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PRESIDENTIAL ADDRESS

Dear IAMFES Members,

It is a pleasure to serve as President of your Association. We held a Board Meeting on October 31, and November 1, 1986, in Ames. I would like to share some of the highlights with you.

Many items were discussed, along with planning another educational program for 1987 with timely topics of interest to the membership. The tentative program will be published in the April issue of *Dairy and Food Sanitation* as well as the *Journal of Food Protection*. Leon Townsend, President-Elect and Chairman of the Program Committee is doing an excellent job in coordinating topics and speakers for the meeting.

The big push for 1987 is to increase our membership. I was thrilled to see the enthusiasm at the Ames office – people striving to get more members. They have an interoffice contest to see who can get the most. Through Telephone Marketing, they are making renewing as well as joining much more convenient. *Dairy and Food Sanitation* has increased 500, and the *Journal of Food Protection* is up 381 from last year at this time. One goal is to add 200 additional student members. I would encourage all of you to talk to students about IAMFES. They are our future. Sustaining Membership has increased by 26 since August. Total Sustaining Members is now at 71, thanks to the Advertising Department at the Ames Office.

The Nominating Committee has come up with two excellent candidates – Bob Sanders, FDA, Washington office and Dr. Mike Wehr, Oregon Department of Agriculture. I would encourage you to cast your vote.

Our Foundation Fund Committee recommended to the Board to set up an audio-visual library at the Ames office. I have appointed Sid Barnard, Past President, to head a task force to put this committee together. If you are interested in this committee, please contact Sid. When this library is functioning, members will be able to check out slide presentations and, possibly, video tapes, at no charge.

The Board authorized five new committees: FDA Interpretations, Retail Food Protection, Food Service Sanitation, Education and Training, and Water Quality and Waste Disposal. Since there has been no activity on the Applied Laboratory Methods Committee, the Board decided to dissolve this committee.

The committees are a very important part of IAMFES. In the past few years, the Board has felt that possibly some of the committees have been slighted, as there just does not seem to be enough time for a proper report. Therefore, the Board decided to put committee reports into the body of the program. If you would like to give a report in 1987, at Anaheim, please contact Program Chairman, Leon Townsend.

I have appointed Duane Shaw, Pennsylvania Department of Environmental Resources, to be the IAMFES representative on the Unicode Development Task Force. They held their first meeting in November, 1986.

The Fourth Edition of *PROCEDURES TO INVESTIGATE FOODBORNE ILLNESS* is now available, with orders and phone inquiries 4 to 6 months before it was even published.

Your association is growing and, therefore, there are bound to be growing pains. One of the concerns of the Board is to have our Annual Meeting in adequate facilities which can accommodate a large crowd and are easily accessible by air. As the membership grows, we may want to consider having two or more affiliates hosting a meeting in a large metropolitan city. The fact that we do have these problems is a positive sign that the organization is growing.

We have an excellent staff at the Ames office. Each one of them is dedicated to serving you. Kathy Hathaway, our Executive Manager, is leading these people and training them to be excellent employees.

I look forward to seeing you in Anaheim!

Roy E. Ginn
President

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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 50010-0701, 515-232-6699.

Membership Dues: Membership in the Association is available to individuals only. Direct dues are $28.00 per year and include a subscription to **Dairy and Food Sanitation.** Direct dues and the **Journal of Food Protection** are $50.00. Affiliate and International Membership include both journals for $50, plus affiliate dues. Student membership is $14.00 per year, with verification of student status, and includes Dairy and Food Sanitation. No cancellation accepted.

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Dairy and Food Sanitation

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Public Health Aspects of Dairies in Southern California

With Specific References to Odors and Vectors, Their Control and Public Attitudes Towards Dairy Farms in Urban Areas

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INTRODUCTION

Dairy farms adjacent to urban areas in Southern California are facing several problems, among which is the urban sprawl resulting in pressure of new neighbors who are not used to and generally less tolerant of the atmosphere of dairy farming. However, aside from that, dairy farms have had intensive health problems. Most annoying to neighboring areas are odors and vectors, particularly flies and mosquitos. During warm weather health departments in Southern California receive complaints on an almost daily basis. In addition to mitigating efforts advised, or enforced, health officials are interested in finding out about the public's attitude towards dairies in urban areas. This paper addresses these issues.

Common Vectors Associated with Dairies in Southern California, Their Public Health Significance and Mitigating Techniques

Dairy Flies

In Southern California, vector biologists commonly associate approximately seven species of flies with dairies. However, in our field research we found the following four species to be the most numerous and pestiferous.

Fly Species

Musea domestica, or "common house fly," is capable of going through its life cycle in seven days (egg, larva, pupa, adult). It tends to land on humans and their food, and can be most annoying. Flight range is 1-2 miles daily. *Musea domestica* is known to be a mechanical vector and spreads disease by physically conveying bacteria from one point to another.

Stomoxys calcitrans, or "stable fly," is a blood sucking fly that attacks man as readily as animals. Often mistaken for the house fly, it can be a great annoyance. Its flight range is short, one-quarter to one-half mile, if the food source is plentiful. Public health potential for *Stomoxys calcitrans* ranges from allergic reactions to secondary infections.

Muscina stabulans, or "false stable fly," is somewhat beneficial in that the larva of this species is predacious on those of other species. Muscina stabulans can be produced in large numbers. Flight range is short (i.e., 1/4 to 1/2 mile daily). There is little or no public health significance associated with this pest.

Calliphoridae spp, or "blow flies," are shiny metallic blue or green pests that tend to develop on dead or decaying organic matter. They are large buzzing flies that tend to annoy people. Flight range is as much as 20 miles daily. They are known to be mechanical vectors.

Breeding of these organisms occurs predominantly in the spring, summer and early fall. However, in Southern California this can occur year round.

An Orange County study noted that "a peak in fly complaints generally occurs in early spring and fall, along with high populations of lesser house flies (*Fannia* spp.). The early spring increase in complaints is higher than the fall peak which probably reflects the combined effect of fewer numbers of house flies and biting stable flies. The summer complaints are virtually all identifiable with house flies and blow flies, and are not as numerous as those concerning "leser house flies (1)."

Fly Production

Conditions that produce flies found on dairies are fairly basic. Each organism needs three factors: food, moisture and warmth. If manure is improperly handled, stored or processed, these factors can easily be found on the dairy and produce huge numbers of flies.

Mitigation

Through proper integrated manure management, fly production can be reduced to a minimum. If we eliminate a fly's food, the moisture in his breeding media, or his warmth in the media, we have broken the fly cycle.

In addition to manure management, one area that should receive particular attention as a potential fly breeding site is the sump area of the flush-out dairy. This problem was highlighted in a dairy waste project study in San Bernardino County, in which it was found that the sump area of the flush-out dairies was a greater and more continuous source for fly development. The areas of fly development were where the manure surged over the sump facilities or backed up between the alley lanes, or which ran over their respective sides (2). These problems could be avoided by adequate side walls, larger pits and pit entrances, and adequate volumes of water or increased water velocity.

These kinds of physical arrangements, coupled with the use of other biologicals and chemicals, gives us a dairy environment where pest problems can be kept to a minimum. Table 1 shows integrated pest management can reduce dairy vector problems.

It is suggested by the U.S. Department of Agriculture Bulletin A106.2 F64 (3), and the University of California Division of Agriculture Sciences Leaflet 2329 (4), that fly parasites should be a necessary part of an integrated management program for dairies.

Insecticide treatment of manure collections for larval control and adult fly control, as a routine program in place of manure removal, has rarely given satisfactory results (1). As such, it is only a satisfactory technique if incorporated in an integrated pest control program, as mentioned earlier.

If the dairy staff can practice integrated pest management in their manure handling practices, as well as watch for waste fee, silage, contaminated calf bedding and afterbirth materials, the dairy may become an accepted neighbor in an urban environment.

Mosquitos

Dairies which utilize holding ponds commonly have mosquito problems if these ponds are not managed properly. Dairy ponds should be made with a 3 to 1 slope on sides, and be kept weed free. Often, secondary ponds are needed to hold waste water while the first ponds are scraped and cleaned, so as to keep weeds down and the ponds at their maximum holding capacity.

In Southern California, vector biologists have identified three species of mosquitos of public health importance which are usually associated with dairy holding ponds (5). They are as follows:

Culex tarsalis, or "encephalitis mosquitos." This mosquito is found throughout the United States west of the Mississippi River. It is principally a rural mosquito. Females feed at night, mainly at dusk and dawn. This mosquito can develop in 18 days from egg to adult. It is believed to be the most important vector of Western equine encephalitis. Flight range is 3 miles average daily (generally upwind), but it can be as much as 10 miles.

Culex pipiens, or the "Southern House Mosquito." This mosquito is found in the South from coast to coast. It can develop from egg to adult in ten days. This is one of the most annoying "pest mosquitos" due to its high pitched buzzing sound and the fact that it is a vicious biter. This mosquito can be a vector of St. Louis encephalitis. Flight range is 3 miles.

TABLE 1. *An Integrated Pest Management Approach to Reducing Vector Problems.*

Condition	% of Eggs Killed*		# of Eggs Left
Manure too hot, too cold, wet, dry	80% (1000-800)	=	200
Fly predators	18% (200-180)	=	20
Fly parasites	1.8% (20-18) (or 85 to 95% of the remaining 20 eggs)	=	2
Chemicals	40-95% of the remaining eggs that become adults		0 to 1

*based on the assumption that an adult female lays 1000 eggs and maximum conditions are in existance.

Culex peus, or "common mosquitos." This mosquito is found in California (most widespread species), but does not bite man. It has no reported public health significance. The flight range is 3 to 5 miles.

It should be pointed out that mosquitos from a major source would be greatly attracted to the lights of a community close by, such as is the case in adjacent urban areas.

Mitigation

In addition to the pond rotation and draining and scraping technique described, a number of larvacides are commercially available that can be used on a routine basis. These range from oils and chemicals to biologicals, all of which can be used with complete success. Basically there can be no excuse for any mosquito population in a dairy environment.

Health authorities throughout California have established rules affecting vector problems. For example, Riverside County has its own fly control ordinances. These are enforced by the Department of Public Health, Division of Environmental Health, Vector Control Section. These sections of Riverside County's health code are in part enforced by Riverside County's Fly Abatement Committee, which reviews violations and makes recommendations to the Health Department and the violator. If these are not implemented, then the Health Department follows with litigation through the courts.

The California State Vehicle Codes require that all hauled manures be covered. In an enclosed system such as this, and if done properly, vector associated problems can be minimized during the hauling of manure through neighboring urban areas. However, traffic noise problems caused by numerous trucks hauling the waste still need to be addressed.

Odors

Character and Intensity of Odors Emanating from Dairies

Livestock odors are considered to be nuisance pollutants. Recently the frequency of odor-based complaints has been noted by air pollution control agencies and health departments (6).

While livestock operations are generally not thought of as a source of air pollution, in 1972 cattle industry emissions were estimated by Peters and Blackwood at 20,500 metric tons of total suspended particulates and 3,480 metric tons of ammonia. Total sulfur compounds were estimated at 522 metric tons, and total amine compound emissions were estimated at 139 metric tons. Miner reported that ammonia volatilization from manure-covered aisles in dairy barns occurs at the rate of 0.5-1.0 kg/ha per day (6). Numerous literature cites volatile compounds associated with livestock operations.

Odor arises from decomposition of organic matter on the farm and the escape of objectionable gases. A fresh manure odor is considered to be less objectionable than that emanating from anaerobically decomposing manure. This is partly due to the fact that fresh manure, even though a source of large volumes of ammonia, does not emanate other gases, e.g. sulfur compounds, associated with stored manure (6).

A large inventory of stored manure, limited rate of air exchange, wind direction, and high animal density, contribute to the intensity of odors. Conflicts between the dairy producer and the surrounding neighborhood are generally associated with these conditions. Complicating factors include duration and frequency of perception, in addition to intensity. Wind direction is another factor, causing odors to be transported in excess of one mile downwind. In land areas such as Southern California and Arizona, dust problems may also occur (6).

