

ISSN:0273-2866
Box 701
Ames, Iowa 50010

January, 1986
Vol. 6, No. 1
Pages 1-44
\$6.00

Dairy and Food Sanitation®

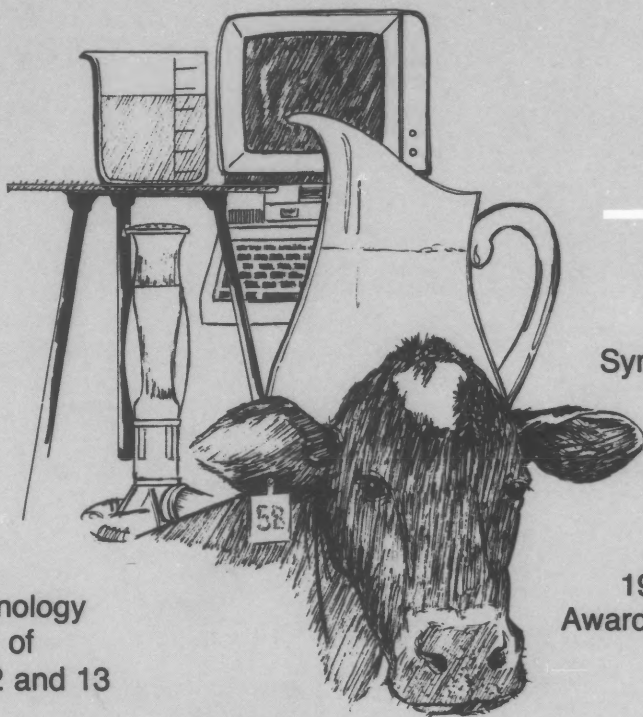


A Publication of the International Association of Milk, Food and Environmental Sanitarians, Inc.

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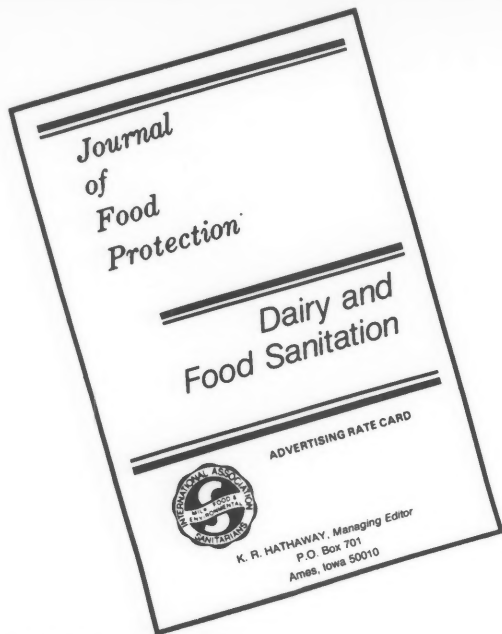
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General Sanitation	21%
Laboratory	16%
Teaching - Research	5%
Industry	7%
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	100%

The circulation of the *Journal* is international and averages 3500 copies per month. *Dairy and Food Sanitation* circulation averages 3000 copies per month.

President's Message January 1986

Your Executive Board met for two days in mid-October for a business session and program planning meeting with a local committee in Minneapolis, Minnesota.

The facilities for our 1986 meeting should be first rate. Room rates are reasonable and good food was available. A buffet within the Radisson South is very reasonable, in addition to a top quality restaurant at a higher price.

The format for the meeting will be the same as the 1985 meeting in Nashville. Committee meetings will be held Sunday afternoon and Monday morning with the general session Monday afternoon. That leaves two days for ten practical and scientific sessions.

The expanded program will have at least 10 separate half day sessions and more, if submitted and graduate student papers exceed the usual number. There will also be a symposia on *Salmonella* and *Listeria*, three sessions each on Food Protection and Milk Sanitation, an Environmental Session, a Dairy Field Representatives Session, and a Food Protection Cracker Barrel evening session.

Continuing Education Units will be awarded by a certificate for those who want it at the 1986 meeting.

Affiliates are urged to indicate who their voting delegate will be. If a response is not received before February 15, the Ames office will phone so that you may indicate a representative. The program will be published in the journals in April this year instead of May. Each affiliate is asked to designate a membership person to serve on the association committee.

Friday afternoon and evening were spent on association business. Chairpersons were selected and approved for 14 committees including Ruth Fuqua to undertake the large task of both General and Sustaining Membership. Kathy Hathaway and Kate Wachtel provided us with a financial report and activities of the association office. Things look good, but we believe that membership can be greatly expanded. Renewals continue into mid-November at a faster rate than usual.

The Association Staff has been at a number of affiliate and other meetings this fall. Interest is great and members, exhibits and Sustaining Members have been added. Ways of getting new members from food and other areas were discussed in detail. Ms. Hathaway was given another one year contract as Executive Manager as she requested.

See you in Minnesota, August 3-6, 1986.

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

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

"Instructions to Contributors" can be obtained from the editor.

Orders for Reprints: All orders should be sent to IAMFES, Inc., PO Box 701, Ames, IA 50010-

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Business Matters: Correspondence regarding business matters should be addressed to Kathy R. Hathaway, IAMFES, PO Box 701, Ames, IA 50010-0701.

Subscription Rates: \$60.00 per volume, one volume per year, January through December. Single copies \$6.00 each. No cancellations accepted.

Sustaining Membership: A sustaining membership in IAMFES is available to companies at a rate of \$300 per year, which includes \$100 credit toward an ad in the "annual meeting issue" of the Journal, the July issue. For more information, contact IAMFES, PO Box 701, Ames, IA 50010-

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Dairy and Food Sanitation

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Integrated Pest Management of Insects In Food Products

Ronald D. Warner, D.V.M., M.P.V.M.
John C. Gordon, D.V.M., M.P.H.

Department of Veterinary Preventive Medicine
College of Veterinary Medicine
1900 Coffey Road
The Ohio State University
Columbus, Ohio 43210

INTRODUCTION

Since ancient times man has stored grains and many other food products, creating micro-ecosystems that are often unbalanced in favor of stored-product pests. Pests can consume much of the harvest, assault the human sense of aesthetics, and sometimes cause human illnesses. It has been estimated that "household" pests destroy more than one billion dollars worth of stored foods annually in the United States.(12,14) Some stored-product pests can cause dermatitis (grocer's or grain itch), intestinal acariasis and canthariasis (beetle larvae in the intestine), or allergies due to insect fragments in mill dust.(14)

In particular, stored-food insect pests cause losses via physical damage (leading to early spoilage), contamination, and/or consumption of foods. Insect control costs are a constant budgetary item in many segments of the food industry. With increasing demands for nourishing human populations, societies can ill-afford to bear either direct or indirect costs of stored-food insects. An insect pest should be controlled in the most practical, cost-effective, and acceptable manner available.

Stored-food insects are part of a larger environmental health problem known as vermin - noxious, troublesome, disgusting animals of small size and common occurrence, which are difficult to control. Classical phases of vermin control encompass: vermin destruction; elimination of harborage, food, and water (restriction); and vermin-proofing buildings (exclusion).(1,4) Integrated pest management is a philosophy and set of working procedures, utilizing and maximizing combined strategies of destruction, restriction, and exclusion unique to each infestation.(2,8)

Integrated pest management (IPM) is based on the premise that no individual control method (e.g. pesticides alone) will be successful. Therefore, a variety of biological, physical, and chemical methods are combined into a program to provide long-term protection. Measures that pose minimal risks to man, nontarget organisms, and their ecosystems are desired. The ultimate objective is to control pests in an environmentally sound and economically efficient manner.(2) Most control efforts focus on identification of species, estimation of population density, and then rapid reduction of insect numbers via chemical methods, elimination of basic requirements (food, moisture, and harborage), and prevention of reinfestations.(10)

Understanding the principles and suppression mechanisms involved when combining different control techniques is considered helpful in planning practical pest management. In suppressing pest populations, the number that survives to reproduce is

a criterion of effectiveness. If method "A" destroys 90 percent of the population and method "B" used concurrently (acting by a different mode) destroys 90 percent of the remainder, only one percent of the original population will survive to reproduce. For example, if an insecticide application destroys 90 percent of a population, and a cultural or sanitation measure is superimposed which destroys 90 percent of the remaining pests, then the total suppressive result should approach 99 percent effectiveness.(9) Ten times as many insects would survive if only one of these methods were used. A pest population will be reduced more efficiently when two or more techniques (with different modes of action) are used on the same generation, rather than applying a sequence of single techniques to succeeding generations. To get the most benefit from techniques that have maximum efficiency when the pest population is low, it is very important to reduce the population to a minimum level, in the shortest time, early in the IPM program.

Identifying Stored-Product Insects and Estimating Their Population Densities

Periodic surveys of stored foods are essential in IPM. Very high reproductive potentials coupled with short life-cycles enable a few "imported" insect pests to quickly reach unacceptable levels.(16) In a suitable environment, cereals with less than one insect per pound can become heavily infested within 30 days.(14)

Food-quality personnel and warehouse inspectors, especially in hot or humid climates, should regard each incoming shipment as potentially infested. The frequency of in-storage surveillance inspections will depend on the local climate, infestation history of the storage facility, product susceptibility and rotation schedule, and the quality of product packaging.⁽¹²⁾ All foodstuffs that are slow to rotate from storage and all seldom-used storage areas should be examined closely. Warehouse windows should be inspected for flying insects; floors, pallets, and walls need to be inspected for newly emerged pests, especially near vulnerable products, including dry pet foods and tobacco items. Flashlights, plastic specimen vials, a hand lens, and sieves of several different mesh sizes are essential aids when inspecting food products and warehouses.

Species identification of stored-food insects is essential if correct control and prevention measures are to be implemented. A multitude of species can infest stored foods.⁽¹²⁾ Figures 1, 2, and 3 have been helpful in our "field" identifications. Timely identification, with appropriate recommendations, is needed to implement rapid population reduction in an IPM program. To assist in early identification and control recommendations, Table 1 lists general characteristics of some significant stored-food insect pests.^(12,14) All "field" identifications should be confirmed by laboratory examination. Samples of infested product and/or adult and sub-adult insect stages (if both are present) should be sent to a laboratory that employs a professional entomologist. The laboratory should be contacted prior to sending samples, to determine specific requirements for preserving and/or packing particular specimens. Any IPM program must be based on the particular species of pest, the degree of infestation, the food storage environment, and the availability and restrictions of chemical control methods.

The degree of food product infestation is best established from population density estimates or indices ac-

PICTORIAL KEY TO COMMON GROUPS OF HOUSEHOLD AND STORED-FOOD PESTS
LARVAL STAGES

Chester J. Stojanovich & Harold George Scott

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE, Communicable Disease Center
Atlanta, Georgia
1962

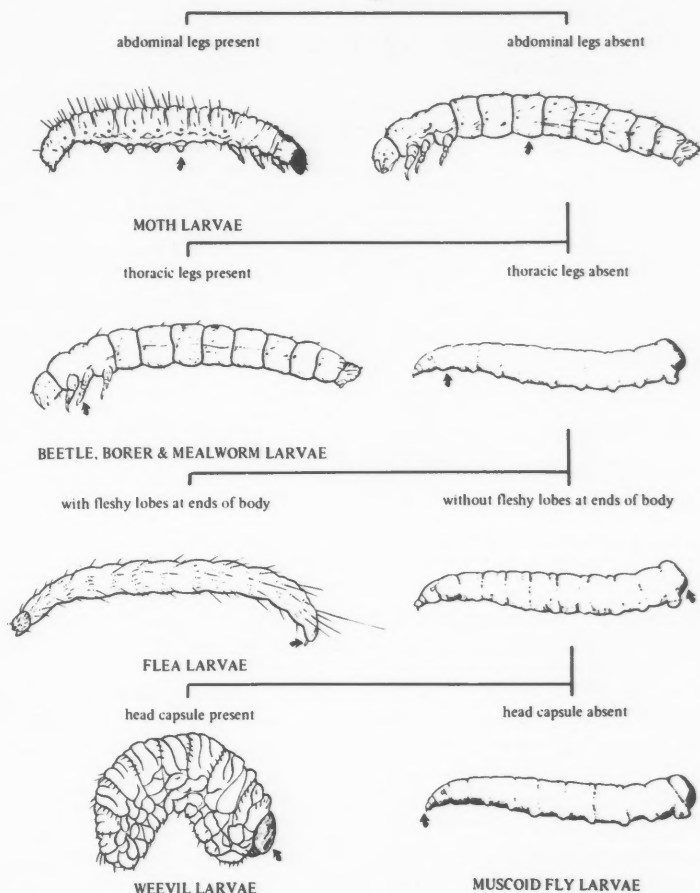


Figure 1. Anatomical features used to differentiate larvae of common insect pests (Reproduced with permission from Centers for Disease Control [CDC], Atlanta, GA; reference 14, pg 49).

quired by random sampling of suspect or vulnerable line items. Stored-food products may have maximum standards (acceptable or allowable) for insect infestation or contamination; indices established by industry quality control programs or mandated by government regulations. Routine pest population surveillance data, and population data before and after the initiation of control efforts, are important keys to any successful IPM program. Once the magnitude of infestation or contamination is calculated, lower levels can be "targeted"

to guide progress toward desired population reductions. Three indices often used by entomologists in estimating the degree of magnitude of facility or food product infestation are sub-adult/adult ratio, adult sex ratio, and/or insects or insect parts per gram of product examined.

