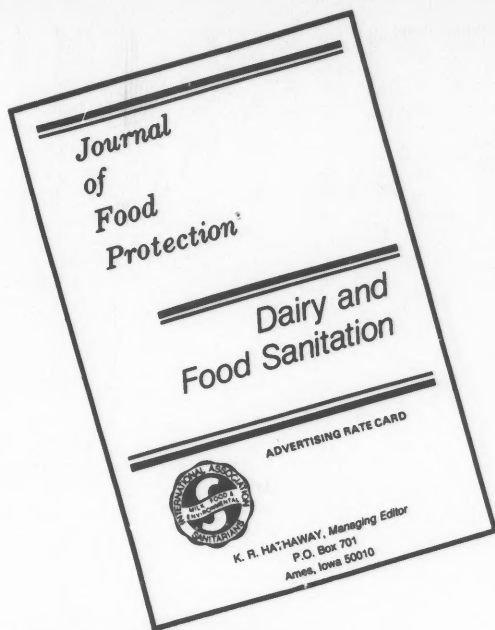
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