Public Health Factors Related to Odors

An acceptable and widely used definition of health is that of the WHO, i.e., a complete state of physical, mental, and social well-being, and not merely the absence of disease or infirmity. Discussion here is considered within this definition and the context of odors emanating from dairy operations.

It is difficult to correlate physical illness and unpleasant odors. Their symptoms are difficult to verify and measure at the normal concentrations of livestock odors. However, a report by the National Academy of Sciences noted that "unpleasant odors can elicit nausea, vomiting, headaches; cause shallow breathing and coughing; upset sleep, stomach and appetite; irritate eyes, nose and throat; disturb, annoy and depress (6)." It is generally accepted that the sense of well-being is affected in persons subjected to odorous compounds. Miner (6) also notes that property values of areas subject to frequent odor invasion are often decreased. This may create social or mental stress for some homeowners.

Commonly Accepted Odor Mitigating Techniques

Minimizing organic compound evolution is the basic action required by the producer in order to minimize odor complaints. Miner (6) lists the following among the recognized mitigating techniques.

1. Conversion of some volatile compounds to less volatile or odorous material through pH control, chemical or biological conversion. For example, addition of lime controls the release of the objectionable gas, hydrogen sulfide (H_2S). If the pH is raised above 9.5, escaping hydrogen sulfide should be minimized.
2. Inhibition of the anaerobic decomposition of manure. Examples of mechanisms to achieve this goal include keeping feedlots sufficiently dry to allow oxygen permeation of the surface. Oxidation ditches of aerated lagoons are among other acceptable techniques.
3. Use of odor control chemicals. These chemicals act by inhibiting the formation of odorous compounds, preventing their release, or masking the objectionable compound. Research on commercially available odor control chemicals produced largely disappointing results. How-

ever, oxidizing agents such as potassium permanganate show promise as odor control chemicals. Mixing this chemical with manure suppresses the release of odorous gases.

4. Proper design and management of livestock operation. While applying this principle as an odor control technique on a case-by-case basis, there are general features which must be considered. Most important factors include site selection and its relation to the prevailing winds, transportation patterns, zoning regulations, and existing or proposed development in the area.

Odor Regulations and Their Intent

While odors are a source of numerous complaints, odors connected to a rural area are generally unregulated by local and state ordinances, except under the general topic of "nuisance" as covered in the public health codes. In some areas the community seeks legal action based on annoyance factors.

Odor and Other Problems Associated With Manure Transportation by Truck Through Urban Areas

It is not unusual for many Southern California dairies to produce approximately 4,000 tons of manure per dairy farm per year. In one particular case, a proposed new dairy was opposed by a neighboring city on the basis that several trucks hauling manure would have to go through the main city street. According to representatives of this city, if no other roads are built to avoid going through the city, then the urban area population will be exposed, even for a short time, to possible dairy odors emanating from manure hauling trucks going through the city. Mitigating factors, e.g., covering as stipulated in the California State Motor Vehicle Code and chemical control of odors would have to be considered in this case.

The combination of these two factors, as well as potential odor, vector and water pollution problems stimulated the city administration and population to demand, through existing environmental control boards, a halt to the development of the new dairy, or as a minimum, the requirement of an Environmental Impact Report (EIR). Resolution of the issue is still pending as the dairy owners are convinced that these problems can be effectively controlled, and their case was presented accordingly.

Public's Attitude Towards Dairy Farms Adjacent to Urban Areas

The conflict between the public and dairy operations stem from the fact that dairies can be potential sources of: a) odor problems; b) fly, mosquito and other vector problems, and; c) water pollution. In order to resolve the nuisance issues created by dairies, strong and consistent mitigating measures must be established. Paramount to these efforts is a sound waste management policy and practice. This is strongly recommended, even though one must keep in mind that two studies indicate that even well managed and well regulated dairies are not completely free of problems (2, 7).

A major and significant question is "Are regulated dairies free of these public health and nuisance problems?"

To answer this question objectively, two sets of documents were reviewed. These are: a) Dairy Study, San Bernardino Planning Commission, County of San Bernardino, and; b) Dairy Waste Management Project. Final Report. A Cooperative California study, by the City of Cerritos, Dairymen's Fertilizer Cooperative, Alta Dena Dairy, State and County Health Departments, Farm Advisors, and University Extension Service, 1968-1971 (2). The senior author served in a research assistant capacity during the conduct of this study.

The Dairy Study conducted by the San Bernardino County Planning Department identified environmental nuisances and surface drainage as among the problems associated with existing dairies in the Chino dairy area. Among the recommendations made by the study is the creation of a vector abatement district to deal with the mosquito and fly problems. Furthermore, the San Bernardino Dairy Study noted that as urbanization occurs around the dairy farms, objection to insects, smells, dust and other byproducts of operating a modern dairy farm increases (7).

The Dairy Waste Project represented a dairy waste management study supported in part by Federal Public Health Service Grant 1-G06-EC-00270-01. These activities became part of the function of the Office of Solid Waste Management of the Environmental Protection Agency. The study was administered by the Public Health Foundation of Los Angeles County. The project was described as a truly cooperative effort of many agencies and individuals, including industry, federal government, and local health departments. One of the main objectives of this project was: defining and evaluating the major environmental problems in managing solid wastes produced by high density cow housing located in close proximity to residential development. It is to be noted that prior to the beginning of the project a court suit charged the Dairymen's Fertilizer Cooperative with creating nuisances and health hazards from dust generated by handling and processing manure.

Under this Dairy Waste Management project a neighborhood opinion sampling was conducted by means of a separate evaluation system designed by Orange County's Environmental Health Director and his staff, and utilized by both his staff and by personnel of the San Bernardino County Health Department, to measure attitudes of people living within various distances of dairies and in various locations with respect to prevailing winds.

The objectives of the public opinion survey, which was conducted in Orange and San Bernardino Counties, were (2): a) interview selected citizens to determine what features of dairy farming are particularly objectionable, and; b) determine whether dairy operations carried out under "ideal" conditions with a minimum of fly production and

odor nuisance would be objectionable to residents. The survey covered both dairy and control areas, and included a number of "well-managed" Orange County dairies. Results indicated the factors representing nuisances for people living near dairies are: a) dust; b) rodents: c) unsightly premises and; d) odor and flies.

A summary of conclusions drawn from the data analysis of this study is as follows (2):

Dust: "As a whole, residents living around dairies will tend to complain more about dust than residents living in neighborhoods without animal establishments."

Rodents: "The evidence favors the conclusion that residents living around dairy ranches will complain more about rodents (mainly gophers) than will residents living in neighborhoods without animal establishments."

Unsightly premises: "The evidence leads to the unquestionable conclusions that dairy neighborhood residents will not complain any more or less about unsightly premises than will residents living in neighborhoods without animal establishments."

Odor and flies: "It is unquestionably concluded that residents living around dairies complain more about odors and flies than residents living in neighborhoods without animal establishments."

CONCLUSION

Characteristically, if improperly managed, dairies can be the foci for vectors, odors, and water pollution. All are unacceptable public health problems. Manure management is the key to mitigation of all the aforementioned potential environmental health problems. Through proper manure management the following can be accomplished: (A) reduce fly production to a minimum; (B) reduce odors, and; (C) prevent surface/groundwater contamination. Otherwise, problems between dairies and neighboring populations are intensified.

This paper emphasized the discussion of vector and odor problems and public attitudes toward dairy farms adjacent to urban areas.

Other studies (9, 10, 11, 12) provide the reader with valuable additional information. Problems such as contamination of surface and groundwater supplies were not discussed here. But these and other public health problems associated with animal waste as well as various management techniques; e.g., methane production, soil application and refeeding, were discussed by the senior author in another publication (8).

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Dairy and Food Sanitation, Vol. 7, No. 3, Pages 121-123 (March 1987)

Weighing the Risks of the Raw Bar

Carol Ballentine
(A member of FDA's public affairs staff)

Reprinted from the September 1986 FDA Consumer

The day after a women's club luncheon in Old Westbury, N.Y., 14 of the members began to feel extremely unwell. Their symptoms - nausea, vomiting, diarrhea, chills - spoke strongly of food poisoning as the cause. The New York State Health Department was notified and, after some medical sleuthing, the culprit was identified as raw littleneck clams the women had eaten.

Only four days earlier, on Nov. 22, 1984, eight people had dined on raw clams at a restaurant in nearby Eastchester, N.Y., and then had developed similar symptoms. And in a little over a week, three more people would fall ill after eating at a restaurant in Syosset, N.Y., again the food they would have been better off not eating was raw clams.

In all cases, the ailing individuals were advised to receive gamma globulin injections immediately to prevent getting hepatitis A, a prolonged viral illness that can be contracted by eating contaminated shellfish. Severe cases of hepatitis A can cause liver damage and, sometimes, death.

The three incidents in New York state are not isolated outbreaks. Reports of viral illness caused by eating shellfish (defined here as edible clams, oysters and mussels), and particularly raw shellfish, are steadily increasing, and the Food and Drug Administration and state shellfish regulatory agencies are concerned.

Many shellfish lovers are worried, too. Recent newspaper and magazine articles, prompted by a medical journal report last spring on illnesses due to eating oysters and clams in New York in 1982, have consumers wondering if eating raw - or even steamed - shellfish is too risky. FDA shellfish experts feel that caution *is* advised, and people with certain health problems should, indeed, avoid uncooked shellfish. But for most healthy individuals who take a few prudent steps, there's no need to totally shun the raw bar.

Since 1925, when the first national shellfish sanitation guidelines were developed by the Committee on Sanitary Control of the newly created National Shellfish Sanitation Program (a triumvirate of FDA, state agencies and industry), bacterial illnesses caused by bacteria in shellfish - such as cholera and typhoid - have been declining steadily. No documented cases of typhoid fever, once the most common shellfish-borne disease, have been reported due to eating shellfish since 1954. But in the 1960s, hepatitis A virus moved into the limelight as a shellfish pathogen. From 1960 through 1963, over 1,000 people were diagnosed with hepatitis A illness after eating oysters and clams.

In 1980, another virus appeared on the scene to make life miserable for raw bar devotees. The Norwalk virus was first identified in 1968 during an outbreak of gastroenteritis linked to drinking water in Norwalk, Ohio. But in 1980, the virus was found in oysters that had sickened six people in Florida.

Initially, the virus, which causes transient flu-like symptoms, was not thought to be a significant cause of shellfish-borne illness. But in March 1986, *The New England Journal of Medicine* described 103 outbreaks of shellfish-caused gastroenteritis due to this virus, in which 1,017 people became ill in 21 counties in New York state between May 1 and Dec. 31, 1982. The shellfish had been caught off the coast of several northeastern states. (In November of that year, there was also an outbreak in Louisiana in which 472 people became ill and 25 percent of the state's shellfish harvesting beds had to be closed.)

The New England Journal article said, "Although recent shellfish-associated outbreaks have not reached the epidemic proportions of 1982, outbreaks in several northeastern states during 1983, 1984 and 1985 (including 59 outbreaks resulting in 888 documented cases within New York state alone) demonstrate that the problem is continuing. Until effective control measures are developed, the public should be warned that consumption of raw clams and oysters poses a risk of enteric [intestinal] illness, particularly Norwalk-like gastroenteritis."

Even as the article was being written, the shape of shellfish regulation was changing. The Food and Drug Administration was overseeing the first revision of the National Shellfish Sanitation Program *Manual of Operations* in over 20 years. The first part, "Sanitation of Shellfish Growing Areas," was published in June; the second part, "Sanitation of the Harvesting and Processing of Shellfish," is still in draft form and must be approved by the Interstate Shellfish Sanitation Conference (a voluntary organization of shellfish-producing states, FDA, the

shellfish industry, and the U.S. Commerce Department's National Marine Fisheries Service).