The scope of this paper does not permit a discussion of sampling theories, survey techniques, trapping devices (using pheromones, food baits, etc.), or statistical procedures. However, the use of any or all of these items is a necessary consider-

PICTORIAL KEY TO SOME COMMON BEETLES AND WEEVILS
ASSOCIATED WITH STORED FOODS
Harry D. Pratt

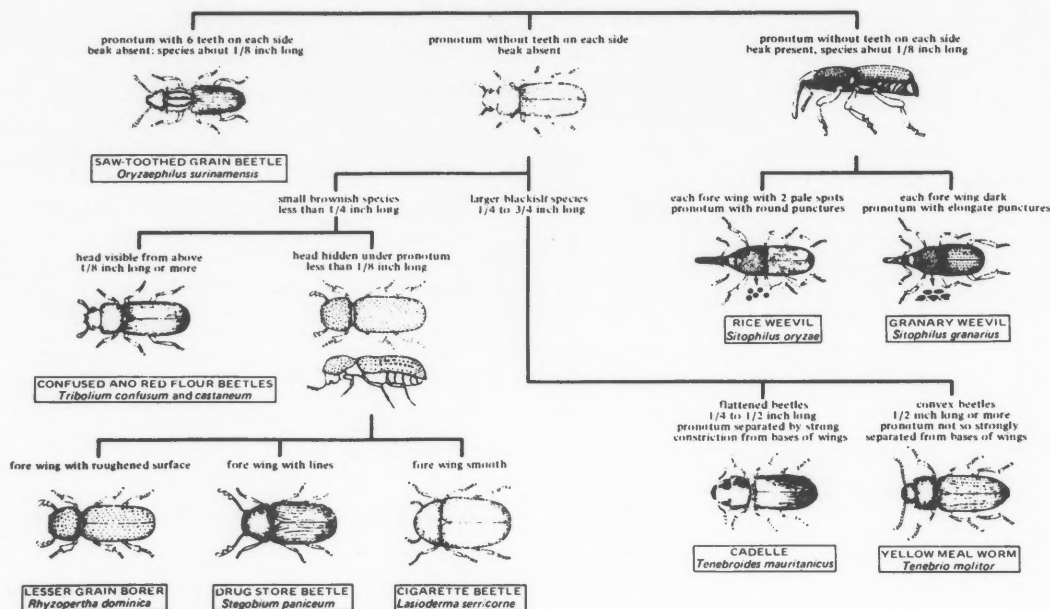


Figure 2. Key to common beetles and weevils that infest stored foods (Reproduced with permission from CDC; reference 14, pg 55).

ation in the correct estimate of insect density or insect impact indices; Fowler and Witter presented a thorough discussion of the accuracy and precision of such estimates.(5) Owens and Bennett completed a comparative study of eight population sampling techniques for the German cockroach and concluded that a trap developed at the University of California, Riverside, gave more accurate overall information.(13) Population estimates of stored-grain insects on farms in Australia were detailed by Sinclair.(17) Additional procedures on survey sampling, sampling theory, sampling techniques, and statistical methods are well documented elsewhere.(3,6,15,18)

Reduction of Insect Pest Populations with Approved Chemicals

Insecticides are an important part of IPM. However, the use of insecticides should be considered supplementary to warehouse sanitation and proper food storage.(1,7,8) Advantages and disadvantages of insecticide

applications (short-term control) must be appraised critically as they relate to the specific pest problem and specific conditions of use. The chief advantages of chemical control are: high degree of immediate control; benefit-cost ratio generally satisfactory for rapid population reduction;(9) availability of a wide selection of chemicals, formulations, and application equipment;(12) and broad-spectrum activities of most insecticides. These are practical advantages, since several species can be controlled with a given material and/or method of use. Major disadvantages of chemicals used for insect control include: hazards to applicators and other non-target organisms exposed to treated environments; chemical control alone will not provide a permanent solution;(7-9) repeated use is usually not effective for keeping insect populations at low numbers (diminished efficiency when populations decline to low numbers); and insects, in general, are prone to develop resistant strains,(9) although resistance has not

been reported in insects that infest stored grains. The use of insecticides in commercial or industrial settings creates little or no environmental hazard if the chemicals are applied in compliance with product labels, and state and federal regulations.(9) It is incumbent upon the insecticide applicator to always read the label and follow those label instructions.

Insecticide application procedures in food storage areas are commonly classified as space spraying, residual spraying, and fumigation. Space-spraying equipment includes fog applicators and mist machines which fill the air with tiny droplets. Also included are ultra-low-volume aerosol generators which produce micron-sized particles that penetrate into very small spaces between pallets and bags, and into structural crevices. Such treatments do not constitute fumigation,(12) but rather destroy insects exposed to the spray - insects which are not shielded by the food or its container.

Only insecticides of low human to-

KEY TO COMMON GROUPS OF HOUSEHOLD AND STORED-FOOD PESTS

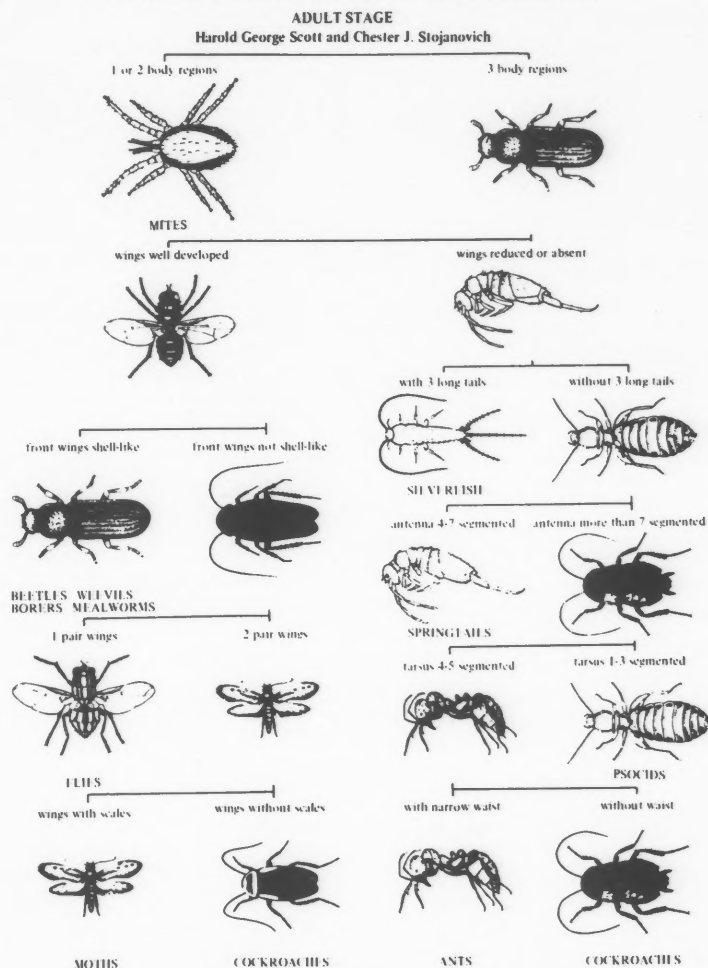


Figure 3. Anatomical features used to differentiate adults of common stored-food pests (Reproduced with permission from CDC; reference 14, pg 48).

xicity, such as synergized pyrethrins, are suitable for space treatment in food storage facilities. Warehouses should be closed to all ventilation for effective space treatment. Space treatment must be conducted when the facility is not in operation and should only be accomplished by certified professional pest control personnel.(14)

Treated facilities must be thoroughly ventilated prior to employee re-entry.

Saw-toothed grain beetles, rice weevils, drug-store beetles, and In-

dian meal moths (that are exposed during much of their life cycle) can often be controlled by residual sprays. One-half of one percent chlorpyrifos (Dursban), 0.5% diazinon, 1.0% propoxur (Baygon), and 0.2% resmethrin (SBP-1382) are available for use as residual treatments: applied to floors, walls, and pallets without food. Only certified pest control operators may use 0.25% bendiocarb (Ficam W) as a residual insecticide.(12) Protect all foodstuffs (open or packaged) from contamination during such treatments.

Fumigation is a useful method of destroying insect pests in grain stor-

age facilities, railroad cars, ships, and food warehouses. Fumigation is a dangerous process and must be conducted only by trained, bonded, certified professionals. Agents used to fumigate stored foods include: methyl bromide, chloropicrin, and hydrocyanic gas.(12) Ethylene dibromide, which was used to fumigate grain products in the United States, was banned for this use on February 3, 1984 by the U.S. Environmental Protection Agency.(19)

Each product, and formulation, has specific guidelines; users must ensure that any insecticide is handled, formulated, applied, and disposed of in strict compliance with product labels and local, state, and federal regulations. The use of insecticides is compatible with most other control measures, especially cultural controls and sanitation measures, and generally results in additive population suppression effects.(9)

Cultural (Environmental Sanitation) Control Methods

Generally, cultural control measures are applied in advance of insect pest damage.(7) They are preventive rather than corrective measures. Most cultural measures that destroy or modify a proportion of a stored-food pest's harborage result in a proportional population decrease. For example, an 85 percent destruction of insect harborage in a facility should result in a proportional adult population reduction in subsequent generations. By contrast, an insecticide kill of 85 percent of the adults in the same facility, with no subsequent implementation of environmental sanitation controls, may unfortunately be followed by "original" population numbers within the next few generations. Adults that remain could be capable of maximum reproductive potential because of less competition for available food, moisture, and harborage. Use of environmental sanitation controls coupled with chemical measures should reduce the labor and cost of insecticides needed in IPM. In addition, control measures having non-chemical modes of action should

TABLE 1. *General characteristics of some common stored-food insect pests*.*

Common Name	Size	Color	Food Sources	Life Cycle	Remarks
Cadelle beetle	8-14 mm.	black	grain products, nuts, potatoes, dried fruits, spices	2-14 months	many adults live more than one year
Cigarette beetle	2-3 mm.	light brown	grains, cereals, tobacco, drugs, raisins	6-12 weeks	adults can fly
Flour beetles	3-4 mm.	reddish-brown	milled grains, flour, cereal products, nuts, beans, spices	2-3 months	adults may live three years; can not attack unbroken grain
Ham beetle	4-6 mm.	shiny blue-green	smoked meats, garlic, bone meal	35-150 days	adult not able to fly
Larder beetle	6-10 mm.	dk. brown with yellow band	smoked meat, cheese, dried fish, tobacco, dry pet foods	40-50 days	cured meats and cheeses should be wrapped in paper and cloth, and stored in reefers
Saw-toothed grain beetle	2-3 mm.	brown	flour, cereals, sugar, drugs, dried foods, and tobacco	3-4 weeks	readily penetrates packaged cereals, fruits, and candy
Angoumois grain moth	14-16 mm.	buff color	wheat, corn, and other grains	larvae & pupa live within the grain kernel	grain infested in storage or in the field
Indian meal moth	12-20 mm.	reddish-brown & gray	grains, dried fruits, nuts, powdered milk	4-6 weeks in heated buildings	often mistaken for clothes moth
Mediterranean flour moth	6-12 mm.	pale gray; black lines	milled grain flour	9-10 weeks	use flour within 2 months of purchase
Cockroaches	10-40 mm.	gray brown, reddish brown, black	many products; esp. carbohydrates (starches, glue, pastes, etc.)	2-12 months; incomplete metamorphosis	many can fly; carry many pathogens

*compiled from material in references 12 and 14.

delay the appearance of resistant strains of insects.(9,11)

The three most important cultural controls for IPM have proven to be effective sanitation, adequate ventilation (moisture and temperature control), and *timely product rotation*.(7,10,12) In most situations, timely product rotation (a result of good inventory control) is a very practical, cost-effective method often overlooked. Adequate sanitation is an essential preventive practice.(1,8) Spilled beans, corn meal, dry pet foods, and other foodstuffs must be promptly swept up and not allowed to remain in the facility. Such food sources can support insect populations which (re)infest shipments of "clean" products.(16) Torn containers should be repaired, or the contents should be repackaged. Bulk foodstuffs should be stored 12 to 18 inches off the floor to facilitate adequate cleaning.(14)

Proper ventilation is an essential requirement of dry food storage.(14) Ventilation reduces high relative humidity and excessive environmental temperatures, which are very conducive to insect propagation.(12) Ideally, maximum ventilation is achieved by three-foot access aisles, three-foot spaces between stacks/pallets and between food storage and the walls, and a two-foot clearance between stacks and the ceiling. *Screened* windows, doors, and vents should be open during relatively dry periods and closed during excessively humid weather. Cold temperatures retard insect propagation,(14) and therefore, warehouse temperatures should be as cool as possible. Most species of insects develop very slowly or not at all at low temperatures; most stages of many insects are killed by freezing, e.g. 0°F for seven days. High-value, "slow-moving", vulnerable, speciality or gour-

met items should be kept in refrigerated storage, if possible. Grain products can be placed in very low-temperature, dry storage without causing product deterioration.

The first principle in efficient warehousing of foodstuffs is: "don't store more than will be used or sold in a *relatively short time*"; followed closely by the guiding principle of stock rotation: "first in; first out." Older stock in storage may allow insect pests to complete one or more life cycles and become the source of infestation for new stocks.(16) Also, packages in storage for excessive times tend to accumulate dust, dirt, and moisture which attract and promote insect infestations. To facilitate timely rotation, all food products should be palletized and coded during storage. These procedures allow easy mechanical movements in and out of storage, promote product rotation and sanitation, and permit ade-

quate ventilation. Another desirable practice in food warehousing is isolation of newly arrived susceptible items, which can help break the chain of reinfestation within the facility.(14)

The final aspect of IPM is to prevent reinfestations, once previous problems have been eliminated. The critical tool in preventive management is surveillance, to include inspection of foods at receipt and thorough, periodic facility sanitation evaluations. *Assure* that good sanitation is practiced daily. *Examine* all vulnerable products and all parts of the building for evidence of insect activity. *Evaluate* the structural repair of facilities. In addition, building custodians, food product representatives, pest control operators, and local public health authorities can be vital links in preventive pest management if they are aware of the program.(10)

CONCLUSION:

The practice of storing foodstuffs promotes insect infestations. Some of these pests fly into storage facilities; some are in the product at harvest; some gain entry to foods during processing; and some are "imported" in shipping containers. If a warehouse provides favorable harborage, moisture, and temperatures, significant economic loss and possible human illness can result from an insect infestation. Much of this can be prevented by applying knowledge of life

cycles, sanitary practices, and chemicals employed in insect control.(12) Thorough scheduled surveillance inspections and expert warehousing/product rotation by alert and knowledgeable employees are often the most practical and effective elements in successful IPM programs. Integrated pest management programs are cost-effective but must be practiced on a continuous basis. We can not afford to ignore the practice of prevention.

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From the Editors

To all article reviewers and book reviewers for *Dairy and Food Sanitation*. Thank you for your time and effort in reviewing articles and/or books for publication in *Dairy and Food Sanitation*. We look forward to working with you in 1986. K. R. Hathaway, editor and Suzanne Trcka, Associate Editor, *Dairy and Food Sanitation*.

Public Health Concerns of Yogurt And Other Fermented Milk Products

William Smith¹
and
Homer C. Emery, Ph.D.²

The popularity of yogurt and other fermented milk products has increased in the United States. Since 1960 the U.S. per capita consumption of yogurt has more than doubled.(2). Numerous studies have indicated that the consumption of these foods may have positive health effects for the consumer, while other literature disputes these claims.

Because of the increasing consumption of yogurt and other fermented milk products, public health officials may become involved in the current debate focused on the health benefits attributed to these foods. Of additional concern to the sanitarian is the ability to determine if a fermented milk product should be considered as a potentially hazardous food. The purpose of this article is to review the microbial ecology of selected fermented milk products and to summarize current literature concerning their health benefits.

The production of fermented milk products normally involves some type of Lactobacilli. Positive health effects that have been reported from consuming these foods have been attributed to the presence of Lactobacilli or their by-products(1). Table one shows different fermented milk products consumed in various countries and the associated bacteria involved in fermentation.

Yogurt, which has become a fad health food in the U.S. has a pH of about 5.0 after initial fermentation. The pH continues to drop to 4.0 or lower and may result in objectionable tastes. Refrigeration of yogurt delays acid production thus lengthening its shelflife(7). New yogurt products that are now available for the consumer include: yogurt based mayonnaise, salad dressing, and even low calorie drinks.

While other fermented milk products have increased in popularity the per capita consumption of buttermilk has declined from 8.2 pounds in 1955 to 4.89 pounds in

TABLE 1. Summary of fermented milk products and associated bacteria.

Product	County	Associated Bacteria
Yogurt also Yoghurt, Yahourt, Yaourt, Jugut	Europe - U.S. probably originated in the Balkans	<i>Lactobacillus bulgaricus</i> <i>Streptococcus</i> <i>thermophilus</i>
Buttermilk	Europe - U.S.	<i>S. lactis</i> <i>S. cremoris</i> <i>S. diacetylactis</i>
Acidophilus milk		<i>L. acidophilus</i>
Bulgarian milk	Balkans	<i>L. bulgaricus</i>
Kefir	Poland and USSR	<i>L. caucasicus</i> <i>L. bulgaricus</i> <i>S. lactis</i>
Kumiss	Parts of USSR	<i>S. lactis</i>
Taette	Scandinavian	<i>S. lactis</i>
Lactofil		
Ymer	Denmark/Sweden	<i>S. lactis</i> <i>L. cremois</i>
Skyr	Iceland	<i>L. thermophilus</i> <i>L. bulgaricus</i>

1975(1). During the culturing process acetic, formic, and other acids develop resulting in a titratable acidity of 0.85 to 0.9%(7). Acidophilus milk, another fermented milk product consumed by the American public, has a titratable acidity of 0.75 to 0.85%. Acidophilus milk has been reported to have negative effects on the growth of *Salmonella typhimurium*, *Staphylococcus aureus*, and *Clostridium perfringens* (3).

While the current definition of potentially hazardous food includes, "any food that consists in whole or in part

¹Lieutenant Colonel, United States Air Force, Retired; Currently food-service sanitation training consultant, San Antonio, Texas

²Currently assigned as Environmental Science Officer, Maj U.S. Army, Brooke Army Medical Center, Fort Sam Houston, Texas

of milk or milk products," it excludes those foods with a pH level of 4.5 or below. The fermented milk products that have been reviewed will not fall within the definition of potentially hazardous food due to their low pH from acids formed during fermentation.

Positive health effects from consuming milk products fermented by lactic acid bacteria have been reported worldwide. Early studies by Metchnikoff, 1907-1908, in the Balkans related the consumption of fermented milks to positive health effects observed in the Balkan population(3). Current research indicates that certain lactic acid bacteria may have anti-diarrheal effects and may be able to inactivate production of staphylococcus toxins in foods. In addition, some studies have shown that the use of fermented milk products in the treatment of alcoholics may alleviate anxiety(6).

During the Third International Seminar on Lactic Acid Bacteria and Human Health(6), held in Seoul, Korea, in 1983 the following nutritional and health benefits from consuming lactic acid bacteria fermented milk products were summarized as:

- Production of enzymes assisting in pre-digest of proteins, carbohydrates, and lipids.
- Production of amino acids.
- Increase protein quality.
- Production of lactase making sugar easier to digest.
- Synthesis of B vitamins.
- Production of anticholesteremic factors preventing accumulation of cholesterol in the blood.
- Production of antibiotics.

While these health effects have been observed by various researchers, the specific mechanisms by which they occur are not clearly understood. Some studies have indicated that the increased numbers of lactic acid bacteria in the intestine are responsible for observed health effects while others dispute these claims.

Summary:

Whether or not consuming fermented milk products will result in reported positive health effects we can expect to see increasing amounts of these foods consumed in the U.S. Some public health officials may find themselves in the middle of this health debate. As new fermented milk products are introduced to the market place the sanitarian will be faced with determining if they should be handled as potentially hazardous foods. It appears that fermented milk products present little danger from pathogens with their low pH. In many parts of the world the low pH value has been used for centuries as a means of food protection without the use of refrigeration. If we are to provide adequate information to the public it will require us to focus our attention on developing research to these unique food products.

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Look for Registration Form and Program in the April Issue of this Journal

Food Antioxidants Symposium To Be Held

The Antioxidant Technical Committee of the International Life Sciences Institute - Nutrition Foundation will sponsor a symposium April 21-23, 1986 at the Loew L'Enfant Plaza Hotel, Washington, D.C. to consider the technological necessity of food antioxidants, methods for studying their activity and chemical reactions with foods, and intake levels of antioxidants from various sources. General toxicity, carcinogenicity and genotoxicity of BHA, BHT, propyl gallate, tocopherol, and TBHQ will be discussed. Speakers will address studies on mutagenicity, mechanisms of action, and tumor promotion. Major panel discussions will consider mechanisms of carcinogenicity of BHA and risk assessment associated with the use of antioxidants in foods. Internationally-recognized experts from government, academia, and industry will participate in the program.

Preregistration deadline: March 14, 1986. For additional information or registration forms, contact: Ms. Elaine Auld, International Life Sciences Institute, Nutrition Foundation, 1126 Sixteenth Street, N.W., Suite 111, Washington, D.C. 20036. 202-659-0074/872-0778.

New Training Program Should Help Make Airline Food Safer

Flight 171 seemed like an ordinary airplane flight. Right after lunch, though, something unusual occurred: about half the passengers became seriously ill. Many were hospitalized, but luckily none died. The cause of the illnesses was traced to the turkey served in flight.

Although Flight 171 is an imaginary flight that is part of a new training program available for airline catering personnel, the example of passenger illness is not imaginary.

"Food poisoning on an airplane is a possibility that exists whenever food is prepared ahead of time and served later," says Robert Gravani, a specialist in food safety at Cornell University.

Gravani and several food service specialists have just developed "*Safe Food Preparation: You're the Key!*" - a new, comprehensive, and practical training program geared to airline catering personnel. It covers the gamut of safe food handling practices in all areas of the kitchen and in transportation to the aircraft.

"With an estimated 350 million meals and snacks served annually to air travelers in the U.S. alone, and with food having to be held and transported for hours, airline food is at risk, especially if food preparation workers don't take the necessary precautions," says Gravani, an associate professor of food science in the New York State College of Agriculture and Life Sciences at Cornell.

Gravani, with six other professionals from airlines, major caterers, and the U.S. Food and Drug Administration, prepared the audio-visual training program. Underwritten by the Inflight Food Services Association, the program simulates officials identifying clues in each department of the kitchen to determine the source of the food poisoning outbreak on Flight 171.

At the end of the program, all of the clues are assembled and the causes of the outbreak are discussed. Interested and knowledgeable employees are the key to safe food preparation, and this fact is highlighted throughout the program.

More than two million cases of bacterial food poisoning occur every year, Gravani points out. Although most are not on airliners, some are and because there are more air carriers, catering firms, and passengers than ever before, proper food handling for airline passengers is essential.

"Although airline caterers have done a very good job of preparing safe and wholesome meals, the new training program will continue to make eating on board an enjoyable and safe experience," says Gravani.

Food & Dairy Expo Attracts Industry Leaders

Food & Dairy Expo '85 again earned the status as the largest and most comprehensive international trade show of its kind in the world. More than 15,700 industry leaders from 90 countries spent five productive days buying, selling, exchanging names and ideas at the only show that displays every aspect of the food, dairy and beverage processing industries. The show closed October 9 at the Georgia World Congress Center in Atlanta.

Food & Dairy Expo '85, the 44th exposition sponsored by Dairy and Food Industries Supply Association (DFISA), has a long and successful history of bringing together the industry's leading processors and suppliers and "this year was no exception," says DFISA President Robert L. Nissen of Ladish, Co., Tri-Clover Division. Nissen said processor attendance totaled 8,543, compared to 5,095

exhibitors. More than 11 percent of the total attendance was comprised of international visitors.

Exhibit highlights included computerized systems for designing facilities; food and dairy liquid packaging machines with closed environments to remove harmful air; self-contained laboratory systems with high temperature, short time sterilization (HTST) processing; antibiotic screening tests; aseptic packaging systems for wines, water, juices, dairy products, and hot beverages; route accounting computer software systems; and the unveiling of other food and liquid processing innovations.

DFISA's Food & Dairy Expo '87 will be held September 26 - 30 at McCormick Place in Chicago, Illinois. For more information on exhibiting and attending contact: DFISA at 301-984-1444; 6245 Executive Boulevard, Rockville, Maryland 20852; TELEX 908706 DFISA ROVE.

Red Lobster Vice President Receives Major Food Industry Award

C. Dee Clingman, vice president/director of quality control for Red Lobster Inns of America, was recently presented with the 1985 Food Industry Sanitarian Award by the National Environmental Health Association.

Clingman was presented with the award for "his outstanding contribution to the field of food protection and sanitation," during the association's annual meeting in Las Vegas, Nev.

Clingman, a native of Dayton, Ohio, has been responsible for developing and directing corporate product safety programs for Red Lobster, the nation's largest chain of seafood restaurants, since he joined the company in 1979.

He joined Red Lobster after serving three years as the Director of Food Protection Programs at the National Institute for the Foodservice Industry. In that capacity, Clingman researched, planned, and developed a national uniform plan for foodservice manager, sanitation training and certification.

The plan he developed was accepted by the U.S. Food and Drug Administration and has become the foundation for the industry's food and safety programs.

Clingman began working in the environmental health field after he graduated from Bowling Green State University in 1969 with a Bachelor of Arts degree in biology and psychology. From 1969 through 1972, he served as Director of the Warren County Health Department in Lebanon, Ohio, while completing work on his Master's degree in Civil and Environmental Health Engineering at the University of Cincinnati.

Between 1973 and 1976, Clingman served as Sanitarian-in-Charge of the Industry Certification Unit of the Ohio Department of Health.

Clingman's commitment to food protection and sanitation is reflected by the organizations to which he belongs.

In addition to the National Environmental Health Association, they include the International Association of Milk, Food and Environmental Sanitarians, the Institute of Food Technologists, the American Society of Quality Control, the American Public Health Association and other food industry organizations that strive to protect the public's health and well being.

Third Annual Cheese Research and Technology Conference To Be Held March 12th & 13th

The Third Annual Cheese Research and Technology Conference sponsored by the Walter V. Price Cheese Research Institute, University of Wisconsin will be held on March 12 and 13, 1986 at the Dane County Forum and Sheraton Inn and Conference Center, Madison, Wisconsin.