The revised guidelines are an attempt to clarify and strengthen existing regulations - for shipping and storing shellfish, among other things - and create uniformity from state to state. The guidelines stress, for example, that shellfish must be traceable to their source from the moment they are harvested from a bay, river or other estuary to when they end up in a restaurant or market. This is vital, says J. David Clem, chief of FDA's Shellfish Sanitation Branch, "otherwise you might end up condemning the shellfishing waters in an entire area or state to control an outbreak." Each container of shellfish must have a tag or label, approved by the appropriate state shellfish control agency, that bears the information necessary to trace the shellfish both to a specific area and a particular harvester. When state inspectors check containers of fresh or fresh-frozen oysters, clams or mussels in markets, they will thus be able to verify if the shellfish came from approved waters. If the mandatory information is not present, they can have the shellfish removed and destroyed.

The increase in viral illness caused by shellfish has led to increased concern about the monitoring of the waters from which the shellfish come. (See "For Oyster and Clam Lovers, the Water Must Be Clean" in October 1984 *FDA Consumer*.) The safety of these waters, called growing areas, is determined largely by the level in the water of two groups of coliform bacteria, including fecal coliform bacteria (found in the intestines of mammals). If these bacteria are abundant, it means that sewage is present and that there may be disease organisms both in the water and in the shellfish (shellfish obtain nutrients by filtering them from water - thus they also take in any pathogens in the water, such as bacteria and viruses, which don't necessarily hurt the shellfish but may cause illness in humans).

Badly contaminated growing areas are restricted from shellfish harvesting. In areas of less contamination, shellfish may still be harvested, as long as they are subsequently purified, under permit, in holding tanks for several days before they are sold, a process called depuration. If Part II of the revised shellfish guidelines is accepted by the Interstate Shellfish Sanitation Conference, guidelines for depuration will be changed to require monitoring of different critical factors affecting the speed with which shellfish are cleansed. These factors include the salt content and temperature of the water, the way in which the shellfish are loaded into the tanks, and the species involved.

The revised guidelines have lowered the level of fecal coliform bacteria that must be present before growing waters are declared restricted. And the frequency with which growing waters need to be surveyed has been increased.

But many scientists feel that the use of coliform indicator organisms for determining the sanitary quality of shellfish growing areas is not good enough. In an editorial accompanying *The New England Journal* article, Dr. Herbert L. DuPont, an infectious disease expert with the University of Texas Health Science Center, urged that methods be developed to test specifically for viruses. "Studies have shown that the absence of fecal coliform bacteria in harvesting areas is an inadequate indicator of safety from virus contamination among shellfish," DuPont said. Also, he said, methods that purify shellfish of bacteria probably are not adequate to rid them of viruses.

FDA's Clem agrees that fecal coliform bacteria are poor indicators for measuring the health hazard posed by viruses, but there is no suitable substitute, he says. FDA is planning to review research reports on different organisms, such as viruses and bacteriophages (viruses that attack bacteria), that could be used to indicate the sanitary quality of shellfish growing waters. The most promising of these "indicator organisms" will be selected for further study.

But shellfish regulators agree that viruses in shellfish are an unresolved problem. Depuration is criticized because some scientists believe it is not as effective in cleansing shellfish of viruses as it is in negating bacteria. And cooking appears to be less effective in killing viruses than bacteria.

Because most of the recent illnesses have involved raw shellfish, some experts, including University of Texas' Dr. Dupont, say that eating raw shellfish is a risky business. The New York State Health Department has advised consumers to cook all shellfish before eating.

But FDA feels that such advice is unwarranted and, besides, the agency is skeptical that mere cooking alone will provide absolute protection to shellfish lovers. "Toxins and some pathogens won't necessarily be killed by cooking," says FDA's Clem. He points out that steamed clams, for instance, are usually judged to be done when the shells open, which happens after about a minute. But it takes four to six minutes of thorough cooking to kill most viruses. In England there was a case in which consumption of cockles (an edible bivalve mollusk common in Europe) caused hepatitis A - even though the cockles had been steamed first and then boiled for four minutes. In any case, even if consumers do cook their oysters, mussels or clams at a high enough temperature (about 212 degrees Fahrenheit) and for a long enough time to kill any lurking virus, the food may be too tough to be worth eating at that point.

FDA does recommend, however, that people with certain health conditions cook their shellfish. Individuals with cancer, diabetes, liver disease, chronic gastrointestinal disease, or any condition resulting in impaired immunity should avoid raw shellfish, but not because of possible viral contamination. The bacterium *Vibrio vulnificus*, a natural inhabitant of coastal waters, can cause infections that lead to blood poisoning in people with these health problems. The mortality rate from *Vibrio vulnificus* infections for these people is 40 percent, according to the American Medical Association. Luckily,

infections from *Vibrio vulnificus* are rare, and the bacteria are killed more quickly by cooking than viruses, so even those individuals with the risk factors can still indulge in a bowl of oyster stew or clam chowder.

Most oysters, clams and mussels being harvested are clean and safe to eat. Unfortunately, there is no way to tell which shellfish do harbor bacteria or viruses. Just because a clam or oyster looks and smells - and even tastes - all right doesn't mean it is free of contaminants, says Clem. A dish of raw oysters might well delight a person's palate one night and keep him awake the next with diarrhea and vomiting.

To guard against shellfish-borne illness, FDA advises consumers to buy shellfish only from reputable sources - definitely not off the back of a truck or from a roadside stand. Labels on the containers should identify the waters from which the shellfish were harvested.

Most cases of gastroenteritis caused by shellfish contaminated with bacteria or viruses usually clear up by themselves in 24 to 48 hours. But anyone with severe, persistent diarrhea and vomiting should see a physician.

Consumers who do get sick from eating clams, oysters or mussels should immediately notify their local health department and FDA regional or district office by phone (the offices are listed in the government section of the local white pages). This helps FDA assess the extent of the current risks from eating shellfish and to identify waters from which contaminated shellfish are being taken, either because they are being harvested from misclassified waters or because they are being bootlegged from condemned areas by unscrupulous harvesters (see "The Cop on the Boat, Tightening the Net Against Unsafe Shellfish," in the February 1986 *FDA Consumer*.)

Meanwhile, FDA and the other members of the Interstate Shellfish Sanitation Conference continue to explore and develop better methods for ensuring shellfish sanitation. Purification methods are being improved, new ways to detect contaminants are being developed, and enforcement against illegal harvesting is increasing. Perhaps someday, viral epidemics caused by eating shellfish will go the way of typhoid fever, and people will only be able to read about them in history books.

Dairy and Food Sanitation, Vol. 7, No. 3, Pages 124-127 (March 1987)

FDA's Dairy Product Safety Initiatives

Preliminary Status Report

September 1986

Food and Drug Administration
Center for Food Safety and Applied Nutrition
Division of Cooperative Programs
Milk Safety Branch
Washington, D.C.

INTRODUCTION

The U.S. Food and Drug Administration (FDA) in cooperation with the states and industry has intensified surveillance efforts involving various types of dairy processing plants under a "Dairy Safety Initiative Progam" which began April 1, 1986. The initiatives incorporated a microbiological surveillance program along with check ratings (audits of interstate milk plants) and FDA inspections. Microbiological surveillance was initiated because raw milk and other raw ingredients may contain organisms such as *Listeria monocytogenes* and *Yersinia enterocolitica*. Both are cold-loving organisms which can survive and grow at refrigeration temperatures. The cold-loving characteristic necessitates the application of appropriate countermeasures as part of a renewed environmental emphasis for the entire dairy industry.

The purpose of this status report is to briefly summarize the findings of the check ratings, inspections and microbiological surveillance. In addition, recommended guidelines are provided to aid FDA field personnel, state regulatory officials and the industry in understanding where problems have been found to date and what actions can be taken to correct these problems.

The FDA dairy initiatives will continue in FY '87. This status report will be updated as ongoing research and additional inspections provide new information and insight as to actions that can be taken to prevent bacterial contamination of dairy products.

SUMMARY OF FINDINGS

Since April 1, 1986, a total of 357 check ratings and inspections have been conducted. The results have shown nine (9) plants (2.5%) with products containing *Listeria monocytogenes;* 20 plants (5.6%) with non-pathogenic *Yersinia enterocolitica;* and one plant with *Salmonella* sp. (0.2%). This totals 30 plants or 8.4% with positive findings.

Extensive follow-up efforts in each plant have demonstrated that *post-pasteurization contamination* has been a significant factor which led to finished product contamination. Although defects in pasteurization equipment and plant design have been noted, environmental sampling has revealed plant conditions which likely have contributed to post-pasteurization contamination. It has not been demonstrated that *Listeria monocytogenes* or other pathogenic organisms have survived the pasteurization process in the plants investigated.

RECOMMENDED GUIDELINES FOR CONTROLLING ENVIRONMENTAL CONTAMINATION IN DAIRY PLANTS

FDA and industry representatives of the Milk Industry Foundation and the International Association of Ice Cream Manufacturers have been working cooperatively, exchanging findings and experiences derived from a preliminary review of check ratings, FDA inspections and industry programs. Recommended guidelines to strengthen control of environmental contamination in dairy plants have been developed. These guidelines do not stand alone but must be combined with strict adherence to basic sanitation principles found in the Pasteurized Milk Ordinance (PMO) and the Good Manufacturing Practices (GMP's). All should serve to *enhance* al-

ready existing programs and should not be considered or used as the sole element in controlling plant conditions. The guidelines are primarily directed at controlling environmental, post-pasteurization contamination of product by such organisms as *Listeria* sp. and *Yersinia* sp.

1. *Pasteurization*

Every plant should immediately reassess the adequacy of their pasteurization equipment to determine if it satisfies the basic principle of pasteurization. This basic pasteurization principle is that "every particle of milk or milk product be heated to at least a minimum temperature and held at that temperature for at least a specified time in properly designed and operated equipment." Dairy products which contain higher fat and/or added sugars need higher pasteurization temperatures. Heavy, viscous products such as eggnog and frozen dessert mixes also need higher pasteurization temperatures and/or longer times.

TABLE 1. *Minimum Pasteurization Temperatures and Times.*

Product	Temperature	Time
Milk	145°F	30 minutes
	161°F	15 seconds
	191°F	1 second
	194°F	0.5 second
	201°F	0.1 second
	204°F	0.05 second
	212°F	0.01 second
Milk Products	150°F	30 minutes
of 10% fat or more	166°F	15 seconds
or added sugar	191°F	1 second
(½ & ½, cream	194°F	0.5 second
chocolate, etc.)	201°F	0.1 second
	204°F	0.05 second
	212°F	0.01 second
Eggnog and Frozen	155°F	30 minutes
dessert mixes	175°F	25 seconds
	180°F	15 seconds

Pasteurization at time/temperature combinations exceeding the minimum stated in Table 1 is recommended to provide a margin of safety in the pasteurization process.

All pasteurization equipment must be properly designed, installed and operated. A properly designed, installed and operating flow diversion device, and properly operating pressure controls for regenerator systems must be on all HTST pasteurizing systems.

It should be stressed that all Grade "A" products must be pasteurized in the plant of final processing and packaging. It is recommended that this practice be employed wherever possible for non-Grade "A" products.

2. *Post-pasteurization Contamination*

The installation, operation and adequacy of cleaning procedures for all processing and filling equipment and piping should be closely reviewed to identify potential areas of post-pasteurization contamination. The heat exchange units (presses) of HTST pasteurizer units need to be routinely opened and closely evaluated for stress cracks, pin holes, gasketing, cleaning, etc. Inspections have revealed holes in regenerator and cooling plates.

A thorough check should be made of sweetwater systems to assure that they are properly protected and do not contain any pathogenic organisms. It is important to include all equipment such as storage tanks, jacketed vessels and any other pieces of equipment that utilize sweetwater or glycol solutions. Inspections have revealed product contamination because of *Listeria* sp. contaminated sweetwater and leaking plates.

Cracks and crevices in silo tanks, leaking valves, agitator shafts, shielding and venting are all areas that have contributed to problems. Improper welds and similar irregular surfaces which cause ineffective cleaning and sanitizing should be eliminated.