The Conference will feature one major topic, automated analyses for the cheese industry, plus the reports of research activities of the Institute and related topics. Research reports will include:

- Listeria and other food pathogens - E. Marth
- Optimizing milk composition for economic return - G. Kerrigan
- Cleaning and Sanitizing UF and RO systems - R. Bradley
- Flavor development in cheese made from UF-treated milk - L. Jensen
- Chemicals (surfactants) from UF permeate - C. Amundson
- White haze (crystal) formation on cheese - M. Johnson

The Thursday morning, March 13 program will feature presentation on automated analyses by Professor G. Richardson, Utah State University and Professor D. Barbano, Cornell University. Professor Richardson will give an update on and evaluation of current and future automated systems. Professor Barbano will cover the applications of selected tests and factors that must be considered in successfully using these techniques.

A review of present cheese moisture analyses procedures and the potential for standardization will be discussed also in the morning session.

An exposition of automated chemical and

microbiological analytical systems will be held Thursday PM at the Sheraton Conference Center. This will allow conference participants to observe and compare the equipment and techniques that are described in the morning session.

For more information contact: Norman F. Olson, Professor, Department of Food Science, UW-Madison, 107 Babcock Hall, 1605 Linden Drive, Madison, WI 53706. 608-263-2001.

American Travellers Alarm Medical Profession

The medical profession is becoming increasingly alarmed at the incidence of illness among Americans travelling outside the United States. This year, thirty million Americans will cross their borders for vacation or business. Out of this "travelling nation" 6,300,000 (or 21%) will experience illnesses ranging from minor irritations to serious medical conditions. For every five who experience illness, one will seek a physician's advice.

Traveller's diarrhea is the most prevalent illness, affecting half of those visiting the mainland tropics and 30% visiting the Mediterranean. The list of exotic diseases being contracted by unwitting Americans includes typhoid, viral hepatitis, malaria and schistosomiasis, to name a few.

The International Association for Medical Assistance to Travellers has been researching medical conditions that affect the traveller abroad for twenty-five years. IAMAT publishes information on the nature, prevention and geographical distribution of diseases that can be easily contracted while travelling but are rarely seen in the United States.

IAMAT compiles and distributes to its traveller members the IAMAT directory of English-speaking doctors who charge moderate fees. There is no cost for membership. Donations, which are tax-exempt, are accepted. For membership write to IAMAT, 736 Center Street, Lewiston, NY 14092. 716-754-4883.

Seminar To Focus On Foods by Mail, Catering

Seminars on foods by mail and takeout cuisine and catering, two of the most talked about subjects by food merchandisers, will be featured at the 11th Winter International Fancy Food & Confection Show.

The trade event, sponsored by the National Association for the Specialty Food Trade, will be

held at the Moscone Center in San Francisco, March 2-4, 1986.

NASFT Retailer Division chairman Bradley J. Petty of Petty's Fine Foods in Tulsa, OK, said two outstanding individuals have been selected to speak by the retailer group.

They are Maxwell Sroge, head of a company devoted to mail order marketing, including food. The firm is Maxwell Sroge Publishing of Colorado Springs, CO.

Takeout cuisine and catering will be discussed by Michael Roman, president of the National Institute for Off-Premise Catering, Chicago, IL. Mr. Roman, who also operates the Mixing Bowl, was a seminar speaker at NASFT's summer show in Atlanta, and was rated highly by the retailers who attended the standing room only session.

"This show is the industry's marketplace for new ideas, for meeting the innovators. We expect a record attendance from all sections of the U.S. and around the world," said NASFT show chairman and treasurer Earle Freedman of Jacob Hamburger Co., Inc.

He announced that NASFT director Mona Onstead of Judyth's Mountain, has joined his committee.

NASFT president John H. Hamstra of H. Hamstra & Company, said the show is expected to exceed 95,000 square feet. He said the nations exhibiting in the International Pavilion include Austria, Belgium, Denmark, France, Germany, Great Britain, India, Italy, Jamaica, Japan and the Netherlands.

Industry members can pre-register at no charge by contacting NASFT toll free 800-255-2502 or 212-505-1770. Or write Jeanne Maraz, executive director, NASFT, 215 Park Ave. South, New York, NY 10003. Registration at Moscone Center will be \$10.00.

For show information contact: Pat Dolson, Manager, IFF&CS, P.O. Box 3833, Stamford, CT 06905. 203-964-0000.

NDC Presents Statement On National Cholesterol Education Program

Representing the dairy industry, National Dairy Council (NDC) presented a scientific perspective on the National Heart, Lung, and Blood Institute's (NHLBI) National Cholesterol Education Program at a meeting sponsored by the NHLBI at the National Institutes of Health campus in Bethesda, Maryland.

Elwood W. Speckmann, Ph.D., vice president, Nutrition Research, represented NDC as a member of a food producers' panel. He discussed ways in which Dairy Council can work with NHLBI to create and

implement the National Cholesterol Education Program, and he also voiced dairy industry concerns about some dietary recommendations regarding cholesterol.

He said, "We do not believe that scientific evidence warrants that all individuals be advised to restrict their fat and cholesterol intake for optimal health; and we do not support categorizing specific food items into *good* and *bad* classifications."

High blood cholesterol is one of three major modifiable risk factors for cardiovascular disease. The National Cholesterol Education Program will inform the public about this relationship and will urge people to reduce high blood cholesterol through a variety of means including dietary changes.

NHLBI held the meeting to apprise industry representatives of the program's development and to give these representatives an opportunity to voice their perspectives on related events and trends. Among the participating organizations were National Cattlemen's Association, Grocery Manufacturers of America, Food Marketing Institute, and Pharmaceutical Manufacturers Association.

Citing NHLBI's successful National High Blood Pressure Education Program, NHLBI Director Claude Lenfant, M.D., said in a letter to NDC, "A national educational program can only be successful if it has the support and active participation of many groups, including those in industry."

Speckmann informed participants about NDC nutrition research and education programs and resources that may be useful to the National Cholesterol Education Program, including an update on fat and cholesterol in the September - October 1984 issue of *Dairy Council Digest*; a resource packet on current nutrition issues, "Contemporary Topics in Nutrition;" and a film currently under production for health professionals and consumers, "Your Body, Your Diet and Cholesterol." He then elaborated on dairy industry concerns about cholesterol education saying, "We do not think scientific evidence supports the recommendation that even healthy people without hypercholesterolemia, which comprise about 75 percent of the population, can or should further lower their blood cholesterol levels by eating fewer foods containing cholesterol and/or saturated fatty acids, and that such dietary modifications will lead to overall improved health and reduced risk of disease.

"We do not think that a food should be viewed as being an inherently *bad* food because it contains cholesterol and fat. Unfortunately, foods are being judged on the basis of a single component rather than on the kind and amount of nutrients they contain...The core of our program is to protect the nutritional integrity of a balanced diet which comprises foods from the basic food groups, including dairy foods." Speckmann concluded, "The

general public is receiving numerous and conflicting messages on diet-related behavior changes directed toward improving an individual's and the Nation's health. The National Cholesterol Education Program could provide a unique situation for private and public sector programs to unify and work together by being sensitive to the viewpoints of all interested parties."

National Dairy Council conducts programs of nutrition research and nutrition education establishing the importance of dairy foods in a healthful diet.

David Bandler Receives 1985 Emmet R. Gauh Award

David K. Bandler, professor of food science at Cornell University, is the recipient of the 1985 Emmet R. Gauh Award, the highest award bestowed by the New York State Association of Milk and Food Sanitarians (NYSAMFS).

Cited for making an outstanding contribution in the field of milk quality, Bandler has become widely known for his research on the topic. The award is in memory of Emmet R. Gauh, one of the founders of the NYSAMFS and its first president.

As the department leader for Cornell Cooperative Extension in the Department of Food Science at Cornell, Bandler assists the dairy industry in developing operational quality assurance programs.

A member of the faculty in the New York State College of Agriculture and Life Sciences at Cornell since 1965, Bandler teaches food science, milk quality, milk hygiene, and milk quality and flavor.

Bandler received the B.S. (1955) and M.P.S. (1971) at Cornell.

12th Annual Technical Seminar by ABC Research Corp. To Be Held February 24 - 26

Food Microbiology and Food Safety; An Update on Fermentation of Foods; New Food Packaging Concepts; Food Product Development; Seafood Technology; and Developing Food Technology will be the program for the 12th Annual Technical Seminar sponsored by ABC Research Corporation here February 24 - 26, 1986. Dr. W. L. Brown, ABC President, has announced the subjects and speakers for the two-day seminar.

Food Safety and Food Technology will be covered in the following areas: Update on *C. botulinum*, Dr.

Mel Eklund, Dept. of Commerce, Marine Fisheries Service, Seattle, Washington, Salmonella in Cooked Beef, Mr. Ralph Johnston, Microbiology Division-Science, USDA, Washington, D.C.; Listeria and Campylobacter in Foods, Dr. Michael Doyle, Food Research Institute, Madison, Wisconsin; Prevention of Microbial Problems, Dr. John M. Goepfert, Canada Packers, Toronto, Canada.

Update Food Fermentation: New Fermentation Technology, Dr. Alastair Pringle, Anheuser-Busch, St. Louis, Missouri; Genetic Manipulation to Improve Food Fermentation, Dr. William E. Sandine, Oregon State University, Corvallis, Oregon.

New Packaging Concepts: New Packaging Equipment, Dr. Richard Saunders, Liquid Air Corp., Countryside, Illinois; Modified Atmosphere Packaging, Dr. Donald A. Kautter, Food and Drug Administration, Washington, D.C.

Food Product Development: Meat and Poultry Products, Dr. David Theno, Foster Farms, Turlock, California; Extruded Products, Mr. Don Wenger, Wenger Manufacturing, Kansas City, Missouri.

Seafood Technology: Surimi Manufacturing and Application, Mr. Kent Holt, Ralston Purina, St. Louis, Missouri; Sulfite Issue, Dr. Steve Otwell, University of Florida, Food Science Department, Gainesville, Florida.

Developing Technology: Food Irradiation Update, Dr. Neil Neilson, Emergent Technologies, San Jose, California; Rapid Microbial Methods - DNA Hybridization, Mr. Patrick Connoy, Integrated Genetics, Farmingham, Mass.

For further information contact: Sara Jo Atwell, ABC Research Corporation, P.O. Box 1557, Gainesville, Florida 32602. 904-372-0436.

3M Receives Another Award for Technological Advances of Year

3M's Petrifilm Plates received the prestigious IR-100 Award for technological innovation. This is the 23rd time in 22 years that a 3M product has been judged one of the 100 most significant technological advances of the year.

The IR-100 Award, sponsored by *Research & Development* magazine, was accepted by Allen F. Jacobson, 3M President, U.S. Operations, at a formal banquet at Chicago's Museum of Science and Industry. 3M will exhibit its winning product at the museum for the next month, along with other winners.

Petrifilm Plates are an alternative to standard laboratory pour plates to test for the presence of

bacteria in the dairy, meat, fish, vegetable, processed foods and restaurant industries. The standard pour plate technique uses Petridishes, agar and bacterial growth nutrients. The technique has not changed substantially in 100 years.

3M's Petrifilm Plates utilize a standardized growth medium and guar, a cold water soluble replacement for agar, coated between two layers of film. Since the agar is eliminated, Petrifilm Plates require no preliminary preparation, which allows samples to be easily plated on site as well as in the laboratory. The plates produce consistent results regardless of the user's technical skill.

The plate is inoculated by lifting the top film, pipetting 1 ml. of sample to the bottom film and rolling the top film back down. A spreader is used to distribute the sample. The sample is then incubated in a similar manner to standard pour plates.

For more information about Petrifilm Plates, write to 3M/Microbiology Products, Department ME85-27, P.O. Box 33600, St. Paul, MN 55133.

Alfa-Laval Gets \$320-Million Unigate Dairy Contract

Unigate Dairies Ltd. signed a \$320-million contract with Alfa-Laval on September 10 for supplying all processing equipment to a new dairy at Wood Lane, Shepherds Bush, London. This new facility will be the first dairy in the United Kingdom to be dedicated exclusively to the production of milk in non-returnable containers.

The order includes pasteurizers, homogenizers, reception and storage tanks, and valves and piping for processing a number of different milk and cream varieties. Also included in the contract are associated service units such as refrigeration, steam generation, air compression, electricity, and water treatment. The plant will be equipped for cleaning-in-place throughout.

The entire plant will be controlled by Alfa-Laval's proprietary Alert 500 automation system including the new Alert 50 analog microprocessor. The plans provide for the future addition of Alfa-Laval's Alcom software package for management information.

The contract involves demolition of the existing dairy and construction of a new 64,800 sq. ft. processing and packaging building. Also included is a 22,500 sq. ft. distribution depot with associated offices.

Alfa-Laval Co. Ltd. of Brentford, Middlesex is the main processing contractor. Longley & Co. is building contractor and Tetra-Pak is packaging con-

tractor.

Centerpiece of the processing facility will be two identical pasteurizing lines, each with a capacity of processing 5,000 U.S. gal. of milk per hour. Cream processing capacity is 2,200 U.S. gal. per hour.

Milk for the processing lines may be routed to any of the eight finished milk storage tanks. The SRC valves are equipped with Alfa-Laval's Altop valve control system which is interfaced with the main operator computer control console.

The new facility is scheduled for completion in the Spring of 1987.

Alfa-Laval's U.S. headquarters is at 2115 Linwood Ave., P.O. Box 1316, Fort Lee, NJ 07024.

Less Sugar, More Sweeteners

Consumers may be developing a false sense of security about reducing sugar in their diets, says a Texas A&M University Agricultural Extension Service nutritionist.

"More people are reading food labels to see if sugar is listed among the top three ingredients," says

Dr. Alice Hunt. "They tend to see these as high-sugar products, and avoid them."

Hunt says there are two problems with this shopping strategy.

"Mostly for economic reasons, food manufacturers are using many other forms of sweeteners, such as corn syrup, high fructose corn syrup, honey, molasses, sucrose, dextrose and maltose," she explains. "So consumers need to recognize all forms of sweeteners when they are listed on labels."

"Food manufacturers may also use more than one type of sweetener in a food product," says the nutritionist.

"This means the sweeteners may be placed far down on the ingredients list," Hunt notes, "because smaller amounts of each type are used."

"But if all the different sweeteners used in the product were added together for one listing, it would be near the top of the ingredients list," the nutritionist points out.

U.S. Department of Agriculture figures show that the per capita consumption of sweeteners is going up, even though the consumption of sugar is going down, reports Hunt.

Since these sweeteners have about the same calories as sugar, weight-conscious consumers should watch their intake of these products, just as they would be concerned about sugar, she advises.

NOTICE

The 3-A Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products, Part I, Number 08-17 have been separated into individual standards for fittings, valves, automatic samplers, and rupture discs. This is not a revision of the original 08-17. There has been no change in the Part I specifications nor in Part II.

Copies of these new individual standards are now available. In requesting copies of the new individual standards, specify by the following designation.

- 08-17 - Fittings and Plug Type Valves
- 08-17A - Compression-Type Valves
- 08-17B - Diaphragm-Type Valves
- 08-17C - Boot Seal-Type Valves
- 08-17D - Automatic Positive Displacement Sampler
- 08-17E - Inlet and Outlet Leak-Protector Type Valves
- 08-17F - Tank Outlet Valves
- 08-17G - Rupture Discs

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

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New Product News

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



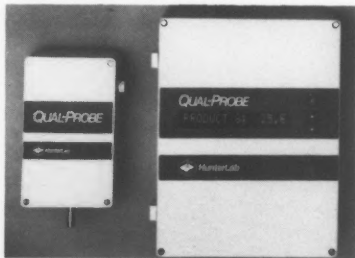
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For more information, write or call collect: A. G. Chemicals, Inc., 215 East 79th Street, New York, NY 10021. 212-249-0444.

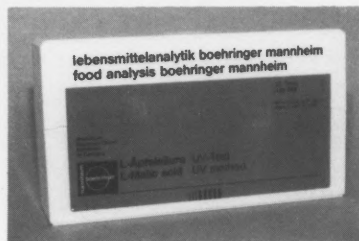
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Qual-Probe by Hunter Lab

In-Process Color Monitoring System Introduced

• HunterLab's Process Monitoring and Control (PMC) Division has announced the introduction of QUAL-PROBE[®], an automatic, in-process color measurement system. QUAL-PROBE improves the user's ability to obtain consistent color depth in the production of processed foods, including baked goods, snacks, cereals, confectionary products and beverages. The system enables the user to monitor and control color and color-related properties faster



Test kit from Boehringer Mannheim Biochemicals

L-Malic Acid Test Kit Now Available

• A test kit for the enzymatic determination of L-Malic Acid in a variety of materials is now available from Boehringer Mannheim Biochemicals. Utilizing the enzymes Malate dehydrogenase (MDH) and Glutamateoxaloacetate (GOT) in a NAD⁺/NADH coupled procedure, the kit contains all reagents necessary to assay 25-50 samples.

With this kit, L-Malic acid may be determined quickly and accurately with minimal sample preparation and set-up time. Intensely colored liquids having very low levels of malic acid (<0.02 g/l) may require decolorization prior to assay. Working procedures for sample preparation in a variety of foods, and for the differentiation between free and esterified L-Malic Acid are available.

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

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and with more precision than has been previously possible.

QUAL-PROBE combines a solid-state fiber optic sensor, with a compact wall-mounted operator station. Both components of the system are designed to withstand the hostile environments of the factory. They meet scrub-down requirements, NEMA/IP standards and are not affected by heat, humidity or vibration. These features contribute to QUAL-PROBE's outstanding accuracy, stability and reliability.

The sensor is positioned above the product as it exits the process line and can be mounted either in a stationary position or on a traversing assembly. This positioning flexibility allows the user to tailor the system to conform to varying product sizes, shapes and flow patterns. The operator station is designed for simplicity of use and can support up to three sensors, for use on separate production lines, or for monitoring top and bottom color on the same line. The operator station allows permanent storage of previously determined color standards and acceptable limits (tolerances) for each product. It displays a single number to

Microbial Media With MUG

• GIBCO Laboratories offers various media formulations containing 4-Methylumbelliferyl-B-D-glucuronide (MUG) for faster identification and enumeration of *E. coli*.

Most strains of *E. coli* produce B-glucuronidase, an enzyme that hydrolyzes MUG to a fluorescent compound, causing the media to fluoresce under longwave UV light. Fluorescence with gas production (in tubed broth) or characteristic colony color (on VRBA) indicates the presence of *E. coli*. These reactions occur within 24 hours or less, thus saving the Q.C. microbiologist valuable time. MUG has been incorporated into EC Broth, Brilliant Green Bile Broth 2%, Lauryl Tryptose Broth, and Violet Red Bile Agar, all of which are available as dehydrated media. In addition, tubed Lauryl Tryptose Broth with MUG with a fermentation tube is also available.

For more information about this product and other GIBCO products, contact: GIBCO Laboratories, 2801 Industrial Drive, Madison, WI. 800-652-7268 (in WI) or 800-356-7204 (out of state).

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Walk-In Coolers And Freezers

• Newly released literature describing Walk-In Coolers and Freezers is now available from Moore & Hanks Co.

For more information contact: R. F. Horak, Moore & Hanks Co., 9702 E. Rush Street, South El Monte, CA. 91733-1778. 818-443-9337

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represent the color value of the product. The operator station can also send process information to and from a host computer, drive an automatic closed-loop system and provide trend information when connected to a strip chart recorder.

QUAL-PROBE increases profits by reducing materials waste and decreasing the amount of time required for production start-up and changeover. The system enables the processed foods producer to achieve unsurpassed levels of product color control, consistency and quality.

For more information contact: Hunter Associates Laboratory, Inc., 11495 Sunset Hills Road, Reston, VA 22090. 703-471-6870.

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Before



After

New Sealing And Coating System For Concrete Floors

• Signed, Sealed & Delivered®, a supplier and applicator of polymer plastic coatings, is now offering a uniquely guaranteed floor coating system designed to seal, protect and beautify concrete floors. Typical installations include such heavy-use areas as food processing facilities, industrial plants, warehouses, automotive service centers and airplane hangars.

All SS&D coating systems offer high resistance to abrasion, chemicals, acids, solvents, detergents and hot water. They also help eliminate two problems common to unsealed concrete floors: 1) "dusting," or the tendency of concrete to release dust in the air, which can badly contaminate foods and other sensitive products, and 2) the build-up of dirt and grease in the pores of unsealed concrete, which creates an ideal environment for the growth of mold and bacteria. In short, SS&D coating systems provide a smooth, non-absorbent, dust-free and sanitary floor that is easy to clean.

Special coating formulations and combinations are available for those customers requiring additional protection against highly corrosive acids and chemicals. For food processors and manufacturers of sensitive products, Signed, Sealed & Delivered® also offers several FDA and USDA - approved systems that emit no solvent fumes and therefore present no danger of contamination during their application and cure.

For more information contact: Edmond V. Russ, Signed, Sealed & Delivered®, 1881 Commerce Drive, Suite 109, Elk Grove, IL 60007. 312-640-6350.

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Dairy Research Foundation Announces New Grants

• Dairy Research Foundation received approval for funding of more than \$460,000 from the National Dairy Promotion and Research Board (NDPRB). The grants will support seven product and process research projects over a three-year period.

To begin in 1986, projects consist of six basic research studies at land grant universities and a national workshop on product/process research opportunities for the dairy food industry.

Dairy Research Foundation, a division of Dairy Research Inc., (DRINC) that is administered by National Dairy Council (NDC), also conducts symposia, funds grants-in-aid through United Dairy Industry Association, recognizes outstanding dairy research through an awards program, and provides technical information to the industry. According to Dairy Research Foundation's Manager Joseph A. O'Donnell, Ph.D., "Dairy industry support of basic research, such as these new grants funded by the National Dairy Promotion and Research Board, builds a pool of researchers who are experts in dairy products. It insures continuing development and improvement of products and processes."

"Dairy Research Foundation is now actively encouraging non-traditional dairy food scientists to turn their attention toward product research," said M. F. Brink, Ph.D., NDC president.

"Dairy farmers have recognized the need for and committed themselves to a broad research effort that will ultimately make dairy products even more competitive in the marketplace," said NDPRB Chief Executive Officer Joe Westwater. NDPRB is already funding 19 basic research projects designed to lead to improved or new product and processing methods.

In one project, David M. Barbano, Ph.D., Cornell University, will try to determine the exact relationship between somatic cell counts in milk and cheese yield. This will help dairies

set the precise economic value of high quality (low cell count) milk for making premium payments to farmers.

A. Morrie Craig, Ph.D., of Oregon State University will study a toxin in groundsel, a weed common in silage in the Northwest. The toxin is known to cause liver disease in many animals, including humans. He will look for the toxin's effects on cows and whether it passes into milk.

The study by Peggy M. Foegeding, Ph.D., North Carolina State University, will examine bacterial spore processes to help find ways to control them to improve food preservation. Her research could form the basis for long shelf life, non-refrigerated dairy products, such as cheese foods.

John E. Kinsella, Ph.D., of Cornell University will look for ways to control the adverse effects of heating on nonfat dry milk. Controlling factors in drying milk will enable the industry to produce nonfat dry milk that is much easier to use in making cheese, cottage cheese, yogurt, and baked goods.

Thomas Richardson, Ph.D., University of California, will use genetic engineering techniques to produce altered caseins in milk, ultimately to change the flavor and texture of dairy products, particularly cheese, made from such milk.

Research by R. L. Richter, Ph.D., Texas A & M University, will look at the role of starter bacteria in development of flavor and aroma in Cheddar cheese. This information might be used in the future to control or accelerate aging of cheese.

Dairy Research Foundation is a division of Dairy Research Inc. which is the product and process arm of the dairy industry. United Dairy Industry Association, with the combined efforts of American Dairy Association, Dairy Research Inc. and National Dairy Council, conducts a total promotional effort for U.S. - produced dairy foods funded by dairy farmers.

For more information contact: Mary Payne, United Dairy Industry Association, Dairy Center, 6300 North River Road, Rosemont, IL 60018. 312-696-1860.

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Monarch Introduces New General Purpose Cleaner

• A new improved Liquid *Sep-Ko*® general purpose cleaner has been introduced by the Monarch Division of H.B. Fuller Company. Improved Liquid *Sep-Ko* cleaner is suitable for applications in home, farm, and food and dairy processing plants.

Liquid *Sep-Ko* general purpose cleaner has been reformulated by Monarch to provide more foaming strength with greater stability. The thicker, creamier texture of new Liquid *Sep-Ko* cleaner is suitable for manual cleaning operations from dishes to equipment exteriors.

Improved detergency on grease and fat make Liquid *Sep-Ko* cleaner excellent for dirty chores ranging from pots and pans to trucks. It rinses freely in cold water without streaking or leaving a residue. Liquid *Sep-Ko* cleaner is compatible in acid or alkaline foam cleaning systems.

For more information on new Liquid *Sep-Ko* cleaner and other members of the family of quality cleaning and sanitation chemicals developed by Monarch, contact: Marketing Manager, Monarch Division, H.B. Fuller Company, 3200 LaBore Road, Vaden Heights, MN 55110. 612-481-1588.

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Food Science Facts

For The Sanitarian



Dr. Robert B. Gravani
Cornell University
Ithaca, NY

Food Deterioration And Spoilage Caused By Light

A wide variety of foods can undergo changes in color, flavor and nutrient composition when exposed to light. The extent of these changes depends on many factors including the composition of the product and the light source. Not all types of natural or artificial light are equally absorbed or equally destructive. The effects of light on a variety of foods will be discussed.

Milk

Increased interest in the nutritional quality of foods has led to concerns about the packaging and handling of milk due to its light sensitivity. Milk is merchandised in retail stores under high intensities of light that can cause considerable photodegradation of milk constituents. This exposure can result in distinct flavor changes as well as the loss of added Vitamin A, Riboflavin and Vitamin C (ascorbic acid).

The off-flavors that develop in milk on exposure to light are called "sunlight" flavors that result from the breakdown of amino acids and proteins. Another type of light-induced off-flavor in milk is called "oxidized" flavor. This defect occurs when unsaturated fatty acids in milk lipids undergo oxidation.

The light-induced changes in milk depend on the intensity of the light, the type of container, milk composition, agitation and several other factors. Loss of quality is most rapid in clear glass, polycarbonate containers and polyethylene jugs. The use of opaque fiberboard containers offers almost complete protection against light. Pigmented plastic containers can also protect against light. Currently, some companies are using either white opaque or cream colored plastic jugs to protect the quality of their milk.