Cleaning and sanitizing regimens should be reviewed for proper times, temperatures, pressures and flow rates. It is important to determine that proper sanitizers are being used at the appropriate strength and contact time. This review should include an assessment of the effectiveness of the cleaning and sanitizing regimen. It has been demonstrated that commonly used dairy and food plant sanitizers are effective against organisms such as *Listeria* sp. Chlorine based sanitizers at 100 ppm, acid anionics at 200 ppm, quaternary ammonium compounds at 100 ppm and iodophors at 25 ppm are recommended for control of *Listeria* sp.[1]. Consultation with suppliers of sanitizing compounds is highly recommended to assure that the compound applied is effective against the organisms of concern.

All piping circuits within the plant need to be visually examined to determine that the lines are being thoroughly washed and sanitized. It is important that all piping circuits be designed to eliminate trapping of washing or sanitizing solutions or allowing product to collect during the operating day. The lines should be free draining or have provisions to be kept free of solution or product except during intended use. All piping circuits should be immediately reviewed to insure that there are no cross-connections linking pasteurized product and raw product lines. It is equally important to search for any possible cross-connections which link product lines with CIP lines and take appropriate corrective action.

The use of absorbent items, such as rags and sponges, should be eliminated to reduce potential harborage and

[1]*Lopes, J.A. Paper presented at American Dairy Science Association Meeting, Davis, CA, June 1986.*

spreading of microorganisms in the plant environment. The use of brushes should be segregated (i.e., using different brushes for internal and external surfaces). Brushes should be maintained in good repair and properly stored when not in use and sanitized between uses.

Filling/packaging operations are also areas where post-pasteurization contamination can occur. Mandrels, drip shields, bottom and top breakers, prefilling coding equipment, deflector bars, cutting blades and extruder heads are critical areas where environmental contamination may occur. Overhead shielding, conveyors, conveyor belts, conveyor lubricants and use of air should be reviewed for troublesome spots. It is important to incorporate a routine cleaning regimen for all conveyors. Blow molding operations and handling of packaging materials should be examined, particularly where containers/jugs are conveyed through nonprocessing areas.

The use of defoaming systems which return product directly back to the filler bowl may cause significant problems and are not recommended. Any product recovered from defoamer systems should be protected from contamination, maintained below 45°F at all times and be repasteurized. A thorough review of the handling of imperfectly capped or filled containers/packages is suggested. Particular emphasis should be directed at eliminating manual handling/filling/capping of container/packages.

3. *Cross-connections*

Cross-connections have been found in a number of the dairy plants, with direct piping connections between pasteurized milk and raw milk, product to CIP circuits or pasteurized product to other potentially hazardous circuits. Most of this is unintentional piping and awareness is a critical factor. Blueprints need to be immediately reviewed and updated to reflect existing piping arrangements. This can only be accomplished by "walking" the blueprints through the plant and physically insuring the blueprints are accurate. Once the blueprints are updated, internal plant controls are needed to prevent any piping changes without previous review by qualified authorities.

4. *Use of Returned Milk and Reclaiming Operations*

Store returns or any product that has been mishandled, unprotected from contamination or which has not been maintained at a temperature of 45°F or less should be discarded. The practice of reclaiming product should be seriously re-evaluated, in view of the potential for environmental contamination. External carton contamination with *Listeria* sp. and *Yersinia* sp. has been demonstrated and may cause product contamination. Therefore, it is essential that if a product is to be reclaimed that proper holding temperatures and sanitary practices, including container handling, be exercised. Repasteurization of all reclaimed products is necessary and higher temperatures and/or longer holding times should be considered. Products returned from stores and outdated products which are being returned to the dairy plant for disposal should be isolated from all other plant operations. Precautions should be taken to prevent these areas from serving as a source of contamination. All equipment (i.e. tanks, pumps, pipelines, etc.) used in this disposal process should be of satisfactory construction and should be cleaned and sanitized daily.

5. *Airborne Contamination*

Airborne contamination is strongly suspected as the cause of some pathogenic contamination. A comprehensive assessment of air supply and utilization, both processing and ventilating air, should be conducted. Heating, ventilating and air conditioning (HVAC) systems should be designed for easy cleaning and should be periodically cleaned. Condensate drip pans and drain lines should be periodically checked to assure they are not providing favorable environments for the growth of pathogenic organisms. Air systems in refrigerated areas should also be designed for easy cleaning and should be periodically cleaned.

HVAC systems should be properly designed and adjusted to maintain positive pressure in areas where product is exposed (e.g., batching operations, filling, packaging). Air transfer from potentially contaminated areas (e.g., raw product receiving, ingredient and supply storage) to processing or packaging areas should be minimized.

Outside air should be filtered and free of condensate. Air flow should be determined and controlled to eliminate direct blowing onto product or packaging. Air filters must be of the type effective in preventing the passage of microorganisms. Filters must be kept clean and replaced according to an established maintenance schedule.

Process air systems which deliver air that contacts product packaging must be designed to enable cleaning. Process air systems should contain appropriate filters to remove extraneous matter. Sanitary check valves should be provided as necessary to prevent product back up into air lines. Air blow and agitation equipment should be checked. Most air blow and agitation equipment is not satisfactorily cleaned by usual CIP methods and should, therefore, be dismantled, manually cleaned and sanitized daily.

Practices which encourage the formation of aerosols (e.g., microscopic water droplets) should be eliminated. Such practices include use of high pressure hoses, unshielded pumps and dripping condensate. *Listeria* sp. has been frequently isolated from floor drains in processing areas and other areas. Because of this potential, floor drains should not be located under or in close proximity to filling and packaging equipment.

6. *Plant Environment (General)*

Particular emphasis on the general plant environment

with special consideration of refrigerated areas is necessary, in light of the growth potential of certain pathogenic organisms (i.e., *Listeria* sp., *Yersinia* sp.) at refrigerated temperatures. Clean floors, walls and ceilings, free from condensate and buildup is imperative. The pooling of milk, water or other processing wastes, such as in ducts, floor plating, grouting, cracks, holes and other areas, must be eliminated. Protection of product and containers from splash during cleaning in storage rooms and coolers should be examined. Returned goods should be isolated in a properly identified morgue area.

Floor drains should be frequently cleaned and periodically flushed with a sanitizing solution and maintained to insure proper drainage. Consideration should be given to relocating drains away from open product areas, and they must be accessible for cleaning and maintenance.

7. *Plant Traffic*

A traffic pattern of restricting access to dairy processing areas should be instituted. Milk haulers and other nonprocessing operation people should be restricted from entering the processing areas. The use of footbaths containing disinfectants should be encouraged and monitored routinely for proper disinfectant strength and cleanliness. Special attention is needed to assure that street clothes are not allowed in the processing area and that plant clothing (including rubber boots) do not leave the plant. Laundering of all work clothing should be the plant's responsibility, and proper procedures for storing and issuing clean clothing need to be developed. Of equal concern is a potential problem associated with plant maintenance personnel working in raw milk areas and then working on pasteurized milk equipment without adequate cleanup of hands, tools, clothing, etc. A review and restriction of the moving of pallets, forklifts and other similar equipment from raw milk, case wash, dock or other such areas into processing/packaging areas is needed.

8. *Personnel Cleanliness*

Employees with obvious illnesses, infected cuts, abrasions, etc. should be excluded from processing areas or other functions which can contaminate product, product-contact surfaces or packaging material. The use of tobacco or tobacco products should not be permitted in any production area.

Handwashing facilities must be properly designed and conveniently located near work stations.

9. *Quality Assurance, Sampling and Testing*

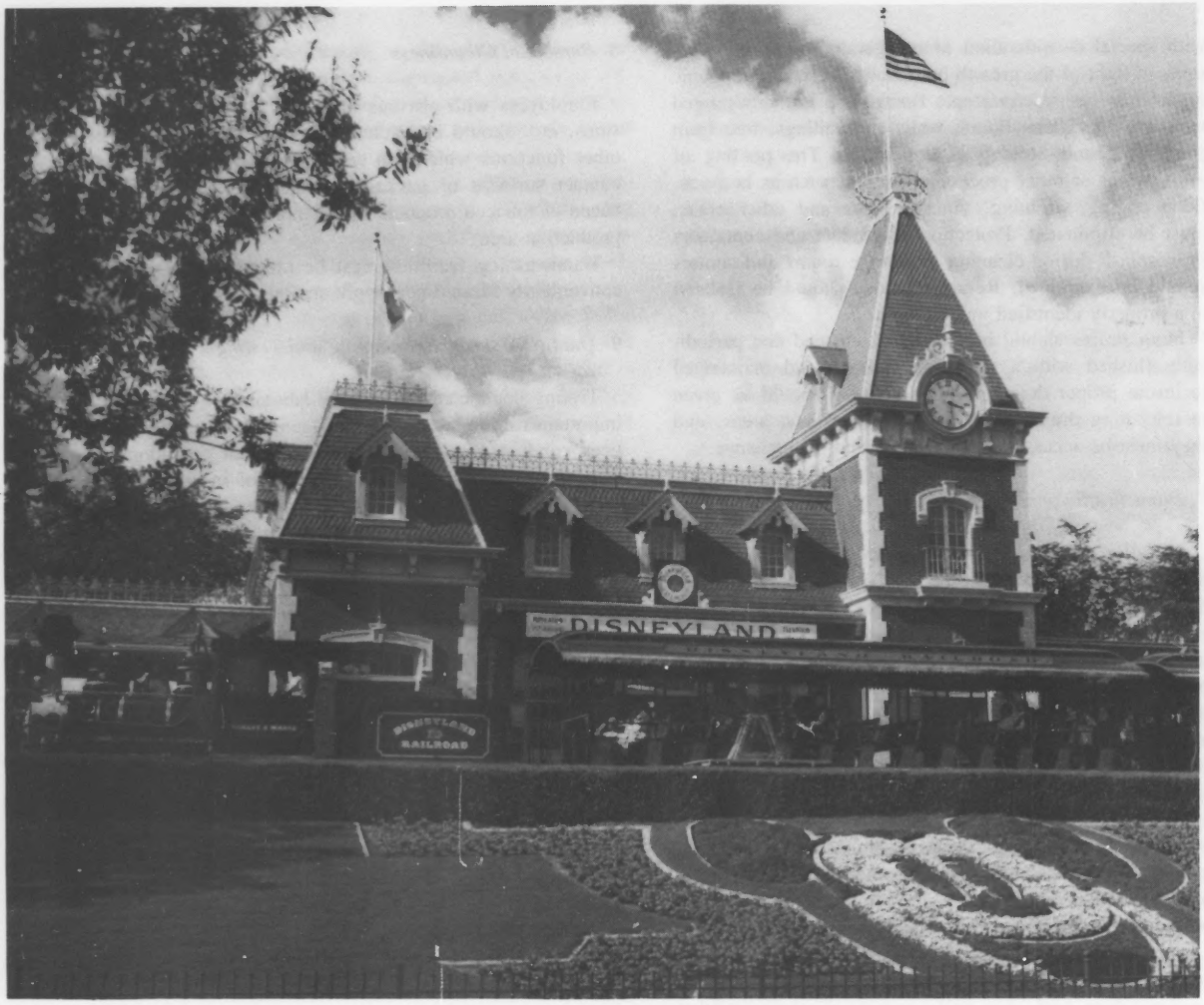
Testing conducted by industry laboratories can play an important role in successful management of sanitary practices conducted as a part of routine plant operations as well as monitoring for quality control of in-line samples and finished product. Tests for keeping quality of finished products can be used to detect various conditions of plant sanitation as well as to monitor for unusual increases of bacterial counts during refrigerated storage.

It is recommended that particular emphasis be given to environmental sampling during the next several months to detect any unrecognized problems.

Coliform testing is still a good index for post-pasteurization contamination. Any coliform level detected should generate a review of plant practices.

All testing for pathogenic organisms should be done in separately isolated laboratories away from dairy plants.

The specific FDA methodology for performing tests for *Listeria monocytogenes* and *Yersinia enterocolitica* may be obtained from: Division of Microbiology (HFF-230), Food and Drug Administration, 200 'C' Street, S.W., Washington, D.C. 20204.



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New 4th Edition of "Procedures to Investigate Foodborne Illness" Now Available

This manual was designed to guide public health personnel who investigate reports of illnesses alleged to be foodborne. It is companion to two other manuals published by the *International Association of Milk, Food and Environmental Sanitarians, Inc.*: "Procedures to Investigate Waterborne Illness" and "Procedures to Investigate Arthropod-Borne and Rodent-Borne Illness."