Milk in polyethylene containers showed a 90% reduction in added Vitamin A after twenty-four hours of exposure to fluorescent light. The loss of Riboflavin under the same conditions was much slower; an 8% loss in Riboflavin was observed after twenty-four hours of expo-

sure. The light-induced destruction of both these nutrients increase as the fat content of the milk decreases. In addition, milk exposed to light also shows a significant drop in Pyridoxine, Vitamin B₁₂ and Vitamin C.

Meats

Fresh meats that are exposed to oxygen usually have a desirable, cherry red color. When exposed to visible light for long periods, the pigment at the surface of the meat is slowly changed to a brownish gray color. Ultraviolet light causes a rapid fading of fresh meat color as well as accelerating the development of rancidity in the meat fat.

Cured meats like ham and luncheon meats undergo a more rapid light-induced color change than do fresh meats. Cured meat contains nitrite which combines with natural meat pigments to give these products their characteristic pink color. On exposure to light in the presence of oxygen, these nitroso-compounds are converted to a brownish gray color. This undesirable color is called light fading and it can be prevented by vacuum packaging the meat, packaging it in oxygen impermeable films or by using opaque packaging materials.

Fats and Oils

Exposure to sunlight and/or fluorescent light accelerates the degradation of vegetable oils, butter, lard and similar products. Light appears to accelerate the autoxidation of fats and oils, resulting in flavor and odor changes. It is thought that light-absorbing compounds in these foods sensitize them to visible and ultraviolet light. Fats and oils have different sensitivities to light depending on their composition, the different amounts and types of sensitizers present and the protective effect of other constituents.

Beer and Wine

When beer is exposed to light, it develops an undesirable flavor (and odor) called "sunstruck" flavor. This is why most beer is bottled in dark containers. The light-induced flavor is caused when constituents of the hops used

to make the beer react with breakdown products of sulfur containing amino acids. The resulting compounds are responsible for the "sunstruck" flavor. One company has developed a unique process to prevent sunstruck flavor and has successfully packaged beer in clear bottles.

Light often causes color changes in wine and that reduces consumer acceptance. The sensitivity of wines depends on the type of wine and the color of the bottle it is packaged in.

Snack Foods

Snack foods (like potato chips), prepared by deep fat frying in oils are susceptible to photodegradation and develop off-odors and off-flavors on exposure to light.

Snack foods in opaque packages retain their quality longer than those packaged in clear, polyethylene bags.

There are only a few classes of foods that are susceptible to the action of light. There are several things that can be done to reduce the photodegradation of foods; the food industry can:

- reduce the exposure of sensitive foods to light;
- package foods in selectively absorbant or opaque packaging materials;
- reduce the oxygen concentration to very low levels;
- decrease the level of light in display cases;
- choose lights that have low photochemical activity.

By following some of these recommendations, shelf-life can be improved and product quality can be maintained for longer times.

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Dairy Quality

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

IMPLEMENTATION OF A QUALITY MANAGEMENT SYSTEM

PART III

The November 1985 *Dairy Quality* defined a Quality Management System (QMS) as a system dedicated to improving product quality and corporate profits. The December 1985 *Dairy Quality* article discussed the planning and organizing necessary before implementation of a QMS. It pointed out the necessity of establishing goals or objectives based on specifications and establishing timetables for development and implementation of policies, procedures, budgets, and other elements necessary to carry out a successful processing operation. This month's *Dairy Quality* discusses the steps of implementation of a QMS.

1. Policy

Successful implementation of a QMS requires that a strong corporate policy be established for quality. This policy is a mandate from a chief executive officer to implement the QMS. Without a policy document, which represents management's commitment to the objectives and goals outlined in the QMS, efforts involved in implementing the QMS will result in a frustrating and less than totally effective program. The document should be succinct and communicate management's intent and commitment to achieving improved quality and increased profits. Suggested items in the policy statement include: 1) the intent and purpose of the policy, 2) objectives and goals of the QMS, 3) implementation procedures, and 4) responsibilities of departments and personnel. The document should be well written, one to two pages in length, and may be supplemented with organizational charts, progress charts, procedure and policy statements concerning processing, ingredients, distribution, and other factors.

2. Process Control System

Based on Hazard Analysis Critical Control Point (HACCP) concepts, critical control points within the process should be identified and appropriate measures and procedures be developed to verify their control. Examples of critical control point procedures might include: 1) mea-

surements of temperature or other quality parameters affecting raw materials, 2) time-temperature measurements at critical processing points throughout the manufacturing, 3) selection of frequency and evaluation of adequacy of cleaning and sanitizing procedures, 4) documentation of written procedures for formulation, and 5) cataloging all distribution for product. All control procedures should be described by listing potential problems, specific control procedures, frequency of measurement, required documentation and responsibility for reporting any deviations.

3. Documentation of the Cost of Quality

A comprehensive accounting system should be developed and implemented to effectively establish the cost effectiveness of the QMS. The system will monitor prevention cost, appraisal cost, and, most importantly, product and process failure costs. The overall effectiveness of the QMS should result in the reduction in the cost of quality. Although prevention or appraisal costs might increase, product or process failure costs should be reduced to a greater extent resulting in an overall reduction in the cost of quality.

4. Communications, Training, and Employee Participation and Commitment

A concentrated effort should be extended to inform all employees of the goals of the QMS and the progress made towards improved quality. The employees' commitment to improve quality should be continuously measured and encouraged. Employee participation and commitment can only occur with effective communications and training. Training must include all members of the labor force as well as management. The QMS requires budgeting of time and other resources necessary for training employees with specific skills for specific tasks such as sanitation, process operations, product evaluations, and other essential activities.

5. Alternative and Contingency Plans

Throughout the implementation of a QMS, alternative and contingency plans should be developed, refined, and evaluated. It is essential that the program be flexible to respond to changing needs, demands, regulations, supplies, and objectives. Efficient modifications and redirections are not possible without contingency plans.

In summary, successful implementation of a Quality Management System starts with developing and communicating a company policy concerning quality. Next, policies and procedures concerning control systems for ingredients, processing, and distribution are set into effect and documented. The effectiveness of the QMS is measured by product conformance to specifications and reduced cost of quality. Necessary elements to assure an effective QMS are communications, training, and employee participation and commitment.

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NATIONAL MASTITIS COUNCIL

What Bacteria Do Once in the Udder

Bacteria enter the true interior of the udder by overcoming the natural defenses provided by the teat duct. The organisms penetrate into the udder cistern and large ducts and multiply. Then they probably are carried through the duct system to milk-producing tissues by milk currents in the udder which result from physical movement such as when a cow walks or lays down.

The ability of bacteria to stick to tissues in the udder helps prevent the organisms from being flushed out during milking.

You are money ahead to prevent bacteria from establishing udder infections. As a result of infection, damage is done to milk-producing (alveolar) tissues and that is what decreases yield. The damage to alveolar cells may be caused by toxins produced by bacteria, the by-products of inflammation (white blood cells and their products), or both.

The milk-producing cells react to infection by changing to a non-secretory state and/or by degenerating, leading to a decrease in milk synthesis.

The dynamic nature of mastitis is evident during subclinical, chronic mastitis characterized by a constant infection and reinfection of isolated areas of a quarter. In mild cases, damaged secretory tissue may redevelop secretory potential or perhaps the remaining healthy tissues compensate for damaged cells. However, the inflammatory response is most often associated with subsequent reduction in yield for that lactation.

In peracute cases of mastitis, the bacterial toxins are believed to cause such widespread necrosis of tissue that the affected quarter is lost for future milk production.

This article is one of a continuing series made available by the National Mastitis Council. For additional information, contact the NMC, 1840 Wilson Blvd., Arlington, VA 22201.

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703-243-8268

**25th ANNUAL MEETING
OF THE
NATIONAL MASTITIS COUNCIL, INC.**

**FEBRUARY 10-12, 1986
HYATT REGENCY COLUMBUS
COLUMBUS, OHIO**

February 10, 1986

Monday

NMC Committee Meetings

February 11, 1986

Tuesday

11:00 NMC Annual Meeting - *Presidential Address and Review of Planning Meeting*, President NMC, E. H. Row

REVIEW OF IDF SEMINAR

11:45 AM *Progress in mastitis control*, F. H. Dodd
12:20 PM Lunch
1:20 PM NMC Business Meeting - Session Chairman, R. J. Harmon
2:00 PM *Diagnosis of mastitis*, D. W. Schultze
2:30 PM Discussion
2:35 PM *Practical measures of control*, K. L. Smith
3:00 PM Discussion
3:05 PM *Role of milking machine in mastitis*, T. W. Smith
3:30 PM Discussion
3:35 PM Break - Session Chairman, Ted Hickerson
4:00 PM *Development of natural defense mechanisms*, S. C. Nickerson
4:25 PM Discussion
4:30 PM *Genetic aspects of mastitis*, G. E. Shook

RESEARCH UPDATE

4:45 PM *Hydraulic milking*, F. H. Dodd
5:00 PM *Predipping*, J. W. Pankey
5:15 PM *IMD update*, M. J. Paape

February 12, 1986

Wednesday

DIAGNOSING A PROBLEM HERD

Session Chairman, Dale Termunde

8:30 AM *Description of herd and determining if it has a problem*, R. P. Natzke
8:50 AM *The use of cell counts to pinpoint potential problems*, A. N. Bringe
9:20 AM *How to utilize the mastitis laboratory*, D. F. Wesen
9:50 AM *Analysis of the herd hygiene*, D. G. Rollins
10:15 AM Break
10:35 AM *Looking at potential treatment problems*, D. Reed
11:05 AM *Checking the milking equipment in the herd*, S. B. Spencer
11:20 AM Discussion
11:40 AM *Mastitis control - areas for potential research progress*, F. H. Dodd

Trichinosis Surveillance, 1982

Introduction

Humans contract trichinosis by ingesting meat containing the encysted larvae of *Trichinella spiralis*. Clinical signs and symptoms are usually associated with exposure to a large inoculum of larvae and include fever, myalgia, periorbital edema, petechial hemorrhage, eosinophilia. The disease can be fatal. Pork is the primary source of infection for humans; however, in recent years bears and other wild game have emerged as important sources of human disease. From 1947, when CDC surveillance activities for trichinosis began, through 1982, 7,627 cases of trichinosis were reported in the United States.

Results

In 1982, 95 cases of trichinosis in the United States were reported to CDC. There were 11 common-source outbreaks, which accounted for 36 (38%) of the total cases. There were no deaths reported, although the case-fatality ratio for the past 5 years (including 1982) has been 6.3 deaths/1,000 cases.

Geographic Distribution

Twenty-one states reported cases of trichinosis in 1982; however, 75% (71) of the cases were from eight states (New Jersey, Pennsylvania, Maryland, New York, Massachusetts, Illinois, Hawaii, and Colorado). The largest number of cases (23) were reported from New Jersey, but the states with the highest annual incidence were Vermont and Hawaii, with 5.8 and 5.0, cases/million population, respectively.

Temporal Distribution

The only consistent seasonal pattern for trichinosis in the United States has been a peak in December and January, often related to common-source outbreaks associated with home-made pork sausage prepared for the Christmas Holidays. In 1982 the incidence peaked in January, coincident with two common-source outbreaks in New Jersey involving 11 cases.

Source of Infection

The types of meat products implicated at the source of trichinosis in 1982 were known for 82 of the 95 cases. Pork products were implicated in 71 (86%). Of 66 cases for which the type of domestic pork product was specified, 46 (70%) involved sausage.

Nonpork products were implicated in 11 cases (13%). Ground beef was identified as the probable source of infection for four cases. Since cattle are strictly herbivorous and therefore not considered a natural reservoir of *T. spiralis*, it is probable that the ground beef was adulterated with pork. Infected bear meat was the source for seven cases in six states (Alaska, Idaho, New Hampshire, New York, Oregon, and Vermont).

The place where the incriminated meat was obtained was reported for 76 cases. For 47 (60%) of these cases, the source was a supermarket, butcher shop, or other commercial outlet. Ten (13%) patients had consumed the incriminated meat items at a restaurant or other public eating place. Feral swine and bears obtained by hunting accounted for 12 (16%) cases. Seven

(9%) cases were caused by pork from swine obtained directly from farms.

The method of cooking the incriminated meat was reported for 81 cases. For 57 (70%) of these, the meat had not been cooked. Reports on the other 24 cases indicated that the meat had been cooked (although apparently inadequately). Samples of the meat items believed responsible for 26 cases were examined by investigators for the presence of *T. spiralis*, and larvae were identified in 22 (85%).

Discussion

A recent review of trichinosis surveillance data for 1947-1981 discussed in detail the decline in the number of cases of trichinosis in the United States from >400 cases/year in 1947 to <150 cases/year observed over the last decade. Multiple factors account for this decline, most of them unrelated to planned trichinosis control measures. They include state and federal laws against feeding hogs raw garbage, which often contains the *Trichinella*-infected remains of livestock game animals, or rodents.

These laws, which were designed to prevent the spread of highly contagious and economically devastating swine viral diseases, have also had an unplanned role in reducing trichinosis in swine. In addition, the widespread commercial and home freezing of pork, which kills trichinae, and increased consumer awareness concerning the need to cook pork products adequately have contributed to the reduction of this parasitic disease in the United States.

While proper curing of sausage destroys *Trichinella* larvae, making further preparation of the meat unnecessary, small processors and householders who prepare their own sausage are not always aware of established standards for the proper curing and cooking of pork products. Furthermore, the stamp "U.S. Inspected and Passed" on fresh raw pork products does not guarantee that the product is free from infective *Trichinella* larvae. U.S. Department of Agriculture specifications require that "ready to eat" pork products have been processed in a manner capable of destroying *Trichinella spiralis*. Methods specified in the regulations include heating, freezing, and curing procedures. The National Pork Producers Council recommends that pork roasts be cooked to an internal temperature of 170°F (77°C).

Selected Bibliography CDC. Trichinosis Surveillance. 1981. In: CDC *Surveillance Summaries* (published four times a year). May 1983; 32 (Suppl. 2):155S-225S.

CDC. Trichinosis Surveillance report - annual summary. 1980. Atlanta: CDC, October 1981. CDC *Surveillance Summaries*, 1984; 33 (No. 25S).

Reported by F. O. Richards, Jr., M.D.; Peter M. Schantz, D.V.M., PhD; and Emily S. Chrisholm, M.P.H., Helminthic Diseases Branch, Division of Parasitic Diseases, Center for Infectious Diseases.

Rocky Mountain Spotted Fever - United States, 1984

For 1984, a provisional total of 847 cases of Rocky Mountain spotted fever (RMSF) in the United States was reported to the

MMWR, for an incidence rate of 0.36 cases per 100,000 population. Oklahoma had the highest incidence rate (119 cases; 3.6/100,000). Other states with high RMSF rates were North Carolina (178 cases; 2.9/100,000), South Carolina (80 cases; 2.4/100,000), Arkansas (28 cases; 1.2/100,000), Tennessee (49 cases; 1.0/100,000), Montana (8 cases; 1.0/100,000), Virginia (48 cases; 0.9/100,000), and Georgia (48 cases; 0.8/100,000).

States submitted case report forms for 717 (85%) of the cases reported to the MMWR. Of the 717 cases, 399 (56%) were confirmed either by serologic testing, isolation of spotted fever group rickettsia, or fluorescent antibody staining of biopsy or autopsy specimens. The other 252 diagnoses (35%) were supported by clinical findings alone. Ninety-six percent of the patients became ill between April 1 and September 30.

Like that of previous years, 1984 surveillance revealed that 51% of the patients were under 20 years of age; 61% were male; and 91% were white. Symptoms reported included: fever (96%), headache (90%), myalgias (86%), rash (84%), and rash on the palms of the hands or on the soles of the feet (61%). Seventy-five percent of the patients were hospitalized. Sixty-six percent of patients for whom exposure information was available reported a tick bite within 14 days of onset of illness. The case-fatality (3.6%) was higher for older individuals and for persons not receiving treatment with either tetracycline or chloramphenicol. Of the 613 patients from whom information about treatment and clinical outcome was available, only 13 (2%) received neither chloramphenicol nor tetracycline. Of these 13 patients, three (23%) died, compared with 16 deaths (3%) among the 600 patients who received treatment with chloramphenicol or tetracycline. For persons 30 years of age or older, the case-fatality rate was 6.5%, compared with 2.0% for individuals under 30. - Reported by Div. of Viral Diseases, Center for Infectious Diseases, CDC.

Editorial note: RMSF, the most commonly reported rickettsial infection in the United States, is transmitted to humans by ticks. The incidence of infection begins to increase in April and is highest in May and June.

After the rapid increase in RMSF noted in the United States during the 1970s, infection rates remained approximately the same from 1977 through 1981, when a decrease in the number

of cases began. In 1984, 25% fewer cases were reported than in 1983, and all states reporting over 10 cases in 1984 reported either a decrease or no change in number of cases from 1983. This decrease occurred in both of the major foci of RMSF in the United States, the West South Central and South Atlantic states. The West South Central states reported 45% fewer cases, and the South Atlantic states, 18% fewer cases. The reason for the decrease in RMSF is not known but does not seem attributable to reporting artifact. The decrease was widespread geographically, occurred in both the cases reported to the MMWR and in cases reported by case report forms, was distributed uniformly over the April 1 - September 30 period, and occurred in the absence of any changes in the reporting system. The decrease may be part of a cyclic pattern of RMSF incidence that appears to be occurring for the second time since reporting began in 1920.

Laboratory confirmation of a clinical diagnosis of RMSF by serologic or other methods remains important in distinguishing RMSF from other diseases with similar clinical presentations, even though treatment frequently precedes confirmation. Laboratory confirmation is also important for improving the specificity of national RMSF surveillance. The importance of obtaining serologic confirmation of clinically diagnosed cases has been reinforced by a recent study that showed at least 36% of clinically diagnosed cases in an endemic area were found not to be RMSF when serologic testing was performed.

No vaccine against RMSF is currently available; RMSF is best prevented by inspecting persons who may have been exposed to ticks. If discovered, ticks should be removed by grasping them with tweezers as close as possible to the point of attachment and pulling slowly and steadily. Fingers, protected with facial tissue, may be used when tweezers are not available. Because ticks' secretions can be infective, hands should always be washed after removal of ticks. Particularly during the spring and summer months in RMSF-endemic areas and during the 3-12 day period after bites or exposures to ticks, RMSF should be considered and medical treatment sought by any individual who develops fever, myalgia, or headache, even in the absence of rash. Failure to treat cases with tetracycline or chloramphenicol, particularly early in disease, remains a risk factor for deaths from RMSF. MMWR 4/12/85

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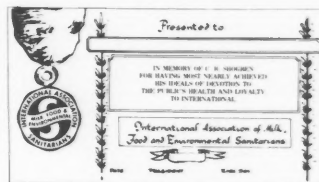
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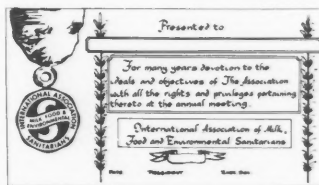
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Abstracts of papers in the January Journal of Food Protection

To receive the Journal of Food Protection in its entirety each month call 515-232-6699, ext. A.

Determination of Bacterial ATP Levels in Raw Milk: Selectivity of Non-Bacterial ATP Hydrolysis, Daniel P. Theron, Bernard A. Prior and Pieter M. Lategan, Department of Microbiology, University of the Orange Free State, P.O. Box 339, Bloemfontein, South Africa 9300

J. Food Prot. 49:4-7

The selective destruction of non-bacterial ATP and subsequent determination of bacterial ATP using the ATP bioluminescent technique was investigated. Treatments to release ATP from somatic cells and hydrolyze free ATP also significantly reduced the ATP content of *Enterobacter cloacae* in skim and raw milk. The reduction can mainly be ascribed to apyrase (an ATPase) affecting the ATP content of intact bacteria. Somatic cell treatments failed to completely eliminate non-bacterial ATP. Although treatment with a somatic releasing reagent, EDTA and apyrase, resulted in a 96% reduction in the ATP content of raw milk, the remaining non-bacterial ATP was still considerably more than found in the bacterial component of raw milk studied here. Until reagents are available to selectively destroy all non-bacterial ATP without affecting the bacterial ATP content, the bioluminescent technique will have limited application in determination of the bacterial quality of raw milk.

Sensitivity and Precision of Bioluminescent Techniques for Enumeration of Bacteria in Skim Milk, Daniel P. Theron, Bernard A. Prior and Pieter M. Lategan, Department of Microbiology, University of the Orange Free State, P.O. Box 339, Bloemfontein 9300, South Africa

J. Food Prot. 49:8-11

Sensitivity and precision of the ATP assay were improved when a chilled *Enterobacter cloacae* skim milk culture was activated at 30°C for 30 min and the ATP was extracted with

boiling Tris/EDTA buffer (1:10 culture/buffer ratio). Of three luciferase-luciferin preparations evaluated, Monitoring reagent (a purified preparation) yielded the highest light output that reached a peak 60 s after injection of the sample and remained stable thereafter. Skim milk quenches the light output and necessitates the use of an internal ATP standard for the ATP assay. Skim milk samples containing between 12.5 and 200 pg of ATP were assayed with a mean precision of 3.1% (coefficient of variation; CV). Lower ATP concentrations could be determined with poorer precision. The lower limit of precise (7% CV) *E. cloacae* enumeration in skim milk was 1.6×10^5 /ml.

Bacterial Mutagenicity of Fractions from Chloroform Extracts of Ceylon Cinnamon, C. Paovalo and M. U. Chulasiri, Department of Pharmaceutical Chemistry and Department of Microbiology, Faculty of Pharmacy, Mahidol University, Bangkok 10400, Thailand

J. Food Prot. 49:12-13

Further to a previous report (*Food Chem. Toxicol.* 22:109-112, 1984) describing the presence of mutagens in a chloroform extract of Ceylon cinnamon (*Cinnamomum zeylanicum* Nees), we report here our findings on the mutagenicity of silica gel column chromatographic fractions from this extract. Mutagenicity was evaluated by the *rec* assay using *Bacillus subtilis* strains H17 (*rec*⁺) and M45 (*rec*⁻). Fractions collected after elution with chloroform, chloroform-ethanol (98:2) and (95:5) exhibited mutagenicity, while those obtained by elution with chloroform-ethanol (85:15), (75:25) and ethanol showed no such activity.

Evaluation of a Comminuted Meat Product Containing a Solid Metal Contaminant, H. W. Ockerman and B. Boesel, Department of Animal Science, The Ohio State University, Columbus, Ohio 43210, and the Ohio Agricultural Research and Development Center, Wooster, Ohio 44691

J. Food Prot. 49:14-17

Frankfurters containing a solid metal object (nail) were subjectively evaluated on the basis of emulsion color change adja-

cent to the metal, insertion channel development, and molding of the meat around the object. Frankfurters contaminated during the processing phase of production, whether boiled or not boiled, showed significantly greater color change than did frankfurters contaminated during the distribution or consumer phase. However, these same frankfurters had significantly less distinct insertion channels. No channel could be observed in frankfurters which were contaminated before processing and before cooking/smoking. Molding of the meat around the object did not provide distinguishable evidence for time of insertion.

Bioluminescent ATP Assay for Rapid Estimation of Microbial Numbers in Fresh Meat, Kenneth J. Littel, Sylvia Pickel and Arnold Spurgash, Food Applications, Packard Instrument Company, 2200 Warrenville Road, Downers Grove, Illinois 60515

J. Food Prot. 49:18-22

The utility of a bioluminescence adenosine triphosphate (ATP) procedure to estimate bacterial levels in fresh meat products was investigated. A double filtration (DF) sampling procedure was used. In this system two filters were fitted in tandem. A prefilter was used to trap food particles which contained contaminating ATP while the second filter retained the microbial population. The second filter was treated with an enzyme reagent to hydrolyze nonmicrobial ATP that was present on the bacterial filter. Using standard curves, that related bacterial ATP (B-ATP) and plate counts, the bacterial ATP levels in fresh beef and chicken samples were transformed into estimated bacterial levels in the products. The ATP procedure was able to predict bacterial levels within $\pm 0.5 \log_{10}$ of the actual plate count for greater than 90% of the fresh beef and chicken samples tested. Mean femtogram (fg) ATP/CFU levels in fresh beef and chicken mixed bacterial flora were 0.88 and 0.94, respectively. Minimal sensitivity of the double filtration/enzyme method was approximately 5×10^4 CFU/g of meat sample.

Enumeration and Characterization of *Clostridium perfringens* Spores in the Feces of Food Poisoning Patients and Normal Controls, Stanley M. Harmon, Donald A. Kautter and Charles L. Hatheway, Division of Microbiology, Food and Drug Administration, Washington, D.C. 20204, and Bacterial Diseases Division, Centers for Disease Control, Atlanta, Georgia 30333

J. Food Prot. 49:23-28

The fecal spore enumeration method for confirming *Clostridium perfringens* as the cause of food poisoning was evaluated using strains implicated in nine outbreaks in the United States. Confirmed spore counts from 66 stool specimens were made on tryptose-sulfite-cycloserine (TSC) without egg yolk and trypticase soy-sheep blood (TSB) agars. Counts from outbreak stools on TSC agar ranged from 2.0×10^4 to 3.5×10^8 (mean $\geq 1.4 \times 10^6$ /g) as compared with $< 10^3$ to 5.0×10^5 /g (overall mean 9.5×10^3 /g) from normal stools. Similar results were obtained with TSB agar. Isolates from seven of the nine outbreaks were nonhemolytic and produced ≥ 100 ng enterotoxin/ml in spore broth, as measured by an enzyme-linked immunosorbent assay. Spores in stools from six of the outbreaks were heat-resistant and survived heating for 30 to 60 min at 100°C in cooked meat medium. Strains from the three remaining outbreaks were heat-sensitive and survived heating for only 15 min at 100°C . Enterotoxigenic isolates from all but one of the outbreaks were serotyped. In all instances, the predominant strain in specimens from an outbreak was of the same serotype, indicating that it was the causative strain. Reexamination of five specimens from each of three outbreaks after storage at -20°C for 6 months showed only a minimal reduction in the spore counts.