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"Procedures to Investigate Foodborne Illness" was prepared by the IAMFES Committee on Communicable Diseases Affecting Man, Food Subcommittee, headed by Dr. Frank L. Bryan.

Single copies are available at $3.50/each; 25-99 copies, $3.25 each; and 100 or more, $2.75 each.

To order contact the IAMFES Office, PO Box 701, Ames, IA 50010 or call 800-525-5223, in Iowa and outside the U.S. call 515-232-6699.

CEM Corporation Appoints David L. Fish

CEM Corporation announces the appointment of David L. Fish as technical services representative. He will provide technical support in the meats, food and related industries as well as market development for new instrumentation.

CEM Corporation manufactures analytical instrumentation for rapid testing in production and laboratory applications. The company serves industries such as food, meat, chemical, pharmaceutical, pulp and paper, waste water, and others.

David Fish has extensive experience as a consultant in the meat and food industries and is a valuable addition to the CEM marketing department providing communication, sales support and technical services to CEM customers.

Basic Pasteurization Courses

The Texas Association of Milk, Food, and Environmental Sanitarians has finalized plans for six training seminars entitled "Basic Pasteurization Course" for 1987. These courses will cover the basic operation and testing of milk pasteurization equipment and controls. Each course will have a maximum enrollment of fifty industry representatives.

Enrollment for the "Basic Pasteurization Course" will be administered by Ms. Janie F. Park. It is requested that all applicants contact Ms. Park by telephone at 512-458-7281 Monday through Friday between the hours of 7:00 AM CST through 4:00 PM CST. Filling of seminar dates will be prioritized on a first come, first served basis. The fee for enrollment is $150.00 per applicant and may be remitted to Ms. Janie F. Park, TAMFES, P.O. Box 2363, Cedar Park, Texas 78613-2363. Checks should be payable to Texas Association of Milk, Food and Environmental Sanitarians or TAMFES. Sustaining members may supply one applicant for this seminar at no charge. Regulatory officials are exempt from the $150.00 enrollment fee.

The training dates for five of the training seminars and the locations are:

Dallas, March 24-26, 1987, Viscount Hotel, 214-522-6650

El Paso, May 19-21, 1987, Travellodge, 915-544-3333

San Antonio, July 14-16, 1987, (to be announced)

Houston, September 8-10, 1987, Viscount Hotel, 713-526-4571

Texarkana, November 10-12, 1987, (to be announced)

Lodging will be the responsibility of the individual registrants. Telephone numbers of host hotels are listed above for your convenience.

Please be reminded that the sooner you apply, the more likely you are to be enrolled at your place and on your date of greatest choice. We look forward to seeing you at one of these training seminars.

UNICODE Task Force Update

There has been discussion recently that a model food establishment Unicode be developed which would bring together in one document the FDA's model codes on food service, food vending, and food store sanitation, and that its development should be a cooperative effort between FDA and key national organizations representing state and local health officials, industry and consumer groups. This concept

was supported at the Third Conference on Food Protection, August, 1986.

The first meeting of the Unicode Task Force was on December 9, 1986 at the FDA Building, Washington DC. It was felt by the Task Force that the Unicode should be developed around a common core, with special sections for specifics, that it will not cover fee issues, that it should cover all aspects of retail food stores, food service, food vending, temporary, mobile, commissary, and catering establishments, and the document should be developed with electronic data processing compatibility so that particular segments of food protection can be extracted from the core and subparts.

A number of issues were discussed that may be controversial and they include: lack of a uniform facility plan review process (NSF-NRA project); how to determine potentially hazardous foods (pH, water activity, exposure time, etc.); safe roast beef cooking procedures; equipment requirements, such as two versus three-compartment sinks; enforcement (training needs); open food product display cases (product versus case temperature); determination of employee training needs; HACCP as an approach for applying code requirements; labeling of food additives; ice manufacturing; and, storage of wiping cloths.

It is anticipated that a first draft of the Unicode will be very comprehensive and should be available by June 1, 1987. It will be distributed to all interested groups and the general public for comment, followed by a second draft. If there are any comments or suggestions regarding development of the Model Food Establishment Unicode, they should be addressed to the U.S. Food and Drug Administration, Division of Cooperative Programs, Center for Food Safety and Applied Nutrition, Washington, DC 20204.

Submitted by:
Duain B. Shaw, Chariman
Food Equipment Sanitary Standarads Committee

American Society of Brewing Chemists To Hold 53rd Annual Meeting

The American Society of Brewing Chemists (ASBC) will hold its 53rd Annual Meeting at the Hyatt Regency in Cincinnati, Ohio, May 31-June 4, 1987.

The Program Committee invites authors to contribute to the Technical Sessions.

The ASBC will consider technical presentations relating to scientific advancement in the brewing, malting, and allied industries. Fundamental or developmental research as well as novel analytical techniques, instrumentation, and applications are encouraged. Additionally, technical contributions on packaging materials, sanitation, water quality, and bio-processing (as they relate to the brewing industry) will be considered.

ASBC Annual Meeting registration materials are available from ASBC headquarters, 3340 Pilot Knob Road, St. Paul, MN 55121. Telephone: 612-454-7250; Telex (MCI/WUI) 6502439657.

Sanitation Rules Booklets for the Food Industry

L. J. Bianco & Associates have just completed a series of three much needed Good Sanitation Practice (GSP) Guideline Rules Booklets to help cope with the increasing sanitation and product quality problems facing the Food Industry.

GSP Guideline Rules for Food Plant Management.
GSP Guideline Rules for Food Plant Employees.
Spanish GSP Guideline Rules for Food Plant employees.

These new training materials serve as aids for management and employee training in the basic and simple fundamentals covering the plant Good Sanitation Practices, Equipment and Facility Cleanup; Sanitation Safety; and Pest Controls.

The management booklet covers:

Plant Sanitation Program; Sanitation Work Responsibilities, Implementation, and Monitoring; Plant Training Program; Good Sanitation Practice Concepts; Standards of Cleanliness; Plant Cleanup; and Guideline Rules for Good Cleanup Practices, etc.

The booklets in English and Spanish for Employees cover:

Importance of Plant Sanitation to Product Quality; Standard Guidelines for Cleanliness; Plant Cleanup; Personal Hygiene and Personnel Practices; Important and Helpful Cleaning Rules, and Pest Controls.

These are available from: L. J. Bianco & Associates or LJB, Inc., 850 Hucklebery Lane, Northbrook, IL 60062. 312-272-4944.

Ron Smith Receives Louis W. Gardner Award

Ronald Z. Smith, director of training resources/in-store bakeries at the American Institute of Baking has been announced the recipient of the Louis W. Gardner Award, according to Dr. William J. Hoover,

president of the Institute.

"This annual award is presented to an individual who has given exceptional service above and beyond the normal duty in promoting the welfare and advancement of the Institute," Dr. Hoover explained.

This Louis W. Gardner Award consists of a certificate and a $500 stipend for travel, supplies, or an educational grant toward continued professional growth.

Smith and his staff have developed an outstanding educational program for personnel working in, managing, or operating in-store bakeries. The program consists not only of regularly scheduled workshops and seminars at the Institute, but also a 16-lesson In-store and Retail Baking Technology correspondence course, and many specialized and individualized seminars conducted both in the Institute's workshop and at regional sites.

"He is working closely with the Kansas Restaurant Association, the Food Service institutions, and the in-store and baking industry throughout the United States," Dr. Darrell Brensing, vice president-education added.

Smith joined the American Institute of Baking in September 1979 to set up and operate a new frozen dough and in-store bakery training program. Prior to that he spent three years with Peavey Company at their Technical Center in Chaska, Minnesota. His responsibilities dealt with all phases of formulation within a full line of mixes and the monitoring of donut flour blends.

Courses in Sensory Evaluation Offered in April at UC Davis

Two courses for sensory scientists will be offered during April by University Extension, University of California, Davis.

"An Introduction to Statistical Methods for Sensory Evaluation of Foods" will take place April 23-25. This course is designed as an introduction for the beginning sensory scientist with little or no statistical background. It is also an excellent update for the experienced professional. The course is application oriented, concentrating on the logic and reasons for the application of statistical tests.

The enrollment fee for the course is $350. In combination with the course "Sensory Evaluation Update," which is offered April 27-29, the fee for each course is $300.

"Sensory Evaluation Update" will be offered April 27-29 on the UC Davis campus. This course not only describes sensory methods, it gives sufficient background to understand why measurement procedures are set up as they are. Course content ranges from the basics to the very latest state-of-the-art.

The enrollment fee for the course is $350. In combination with "An Introduction to Statistical Methods for Sensory Evaluation of Foods," which is offered April 23-25, the fee for each course is $300.

Both sensory evaluation courses are taught by Michael O'Mahony, associate professor in the Department of Food Science and Technology, UC Davis. He is the author of "Sensory Evaluation of Food: Statistical Methods and Procedures." Professor O'Mahony has been a consultant to the food industry in this country, as well as in Europe and Asia.

To obtain a brochure on these courses or to enroll by phone call 916-752-0770.

Product Research Priorities Available to Dairy Groups

A summary of research priorities identified by key segments of the dairy industry is now available to interested groups and individuals from United Dairy Industry Association (UDIA).

The summary, prepared by UDIA's Dairy Research Foundation (DRF), targets food safety, efficient processing and new competitive products as the top research priorities. The listing is the result of a precedent-setting meeting held in Berkeley, Calif., this fall. The meeting was organized by DRF in cooperation with the University of California-Davis with funding from the National Dairy Promotion and Research Board. More than 100 participants, through two days of focused group discussions, reached a consensus on priorities in recommending future research needs.

The meeting participants largely represented dairy processing co-ops and proprietary companies throughout the country. Industry associations, dairy producers and governmental agencies, including the U.S. Food and Drug Administration and Department of Agriculture, also were represented. Several prominent university scientists served as technical advisors.

"This unified effort will help communicate that the dairy industry is serious about being competitive in the U.S. and international marketplace," said Joseph A. O'Donnell, vice president of Dairy Research Foundation. "Further, the attention to paramount issues such as food safety re-emphasizes the industry's dedication to meeting consumer needs and concerns."

Some suggestions in the area of dairy food safety include improving analytical methods that identify bacteria, and controlling the processing environment through modern sanitation techniques, equipment and

plant design.

The complete summary may be obtained by writing Joseph A. O'Donnell, Ph.D., vice president, Dairy Research Foundation, UDIA, 6300 North River Road, Rosemont, IL 60018.

Congress on Food Microbiology and Symposium on Preservation of Foods

The First Latin American Congress on Food Microbiology and the I Argentine Symposium on Preservation of Foods will be held in Buenos Aires, Argentina, from November 30 to December 4, 1987. The participation, papers and contributions of American scientists are welcome. Detailed information can be obtained from Dr. Ricardo Sobol, Secretary General, Bulnes 44 P.B. "B", 1176 Buenos Aires, Argentina.

For more information, contact: Dr. Fernando Quevedo, 525 Twenty-Third St., N.W., Washington, D.C. 20037.

Food Processing Waste Conference

This conference, to be held September 1-2 at the Atlantic Radisson Hotel, is the first in a series of forums for the exchange of information concerning all aspects of managing wastes generated by the food processing industry. It is designed to promote the understanding of new research, design, operating, and regulatory issues within the industry.

Conference topics will deal specifically with the management and control of wastes from food processing industries. Papers on research, design, operations, economic analysis, and case histories are invited. Papers should address topics of interest to the food processing industry such as:

- Wastewater Treatment
  - Biological
    - Aerobic
    - Anaerobic
  - Physical/Chemical
  - Land Application
- Water Conservation/Recycle/Recovery
- Plant Process Modification
- Energy Efficiency in Waste Management
- Economic Analysis
- By-Product Recovery
- Treatment and Disposal of Solids
- Legislation and Regulations

Concurrent sessions each day will cover the major treatment and utilization of food processing wastes (anaerobic, aerobic, physical-chemical, nutrient recovery, etc.)