Toxigenic and Nontoxigenic Strains of *Aspergilli* and *Penicillia* Grown in the Presence of Sodium Chloride Cause Enzyme-Catalyzed Hydrolysis of Protein, Fat and Hydrogen Peroxide, Fathy E. El-Gazzar and Elmer H. Marth, Department of Food Science and The Food Research Institute, University of Wisconsin-Madison, Madison, Wisconsin 53706

J. Food Prot. 49:29-32

Eight strains of *Aspergillus flavus*, three of *Aspergillus parasiticus*, one of *Aspergillus ochraceus* and ten of *Penicillium* spp. were evaluated for their ability to hydrolyze protein, fat and hydrogen peroxide when the molds were grown in the presence of different amounts (0-10%) of sodium chloride. Proteolytic and lipolytic activities of strains of *A. flavus* generally increased with an increase in the amount of sodium chloride in the medium. This was true for proteolytic and less so for lipolytic activity of *A. parasiticus* and *A. ochraceus*. Of the penicillia tested, five exhibited a marked increase and five a smaller increase in proteolytic and lipolytic activity at 2, 4 and 6% sodium chloride, but such activity either remained constant or decreased at 8 and 10% sodium chloride. Peroxidase activity in mycelia of all strains of aspergilli increased with an increase of sodium chloride in the medium. Most strains of *Penicillium* spp. exhibited maximum peroxidase activity at 2% sodium chloride, and some reduction in activity when the amount of sodium chloride in the medium exceeded 2%.

***Clostridium perfringens* as an Indicator of Hygienic Quality of Depurated Shellfish**, Robert H. Madden, H. Buller and D. W. McDowell, Department of Agriculture, Agriculture and Food Bacteriology Research Division, Newforge Lane, Belfast BT9 5PX, United Kingdom and The Queen's University of Belfast, Department of Agricultural and Food Bacteriology, Newforge Lane, Belfast BT9 5PX, United Kingdom

J. Food Prot. 49:33-36

A comparison of the recoveries of *Clostridium perfringens*, *Escherichia coli* and *Streptococcus faecalis* from naturally and artificially contaminated mussels and oysters was made. Only *C. perfringens* was regularly recovered from naturally contaminated shellfish. Laboratory studies showed that this was due to *C. perfringens* spores retaining viability significantly longer than vegetative cells of the other organisms tested, under marine conditions. Over 97% of presumptive *C. perfringens* colonies were confirmed as positive. A survey of mussels at 24 sites, over ca. 60 km of coastline, found *C. perfringens* at 23 but *E. coli* at only two of the sites. Therefore, enumeration of *C. perfringens* can indicate fecal pollution where enumeration of *E. coli* shows none. Also, confirmation of presumptive colonies may not be required, rendering enumeration more rapid. Despite the greater persistence of *C. perfringens* spores, studies in a commercial depuration tank showed that oysters were cleansed to an acceptable level using a standard 48-h immersion. Depuration was found to be essential because all three organisms tested survived for a considerable period of time in oysters stored dry at 4°C, which is normal commercial practice.

Effects of Iron Alone and in Combination with Calcium, Zinc and Copper on the Mineral-Binding Capacity of Wheat Bran, S. R. Platt and F. M. Clydesdale, Department of Food Science and Nutrition, Massachusetts Agricultural Experiment Station, University of Massachusetts, Amherst, Massachusetts 01003

J. Food Prot. 49:37-41

The addition of various combinations of iron, calcium, zinc and copper to soft white wheat bran (SWWB) and hard red spring wheat bran (HRSWB) was shown to effect both the solubility of added minerals and those occurring endogenously. The addition of equimolar concentrations of Fe and Zn resulted in a significant decrease in soluble iron of 5.4% and 9.0% for SWWB and HRSWB, respectively, and a significant decrease in soluble magnesium, compared to wheat bran systems with iron alone. However, when equimolar concentrations of Fe and

Cu were added to the wheat bran systems, there was no significant effect on Fe solubility and a significant increase in Mg solubility. Further, the addition of Fe and Ca (160 mg) to wheat bran systems caused a significant decrease in soluble iron of 12.0% for SWWB and 17.4% for HRSWB, and a significant increase in Mg solubility. These results suggest that there are mineral-specific binding sites in wheat bran.

Microbiological Stability of Pasteurized Ham Subjected to a Secondary Treatment in Retort Pouches, P. J. Delaquis, R. Baker and A. R. McCurdy, Department of Applied Microbiology and Food Science, University of Saskatchewan, Saskatoon, Saskatchewan S7N 0W0, Canada

J. Food Prot. 49:42-46

A ham processing procedure consisting of pasteurizing, packaging in retort pouches, and subjecting the hams to a secondary heat treatment was evaluated as a method of increasing microbial stability. Pasteurized hams reheated at 121°C for 10 min and stored at 1±1°C or 6±1°C showed no microbial growth after 6 or 12 months of storage. The number of microorganisms in pasteurized hams not receiving the secondary heat treatment ranged from 10³/g to >10⁸/g and from 10² to >10⁸/cm² on the surface after 3 to 5 months of storage. Pasteurized hams that had been inoculated with *Clostridium sporogenes* spores before pasteurization followed by a secondary heat treatment at 121°C for 10 min showed a delay in the occurrence of swollen packages when stored at room temperature compared to hams not receiving the secondary heat treatment. However, the secondary heat treatment did not prevent spoilage of hams. Ham that has not been treated to eliminate spores should be refrigerated.

Cellular Damage in Dried *Lactobacillus acidophilus*, Merry Brenna, Bahijah Wanismail, M. C. Johnson and Bibek Ray, Food Microbiology, Animal Science Department, University of Wyoming, Laramie, Wyoming 82071

J. Food Prot. 49:47-53

Lactobacillus acidophilus cells surviving freeze drying and vacuum drying became sensitive to oxgall and lysozyme probably from damage to the cell wall. The dried cells also became sensitive to NaCl and permeable to ortho-nitrophenol β-galactoside from damage to the cytoplasmic membrane. Scanning

electron microscopy indicated loss of some surface material from the damaged cells. Transmission electron microscopy (TEM) revealed partial loss of wall and membrane material, but these losses seemed to have resulted from the treatments given during fixation of cells for TEM and as a consequence of damage to the wall and membrane that occurred during drying. A surface protein of 46-kilodalton molecular weight, that is bound to the wall by hydrogen bonding, was also lost from the dried cells. It is postulated that drying adversely affects some weak bonds of the cellular macromolecules probably from the loss of bound water.

Influence of Addition of Newly Drawn Milk and Fluctuating Temperatures of Farm Bulk Tanks on Growth of Mastitis-Causing Bacteria, Halit H. Oz and R. J. Farnsworth, Department of Larger Animal Clinical Sciences, College of Veterinary Medicine, University of Minnesota, St. Paul, Minnesota 55108

J. Food Prot. 49:54-57

Effect of addition of newly drawn fresh milk of consecutive milkings on growth of *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus agalactiae*, *Streptococcus dysgalactiae*, and *Streptococcus uberis* in milk held at fluctuating temperatures of a farm bulk tank for 48 h was studied. There was a statistically insignificant effect of the addition of newly drawn fresh milk of consecutive milkings on the growth rate of *S. aureus*, *S. epidermidis*, *S. agalactiae* and *S. uberis* but there was a significant ($p < 0.001$) growth enhancing effect on *S. dysgalactiae*. However, all the bacteria grew significantly ($p < 0.001$) in milk held at fluctuating temperatures of farm bulk tank for 48 h.

Use of Antioxidant-Coated Salts as N-Nitrosamine Inhibitors in Dry- and Brine-Cured Bacon, P. H. Bernthal, J. I. Gray, A. K. Bandagere, W. G. Ikins, S. L. Cuppett, A. M. Booren and J. F. Price, Department of Food Science and Human Nutrition, Michigan State University, East Lansing, Michigan 48842

J. Food Prot. 49:58-61

Several experiments were completed to further evaluate use of α -tocopherol-coated salts as inhibitors of N-nitrosamine formation in fried bacon. Studies with dry-cured bacon prepared with various levels of α -tocopherol indicated that the chemical did not contribute to formation of N-nitrosodimethylamine (NDMA). N-Nitrosopyrrolidine levels for the α -tocopherol-treated bacon samples were generally below 5 $\mu\text{g}/\text{kg}$, which represents an average reduction of approximately 70%. Experiments were also done to evaluate the role of lecithin as a possible precursor of NDMA in brine-cured bacon. At concentrations used to disperse α -tocopherol in the curing brine, lecithin did not contribute to NDMA formation in bacon prepared with α -tocopherol-coated salts.

Resuscitation of Injured *Salmonella* spp. and Coliforms from Foods, Wallace H. Andrews, Division of Microbiology, Food and Drug Administration, Washington, D.C. 20204

J. Food Prot. 49:62-75

Because damaged cells may account for a substantial proportion of the bacterial population in processed foods, the food microbiologist must choose the most appropriate methods for detecting damaged as well as noninjured cells. Any method intended to recover damaged organisms should include a resuscitative, or repair, process that will restore the injured cells to a sound physiological condition before subjecting them to the severity of selective enrichment media. It should also provide a reliable indication of the microbiological safety and quality of any particular food. This paper reviews various factors that affect the recovery of *Salmonella* spp., which include: (a) sample rehydration, (b) period of preenrichment, (c) incubation in both aerobic and anaerobic environments, (d) media composition and (e) the relative merits of preenrichment and direct selective enrichment. Because resuscitation of injured *Salmonella* cells does not occur during the selective enrichment step and beyond, the effect and interaction of these factors are considered primarily for the preenrichment step of the isolation procedure for *Salmonella*. This paper also reviews five methods recently developed for recovery of coliforms, which include: (a) hydrophobic grid membrane filtration, (b) radiometry, (c) electrical impedance, (d) fluorogenic assay and (e) the Petrifilm system. Each of these methods may incorporate a step for resuscitation of injured organisms.

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January 20-24, FOOD MICROBIOLOGY WITH AN INTRODUCTION TO HAZARD ANALYSIS, to be held at the UCLA Extension Building, Los Angeles, CA. For more information contact: UCLA Extension, 10995 Le Conte Avenue, Los Angeles, CA. 213-825-1295.

January 27-29, BAKING PRODUCTION TECHNOLOGY SEMINAR, to be held at the Sheraton Anaheim, Anaheim, CA. For more information contact: Mrs. Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

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 10-12, 25TH ANNUAL MEETING OF THE NATIONAL MASTITIS COUNCIL, to be held at the Hyatt Regency Columbus, Columbus, OH. For more information contact: John Adams, National Mastitis Council, 1840 Wilson Blvd., Arlington, VA 22201. 703-243-8268.

February 12-13, DAIRY AND FOOD INDUSTRY CONFERENCE, to be held at Ohio State University. For more information contact: John Lindamood, Department of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH 43210.

February 17-19, FOOD PESTICIDE APPLICATORS' RECERTIFICATION WORKSHOP for Arkansas, Alabama, Louisiana, Mississippi, Little Rock, Arkansas. For more information contact: Harold Rowe at 813-586-5710 or write: Jean Day, Registrar, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540.

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 32602. 904-372-0436.

February 27, MEAT PROCESSING CONFERENCE, to be held at the Hyatt Regency, Oakland, California. For more information contact: A. W. Brant or Shirley Rexroat, Department of Food Science & Technology, University of California, Davis, CA. 95616. 916-752-2191.

March 9-11, FOOD SANITATION EDUCATIONAL EXPERIENCE WORKSHOP, Orlando, FL. For more information contact: Harold Rowe at 813-586-5710 or write: Jean Day, Registrar, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540.

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March 19, INDIANA DAIRY INDUSTRY CONFERENCE, to be held at Stewart Center, Purdue University, West Lafayette, IN. For more information contact: James V. Chambers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN. 47907. 317-494-8279.

March 24-28, MID-WEST WORKSHOP IN MILK AND FOOD SANITATION, to be held at Ohio State University. For more information contact: John Lindamood, Department of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH. 43210.

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

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

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

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

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

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

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

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

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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**You can weigh,
dissolve, wait...
sterilize, wait...
temper, wait...
inoculate,
pour,
incubate.**

**Or, you can
inoculate
and incubate.**

Compare 3M Petrifilm™ Plates to conventional pour plates. With Petrifilm Plates, you eliminate the tedious preparation needed with conventional pour plates. Preparing a test is quick and simple—inoculate the sample onto the Petrifilm Plate and incubate. The time and labor savings are obvious.

Petrifilm Plates are much more convenient than conventional pour plates. They can be used anytime, anywhere. No media preparation is needed. You can plate a sample on-site instead of having to bring it to the lab. Petrifilm Plates save space, too.

Petrifilm Plates provide comparable results to conventional pour plates, and you can count on consistent results because each lot is **PETRIFILM** subject to the same stringent quality standard.

The Petrifilm Plate methods have been collaboratively tested and adopted by the Technical Committee of the 15th Edition of Standard Methods, A.P.H.A. The methods have also been granted A.O.A.C. Interim Official First Action.

To find out more about how 3M Petrifilm Plates can simplify your testing procedures, call **(800) 328-5727** (outside MN) or **(800) 742-5685** (in MN) and ask for Ext. 40.

Outside of the United States, contact the local 3M subsidiary. In Canada, contact 3M Canada, Inc., P.O. Box 5757, London, Ontario, N6A-4T1, 1-800-268-9696.

**Microbiology Products
Medical-Surgical Division/3M
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