Conference registration forms will be mailed out in the spring. In the meantime, for further information, contact Edd Valentine or Chuck Ross at 404-894-3412 or at this address: Edd Valentine, Conference Chairman, Georgia Tech Research Institute, Economic Development Laboratory, Environmental, Health, and Safety Division, O'Keefe Building, Atlanta, GA 30332.

1986-87 Minnesota Dairy Report is Now Available

For dairy producers, keeping on top of production and policy news and research is critical. They will be interested in the "1986-87 Minnesota Dairy Report" (AG-BU-2235), which covers current dairy topics such as rations for economic milk production, AI technology and dairy policy. The report is now available from the University of Minnesota's Extension Service. Here is a sampling of some of the articles in the report:

"Most dairy producers only evaluate a recommended 'paper' ration," say dairy scientists James G. Linn and Donald E. Otterby in an article on how to formulate rations while controlling costs. They provide guidelines for evaluating the adequacy of "paper" rations to meet a herd's nutritional requirements.

Extension economist Steven J. Taff discusses dairy policy and tackles the quota issue in another article. He says, "Any proposal to increase the dairy sector's income at the expense of all others--and dairy quotas would do just this--can expect resistance. Supply control is not a no-lose proposition."

G. D. Marx, dairy scientist with the Northwest Experiment Station, Crookston, reports research using high-moisture corn in lactating dairy cow rations. High-moisture corn has several advantages including no artificial drying expense, reduced weather risks, more harvesting time and increased yield. The disadvantages are that it can be used only as livestock feed and spoilage may be rapid after removal from storage. A two-year study resulted in a 4.3-percent advantage in milk production during early lactation with high-moisture shelled corn.

The "1986-87 Minnesota Dairy Report" is available from county extension offices in Minnesota or by writing the Distribution Center, 3 Coffey Hall, University of Minnesota, St. Paul, MN 55108. Ask for publication AG-BU-2235 and enclose $1.50 per copy for mail orders. Checks should be made payable to the University of Minnesota.

New Product News

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

The RubbAir XHD Traffic Door

• An extra-heavy traffic door with a replaceable fork entry flap is now available from the RubbAir Door Division of Eckel Industries.

The RubbAir XHD Traffic Door is a significantly reinforced version of the Flexible, full thickness RubbAir Standard Traffic Door. Specifically designed to withstand daily punishing impact from lift trucks and other rolling stock, the XHD Door is reinforced in major stress areas to assure exceptional durability.

The XHD door body is reinforced by laminated internal and external back strips extending from the jamb edge onto the face of the door, as well as an optional heavy-duty impact wear panel which wraps completely around the lower portion of the door to the required height.

Heavy-duty mounting features include an offset steel mount assembly with full length steel shaft and reinforced hardwood stile.

The replaceable fork entry flap extends the full length of the lower edge of the door. The flap "gives" on impact from lift trucks to minimize the damage caused by fork impact.

Like the RubbAir Standard Door, the XHD Door is a full 1 3/4" thick, exceeding Commercial Standard requirements for door thickness. Construction features include a flexible, shock absorbing framework of rubber honeycomb and I-beam extrusions at all critical locations in the door body, for high dimensional stability and reliable recovery.

The RubbAir XHD Door is custom-fabricated to the exact requirements of the door opening.

For more information and free product literature, contact: Mr. Jim Collins, RubbAir Door Division, 100 Groton-Shirley Road, P.O. Box 368, Ayer, MA. Telephone: 617-772-0480.

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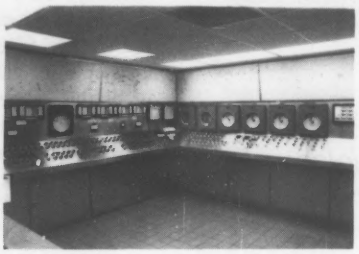

Control Enclosures From Hartel Corporation

• Hartel Corporation control enclosures are designed and engineered in many different configurations and sizes. This particular panel was requested to be made in this configuration, with these controls required by the customer's process. They also requested the process switch-gear, as shown. Hartel Corporation constructed the panel to make certain it worked as required. Hartel Corporation can also do ALL the customer's engineering, making certain ALL phases of the customer's operation are properly mounted in the control panel. Panels are furnished with complete wiring and pneumatic diagrams, including internal and field wiring, component location and panel to equipment wire numbers. Remember technical field engineering and services are available, one panel, one hundred or more!

Contact Hartel Corporation, the system's people, for your control panel requirements. Hartel Corporation, 201 N. Main St., P.O. Box 41, Fort Atkinson, Wisconsin, 53538. Telephone 414-563-8461, telex 910-260-3734.

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TIP I - Photovac's New Analyzer

• Originally designed for industrial hygiene and hazardous site monitoring, TIP uses multiple energy photoionization detection to measure chemical contaminants in the range of 0.1 to 2000 ppm. Food and sanitation applications include measurement of fumigants and solvents in air, water and food products, leak testing and worker safety. TIP is direct reading, easy to calibrate and simple to use.

For more information, contact: Photovac International Inc., 741 Park Avenue, Huntington, NY 11743. Telephone: 516-351-5809

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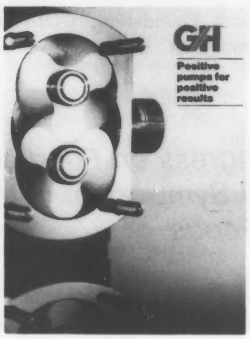

G&H Products Details 36 Models of Positive Pumps in New Brochure

• Just out from G&H Products Corporation, Kenosha, Wisconsin, is a new 4-color, illustrated brochure on the company's full line of positive displacement rotary pumps. Detailed in the 6-page gatefold are 36 pump models in capacities up to 510 gpm and pressures up to 300 psi. The brochure shows the standard, flushed, aseptic, and internal seals available, a new pressure relief valve, inlet/outlet connections, and rotor selection. It presents features for high pressure pumping as well as information on dimensions, seal face materials, and motor specifications.

A demonstration of the maintenance system shows how G&H assembles the working components of a pump in a single, compact, easily replaced cartridge, construction which reduces maintenance time and costs. Optional extras include the HyFlo Series for special applications. G&H technical personnel will be happy to assist in recommending and sizing pumps for special applications.

For a free copy, phone or mail request to G&H Products Corporation, P.O. Box 1199, Kenosha WI 53141. Telephone: 414-694-1010 or 1-800-558-4060.

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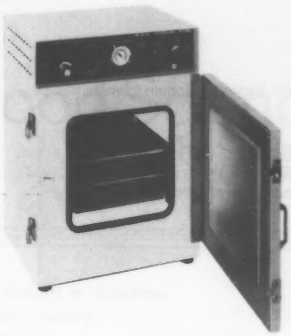

Moisture Determination Ovens

• Lab-Line's new Moisture Determination Ovens feature excellent temperature control and uniformity not found on any other vacuum oven. A proportional electronic temperature controller maintains ±1°C variance from the specified temperature for equal sample conditioning throughout the chamber. Moisture, as it is liberated, is carried off through a unique air flow system. Preheated, dessicated air is introduced through a manifold located at the lower front of the chamber. The air sweeps across the chamber exiting through a vacuum controlled manifold in the upper rear section of the oven. Temperature is maintained by radiant heaters mounted in the walls and is displayed on a large L.E.D. readout. Accidental temperature rise is prevented by an adjustable overtemperature thermostat. Maximum temperature is 150°C. The chamber is fabricated of 1/4" stainless steel and the cabinet has heavy gauge steel finished with baked enamel. Two sizes are available with chamber capacities of 1.1 and 1.7 cubic feet. Both have three removable perforated shelves providing 2.8 and 4.7 square feet of storage space respectively. Comes complete with an internal thermocouple. As many as these additional thermocouples of either flexible or rigid types are available as an option.

For more information, contact: Gregory G. Poupitch, Product Manager, Lab-Line Instruments, Inc., 15th and Bloomingdale Avenues, Melrose Park, Illinois 60160. Telephone: 312-450-2600, Telex: 687 1028 LBLIN UW.

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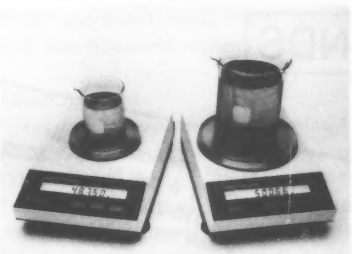

Raffinose Test Kit

• A test kit for the enzymatic determination of Raffinose in a variety of materials (such as molasses, syrup, soybean and cereal flavors) is available from Boehringer Mannheim Biochemicals. This kit is also useful for determining raffinose in fermentation samples and cell culture media.

With this procedure, raffinose may be determined quickly and accurately, even in the presence of high concentrations of substances with B-galactoside linkages, such as lactose. The kit comes complete with all reagents to perform 30 assays and a working procedure with sample preparation tips and literature references is included.

For more information, contact: Kristen E. Kinkade, Boehringer Mannheim Biochemicals's Enzymatic Test Kit Department, 7941 Castleway Drive, P.O. Box 50816, Indianapolis, IN 46250. Telephone: 1-800-428-5433 (in Indiana, call collect at 317-849-9350).

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Series 5000 Electronic Balance Line

• Scientech's new 5000 Series electronic balance line features three dual range models with capacities of 0-50.000/0-500.00, 0-500.00/0-5000.0 and 200.000/2000.00 grams. In addition to the dual range capability of these balances, autoranging and Scientech's Floating Range™ are standard features offered, providing low range resolution throughout the entire capacity of the balance. Other standard features include seven selectable units of measure, autocalibration, below balance weighing and custom checkweighing capability.

Designed to run cool, the 5000 Series uses an easy to read LCD display and remote power supply that eliminate heat buildup within the balance that could cause drift or instability. The balance case also features adjustable feet, level bubble and a built-in security bracket. Optional accessories include multifunctional data input keyboard, lab windscreen, RS-232 C, Centronics and analog outputs.

For more information, a free brochure and pricing on the Scientech 5000 Series balance line, contact: Scientech Incorporated, 5649 Araphahoe Avenue, Boulder, Colorado 80303. Telephone: 303-444-1361 or 800-525-0522.

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New Liquid Handling Catalog

• Bio-Rad's new Liquid Handling Catalog describes a wide selection of disposable products for pipetting, dispensing, measuring, and storing liquids. Products featured in this catalog include a wide selection of bulk and sterile pipet tips to fit practically any pipettor, tips in racks for multi-well pipetting, test tubes, transfer pipets, cuvettes, microtitration plates, and vials. The catalog gives exact product dimensions and chemical data, as well as applications information for each product. Major pipet brands are cross-referenced to the tips which give precise results with each pipet, and a procedure for comparing the precision of pipet tips is included. Request your free copy from Bio-Rad Laboratories.

For more information, contact: Anne Stevens, Bio-Rad Laboratories, 1414 Harbour Way South, Richmond, CA 94804. Telephone: 415-232-7000.

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Automatic Titrator

• Baird & Tatlock Model AF5 Automatic titrator has been improved to offer automatic sample weighing, computer interface and more versatile sample measurement parameters. The unit is available in the US from Vector Marketing, Valley Cottage, New York.

The AF5 has a unique, sealed sample vessel preventing the intrusion of unwanted ambient moisture. A sliding seal allows opening for introduction of solids while a septum is provided for injection of liquids from a syringe. The user friendly micro-processor leads the operator through each test with simple YES/NO questioning. A range of 10ppm to 100% makes the AF5 ideally suited for most liquids and solids. Delay times are available for more difficult materials.

User programing allows up to four different procedures to be stored in the instrument for ready use. Variables include delay titration, adjustable end point time, titration rate control, electrode sensitivity as well as a variety of data parameters.

Supplied with a printer the AF5 tracks test results providing a summary report with the mean and standard deviation calculated for each sample series.

The company offers extensive application and procedure references to aid users with the more difficult samples.

For more information, contact: Jerry Gerdes, Vector Marketing, P.O. Drawer 18, Valley Cottage, NY 10989. Telephone: 914-620-1166.

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Food Science Facts
For The Sanitarian

Dr. Robert B. Gravani
Cornell University
Ithaca, NY

BACTERIAL FOODBORNE DISEASES
Continued from the February Issue

Yersiniosis

Yersinia enterocolitica is an organism that has received a tremendous amount of interest in the last several years. Due to several large yersiniosis outbreaks in milk in the U.S., many scientists have become interested in this organism (20).

Nature and Source of the Organism

Yersinia enterocolitica is found in the intestinal tracts and feces of wild and domestic animals; raw foods of animal origin; non-chlorinated water supplies; and wells, lakes, streams and rivers (21,22). Evidence indicates that animals harboring *Yersinia* are an important mode of transmission. The presence of this bacterium in the intestinal tract of animals explains its occurrence in raw meats, raw milk and non-chlorinated water supplies (21,22).

In addition to the animal to food/water to human mode of transmission, *Yersinia* is also thought to be transmitted from person-to-person. Humans who carry *Yersinia* may not show signs of illness and can transmit these organisms to other people if good sanitation is not practiced (21,22,23). Unlike most other bacteria that cause foodborne illness, *Yersinia enterocolitica* can grow at refrigeration temperatures. If present on foods that are refrigerated, the organism can multiply, but at a slower rate than at room temperature (21,22). The bacterium is sensitive to heat, and is easily killed at temperatures over 140°F. When processed foods were incriminated in outbreaks, post heat treatment contamination was suspected.

Foods Involved

Yersinia enterocolitica and related bacteria have been isolated from a wide variety of foods including (21,22,23):

- dairy products (raw and pasteurized milk, ice cream, egg nog, cream and cheese curd);
- raw or rare meats (beef, pork, lamb and poultry);
- seafoods (fish, clams, mussels, oysters, shrimp and crab); and
- fresh vegetables.

It is important to recognize that all of these foods are eaten regularly without any ill effects because not all types of *Yersinia enterocolitica* are capable of causing illness in humans. Some strains of *Yersinia* are known as environmental (or non-invasive) types and can be present in foods without causing illness. The real problem is those infrequently found pathogenic strains that cause foodborne illness (21,22,23).

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

The Disease

Yersiniosis appears most often in children and teenagers but it also can occur in adults. The symptoms usually appear no less than 24 to 36 hours after consuming the contaminated food and often occur from 3 to 7 days after ingestion (2,22,23).

The symptoms include abdominal pain, fever and diarrhea (2,22,23). Vomiting and skin rashes have also been observed in some outbreaks. The one symptom of many *Yersinia enterocolitica* infections that helps distinguish it from other causes of gastroenteritis is the sharp pain in the lower right quadrant of the abdomen (23). When this pain is accompanied by fever, the illness is often mistaken for appendicitis. In recent U.S. food related outbreaks, several children underwent appendectomies. In these cases, the appendix was usually normal, but the lower intestine and/or surrounding lymph nodes were inflamed. The type of symptoms depends on the strain of disease causing *Yersinia enterocolitica* that is present in the food (23).

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

Prevention

While many foods provide an environment that will

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

Campylobacter *Enteritis*

Campylobacters have long been recognized as the causative agent of veterinary diseases in cattle, sheep and poultry (24,25,26). But only recently, with improvements in detection and isolation has the organism *Campylobacter jejuni* been incriminated as a cause of human foodborne disease outbreaks. This organism is one of the most common causes of diarrheal illness in humans and is recovered as frequently or more frequently in the feces of persons with diarrhea than *Salmonella* or *Shigella* (26). *Campylobacter* enteritis is now recognized as an important disease transmitted by food.

Nature and Source of the Organism

C. jejuni is found in the intestinal tracts of healthy cattle, sheep, swine, ducks, chickens and turkeys. High levels of *Campylobacter* in fecal materials explain how animal carcasses can become contaminated during the slaughtering process. *C. jejuni* has also been isolated from milk, eggs, soil and water that have come in contact with animal manure (24,25,26).

The organism is rather fragile and needs small amounts of oxygen to grow. The normal levels of oxygen in air inhibit the growth of this organism. The fact that it grows slowly and is difficult to culture, accounts for why it has just recently been recognized as an important human pathogen (24,25,26).

Survival in raw foods depends on the strain of *C. jejuni*, initial number of organisms and environmental conditions, especially storage temperature. This organism is easily killed by heating foods to a minimum internal temperature of 140°F. The holding time at 140°F varies with the food product and is several minutes for beef and about 10 minutes for poultry (26).

Foods Involved

C. jejuni has been found in raw foods of animal origin including poultry, pork and beef (26). Poultry carcasses and parts have been found to be a major source of *C. jejuni*. This organism has been isolated from about 92% of poultry carcasses and 85% of poultry livers that were surveyed (26). It was also isolated from freshly slaughtered pork carcasses. So far, limited studies have shown that the incidence of *C. jejuni* on retail cuts of red meat is considerably less than on retail poultry meat (26).

The Disease

Several animal products have been involved in human *Campylobacter* outbreaks. The illness has been found most frequently in children over ten years old and in young adults, although all age groups have been affected.

The *Campylobacter* infections are thought to affect both the small and large intestines and produce a diarrheal illness. The symptoms usually appear 3 to 5 days after eating contaminated food, although a range of between 1 to 11 days has been suggested (21,24,25,26).

The symptoms of *Campylobacter* enteritis can vary widely. Some people have mild cases and show no visible signs of illness but shed bacteria in their feces, while others have severe cases (2,24,25,26). Symptoms include abdominal pain and cramping, diarrhea, fever and prostration. Diarrhea usually occurs at the beginning of the illness or it may develop a few days after the abdominal pain and fever become apparent. After 1 to 3 days of diarrhea, blood may appear in the stools. Other symptoms that may occur are headache, malaize, muscle pain, dizziness and delirium. Although vomiting is not common, it has been observed in some cases. The length of illness varies, but usually lasts from 2 to 7 days. Deaths, although rare, have been reported (2,24,25,26).

Prevention

Campylobacter enteritis can be prevented by the proper handling, cooking and storage of foods of animal origin (24,25,26).

Listeriosis

Listeriosis is a disease caused in humans by *Listeria monocytogenes*, a well known veterinary pathogen. Before 1967, listeriosis was considered a rare disease in humans but recent foodborne outbreaks involving this organism have highlighted its public health importance. Between 1967 and 1971, 472 cases of human listeriosis were reported to the CDC (27,28). It seems that this disease is not so rare but is frequently misdiagnosed or in some mild cases, goes unnoticed (27).

Nature and Source of the Organism

Listeria monocytogenes is found in soil, decaying and dead vegetation, and in the intestinal tracts of over 50 domestic and wild species of birds and animals including sheep, cattle, chickens and swine. This organism has also been isolated from stream water, mud, sewage, silage, as well as trout, crustaceans, ticks and houseflies. It is also found in the intestinal tracts of asymptomatic human carriers (2,18,29,30).

The optimum temperature for the growth of *L. monocytogenes* is 98.6°F but it has been shown to grow at temperatures as low as 36°F (30).

Foods Involved

Foods that have been incriminated in listeriosis outbreaks include milk, cole slaw (made from cabbage that had been fertilized with the manure of infected sheep) and Mexican-style cheese (2,31). Recently, certain brands of Brie cheese were recalled due to the presence of *L. monocytogenes*, although no illnesses were reported (32).

The Disease

Listeriosis is a disease that primarily affects newborn infants and those over 50 years of age, pregnant women, people debilitated by diseases such as alcoholism, diabetes and cardiovascular disease as well as immuno-compromised individuals such as those undergoing chemotherapy (2,18,29,30).

Meningitis, (inflammation of the membranes that envelope the brain and spinal cord) or meningoencephalitis, (inflamation of the brain and the membranes enveloping the brain and spinal cord) are the most common manifestations of the disease in adults. Listerial septicemia (blood poisoning caused by the presence of *L. monocytogenes*) occurs as a complication in physically weakened individuals (2).

Onset of meningoencephalitis may be sudden with fever, intense headache, nausea, vomiting and signs of meningeal irritation or it can be subacute, particularly in an immuno-compromised or elderly host. Delirium and coma may appear early and occasionally there is collapse and shock (2).

In a typical healthy person, listeriosis may occur as a mild illness, sometimes with influenza-like symptoms and fever. Infection in pregnant women may result in infection of the fetus and interrupted pregnancy (2). Infants may be stillborn, born with septicemia or develop meningitis in the neonatal period, even though the mother is asymptomatic (2). The fatality rate is 30% in newborn infants and approaches 50% when onset occurs in the first 4 days (2). The incubation period is thought to be a few days to 3 weeks. The fetus is usually infected within several days after maternal disease (2).

The exact mode of transmission is unknown, but the oral route through the consumption of contaminated foods has been identified as one mode of transmission. The disease can also possibly result from person-to-person contact or from inhalation of the organism. Direct contact with infected material, animals or soil contaminated with infected animal feces can cause lesions on the hands and arms (2,18,29,30,31).

Prevention

The risk of listeriosis can be reduced by avoiding raw meats, unpasteurized milk and foods made from contaminated ingredients. Pregnant women should avoid contact with infected animals (2,18).

TOXICOINFECTIONS

Toxicoinfections are caused by the ingestion of large numbers of bacteria that reach the intestinal tract, multiply and produce enterotoxins that result in gastrointestinal disturbances (1). The organisms that cause toxicoinfections were previously classified as infections, but this new designation, toxicoinfections, better describes their mode of action.

Clostridium perfringens *Gastroenteritis*

Clostridium perfringens causes gastroenteritis in humans and each year follows salmonellae and staphylococci in the number of cases of foodborne outbreaks (4). Between 1972 to 1978, *C. perfringens* was responsible for 11.3% of all reported cases of foodborne outbreaks in the U.S. (6). Since the illness caused by this organism is mild and of short duration, those affected seldom seek medical treatment. The number of cases reported are thought to be much lower than the actual number that occurs each year (1,4).

Nature and Source of the Organism

C. perfringens grows in the absence of air (although it tolerates some air) and produces spores. It is found in soil, dust, air, sewage, human and animal feces and many food products. *C. perfringens* is so common in the environment that meat, poultry, soil-grown vegetables and spices are frequently contaminated (1,4,33).

Foods Involved

Foods involved in *C. perfringens* gastroenteritis usually include protein foods that have been boiled, stewed or lightly roasted (1,4). Meat and poultry stews, gravies, sauces, meat pies, casseroles and bean dishes can support the growth of *C. perfringens* and have been incriminated in outbreaks. The majority of reported outbreaks usually occurs in food service operations where foods are cooked several days in advance, allowed to cool slowly and then held for long periods before reheating and serving (1,4). When these stews are first cooked, the heating lowers the oxygen content of the food and provides a more anaerobic (airless) environment for the clostridia to grow.

Since *C. perfringens* forms spores, it causes illness in a very unique way. The cooking of foods contaminated with the organism destroys growing bacterial cells and some spores, but heat resistant spores can survive. When these foods are cooled slowly or inadequately refrigerated, the spores germinate and the vegetative cells multiply (1,4). Under ideal conditions, they can multiply rapidly, doubling their numbers in as little as 8.5 minutes (1). When foods containing large numbers of *C. perfringens* are ingested, the organisms reach the small intestine, where they multiply and form spores. The sporulating cells produce the enterotoxin that causes the gastroenteritis.

The Disease

The incubation period for this illness usually ranges from 6 to 24 hours, with most illnesses occurring between 8 and 12 hours after ingesting the contaminated food. The predominant symptoms are watery diarrhea and abdominal pain with nausea and headache sometimes occurring. Vomiting and fever are rare. The illness is relatively mild and the symptoms commonly last from 12 to 24 hours (1,4,33).

Prevention

Prevention of *C. perfringens* gastroenteritis depends on the adequate cooking, rapid cooling and proper reheating of foods like stews, meats and gravies.

Cholera

Vibrio cholerae causes a gastrointestinal illness in humans called cholera (1). It is usually associated with crowded conditions, poor sewage disposal and inadequate treatment of drinking water. The disease is of worldwide significance and occurs occasionally in the U.S. *Vibrio cholerae* is ingested with contaminated water or food and then the vibrios multiply in the small intestine and produce a potent enterotoxin that causes the illness (1).

Nature and Source of the Organism

Humans are the only known natural reservoir of *V. cholerae*. Patients and asymptomatic carriers shed the organisms which have the ability to survive in the environment and contaminate water and foods (1,2).

Foods Involved

Cholera has resulted from the consumption of water, raw and undercooked fish and shellfish from polluted water. Ingestion of foods contaminated with vibrios from polluted water, feces, soiled hands or flies can also cause the illness (1,2).

The Disease

The incubation period of cholera ranges from 1 to 5 days, but is usually 2 days (1,2). There is a sudden onset of vomiting, not accompanied by nausea, and painless watery diarrhea. Rapid dehydration results in circulatory collapse. Death can result from dehydration or shock but with proper medical treatment, fatalities are very low. Sometimes, mild cases with only diarrhea occur.

Prevention

The sanitary disposal of sewage and the establishment of safe, protected water supplies reduce the risk of cholera spreading. Fish and shellfish should not be harvested from polluted water.

Enterotoxigenic Escherichia coli *Gastroenteritis*

Enterotoxigenic *Escherichia coli* gastroenteritis, one of the most common foodborne illnesses known around the world as travelers diarrhea or "turista", is caused by enterotoxigenic strains of *E. coli (1)*. It affects many people, but is rarely identified.

Nature and Source of the Organism

Although there are several types of *E. coli* that cause enteric diseases in humans, the enterotoxigenic strains produce an enterotoxin as they multiply in the upper part of the small intestine. This enterotoxin causes cholera-like symptoms including profuse watery diarrhea. The main habitat of *E. coli* is the intestinal tract of humans and animals. Due to fecal contamination, it is found in soil, water, on animal carcasses used for food and in shellfish from sewage contaminated water (1,2).

Foods Involved

Since transmission is by the fecal-oral route, foods that are contaminated with enterotoxigenic *E. coli* and not subsequently heat processed have been involved in outbreaks.

The Disease

When studied in human volunteers, the symptoms of toxigenic *E. coli* gastroenteritis developed 8 to 44 hours after ingestion with 26 hours being the average incubation period (1,2). The symptoms include mild to severe diarrhea with severe dehydration and shock. Fever is absent. The diarrhea usually ceases within 30 hours. In severe cases, dehydration, prostration and even cardiovascular collapse can occur. The symptoms are sometimes indistinguishable from cholera, but is usually milder and of shorter duration.

Prevention

Enterotoxigenic *E. coli* gastroenteritis can be prevented if water supplies are safely maintained, sewage is properly treated and disposed, and if people working with food practice good personal hygiene.

GENERAL RECOMMENDATIONS

The prevention of bacterial foodborne disease is the job of everyone who works with food. People who process, prepare, store and serve food should always keep three important concepts of food safety in mind. They should think about how to:

1) limit/prevent contamination
2) inhibit growth of microorganisms
3) destroy microorganisms.

To achieve these objectives, people should (1,9):

- Practice good personal hygiene and wash hands frequently but especially after using the bathroom, handling raw foods and touching the nose, mouth and hair.
- Cook foods thoroughly.
- Hold hot foods above 140°F.
- Cool foods rapidly in shallow containers.
- Reheat leftovers to 165°F.
- Boil home-processed low-acid canned foods for 10 to 15 minutes prior to serving.
- Avoid holding cooked foods between 45°F to 140°F for more than 2 hours.
- Refrigerate foods at 45°F or below.
- Prevent cross-contamination by keeping raw and cooked foods separate and by using different equipment and utensils to handle these foods.

- Keep equipment and utensils clean and stored properly.
- Reject all swollen, gasey, or spoiled canned foods.
- Avoid tasting or eating foods from containers that are leaking, bulging, severely damaged or cracked, spurt liquid or foam when the container is opened; or have an abnormal odor or appearance.

By following these simple procedures, bacterial foodborne disease can be prevented and everyone can enjoy safe and wholesome foods.

The next two issues of Food Science Facts will review the causes and prevention of chemical, parasitic and viral foodborne diseases.

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Campus Coffee Bars

For the past five years guidelines have been in effect at the University of Massachusetts regulating the sanitary operation of campus coffee bars. The coffee bar is typically a temporary foodservice operation that specializes in the preparation and sale of hot beverages, bakery products such as donuts and pastries, and other foodstuffs served mainly in the morning hours.

The guidelines and a checklist of sanitation procedures are issued with the application for permit which must be filed prior to setting up the temporary facility. The permit requires applicants to signify that they are familiar with the Coffee Bar Guidelines "and prepared to follow the minimum health and safety requirements outlined."

For sample copies of the Guidelines, Checklist, and Application for permit, send a self-addressed, stamped envelope to George H. Reed, Environmental Health Specialist, Environmental Health & Safety, University of Massachusetts, N414 Morrill Science Center, Amherst, MA 01003.

-E.N.D./May-June 1986

Acute Respiratory Illness Following Occupational Exposure to Wood Chips - Ohio

The inhalation of organic dust contaminated with microbes has been recognized as an occupational hazard for persons who work with decomposing vegetable matter. An outbreak of illness caused by such inhalation occurred in Ohio in 1983. The investigation that followed is described below.

On June 21, 1983, five employees at a municipal golf course became ill with an influenza-like syndrome within hours after manually unloading a trailer full of wood chips. Physicians from the city health department examined and tested all golf-course employees who had helped in the unloading and requested assistance from the National Institute for Occupational Safety and Health in evaluating the outbreak. On June 24, a questionnaire was administered to those employees exposed to wood chips, and their medical records were reviewed. The investigators inspected the unloaded wood chips, collected samples, and interviewed the wood chips' vendor.

The wood chips were brought to the golf course in an enclosed, 40-foot trailer. Eleven employees participated in some aspect of the unloading process. Although fresh chips had been ordered, the vendor included old chips that had been stored in the front of the truck for approximately one year. Unloaded chips from the front were grossly moldy, and cultures revealed a wide variety of mesophilic and thermophilic bacteria and fungi.

A case was defined as the presence in an employee of at least five of the following six symptoms after exposure to wood chips: malaise, fever, difficulty breathing, chest tightness, headache, and cough. Except for cough, which was reported by two persons who did not meet the case definitions, each symptom was reported more frequently by ill persons than well persons ($p < 0.05$).

All five ill employees had worked in very dusty conditions without respiratory protection while unloading the front of the trailer on the afternoon of June 21. The time from beginning of unloading until onset of illness ranged from 4 hours to 16 hours (median 13 hours). None of the workers were hospitalized, but one reported to a local emergency room, and two were too ill to work the following day. Within 48 hours, symptoms were very much improved; within 72 hours, all affected workers had completely recovered.

The other six employees included three who had unloaded fresh chips from the back of the trailer on the morning of June 21, one supervisor who had briefly checked on the unloading process, and two workers who finished unloading the front of the trailer on the morning of June 22 but wore air-purifying respirators. Thus, all five workers who had unloaded the moldy wood chips without respiratory protection became ill, compared with none of the other six workers.

The mean total white blood count in ill workers (11,000) was significantly higher than in those who remained well (8,100); a significantly greater mean absolute polymorphonuclear leukocyte count was also found among the ill (ill: 8,300, well: 5,600) ($p = 0.008$). The erythrocyte sedimentation rate was elevated in all five ill workers but in only two of the six who did not become ill. Except for one individual who had radiographic changes due to previous surgery, all those who became ill had normal chest radiographs and spirometry. Furthermore, none had positive tests for precipitating antibodies against a standard panel of 11 antigens associated with hypersensitivity pneumonitis extracts of three types of wood chips and 12 microbial organisms isolated from the wood chips. Tests for complement fixing antibodies as evidence of histoplasmosis produced low titers in both the acute and convalescent sera of the ill workers.

On the basis of clinical and epidemiologic evidence, the investigators concluded that this episode probably represented an outbreak of self-limited, acute toxic reaction associated with inhalation of large amounts of dust heavily contaminated with microbial toxins from decomposing vegetable matter.

Editorial Note: In 1975, an apparent toxic pulmonary illness was reported among 10 farmers who became ill several hours after removing moldy silage. The authors of that report referred to the illness as "pulmonary mycotoxicosis" because the etiology presumably involved toxic components of inhaled fungal organisms. Others have recognized an apparently identical syndrome but have applied other names to it. Thus, it has been vari-

ously referred to as (1) "silo unloader's syndrome" to contrast it with silo filler's disease, a toxic pulmonary edema following inhalation of the oxides of nitrogen in freshly filled silos; (2) "precipitin test negative farmer's lung" to emphasize its clinical similarities to and its pathogenetic differences from farmer's lung disease, an immunologic lung response to microbial antigens in moldy hay; and (3) organic dust toxic syndrome" (ODTS), a generic description to emphasize the mycotoxin exposure is not a necessary prerequisite and that the syndrome is not restricted to either silo exposures or farming occupations. A striking similarity has been recognized between ODTS and "mill fever" in cotton textile workers, "grain fever" in grain elevator workers, and "humidifier fever" in building occupants exposed to air from highly contaminated ventilation systems. Similar to the current report, moldy wood chips were etiologically linked to symptoms of ODTS in individuals exposed to dust from wood chips that had been stored in basements as a fuel source for woodburning furnaces.

Epidemiologically, ODTS often occurs in small outbreaks, with illness affecting all or most individuals who have had intense exposure to microbially contaminated vegetable dust. The syndrome is clinically characterized as an acute febrile illness with respiratory symptoms; onset usually occurs 4-12 hours after exposure. General malaise, headache, and cough are common symptoms, while dyspnea is variably present. Chest auscultation usually reveals normal breath sounds; the chest X-ray is remarkably clear; and pulmonary function may be only slightly impaired. Leukocytosis with a predominance of polymorphonuclear leukocytes is the rule, and serologic testing for precipitating antibodies associated with farmer's lung disease is usually negative.

With removal from exposure, ODTS is a self-limited illness, occasionally resolving within 24 hours, often within several days, and sometimes only after a few weeks. To date, no deaths have been reported, and there is no evidence for residual pulmonary fibrosis. Some individuals, however, have been hospitalized with severe symptoms, and a few have undergone diagnostic bronchoscopy and lung biopsy. Bronchoalveolar lavage has revealed a predominance of PMNs, and biopsy has demonstrated an acute inflammation without granulomas, as well as an assortment of microorganisms in the airways.

ODTS probably occurs much more frequently than is currently recognized. Only serious solitary cases or those that occur in suspicious clusters are likely to come to medical attention, and when a history of environmental exposure is elicited, these are often diagnosed by physicians as silo filler's disease or farmer's lung disease. Because the incidence, etiologic agent(s), and pathogenesis of ODTS remain unknown, physicians are encouraged to report to appropriate health authorities any influenza-like illness following intense exposures to organic dust. Based on current understanding, symptomatic treatment alone should suffice. Prevention measures should include storing vegetable matter in a way that limits microbial growth and wearing appropriate protection when intense exposure to organic dusts cannot be avoided.

-MMWR, 8-1-86

Bacillus cereus - Maine

On September 22, 1985, the Maine Bureau of Health was notified of a gastrointestinal illness among patrons of a Japanese restaurant. Because the customers were exhibiting symptoms of illness while still on the restaurant premises, and because uncertainty existed as to the etiology of the problem, the local health department, in concurrence with the restaurant owner, closed the restaurant at 7:30 p.m. that same day.

Eleven (31%) of the approximately 36 patrons reportedly served on the evening of September 22 were contacted in an effort to determine the etiology of the outbreak. Those 11 comprised the last three dining parties served on September 22. Despite extensive publicity, no additional cases were reported.

A case was defined as anyone who had vomiting or diarrhea within 6 hours of dining at the restaurant. All 11 individuals were interviewed for symptoms, time of onset of illness, illness duration, and foods ingested. All 11 reported nausea and vomiting; nine reported diarrhea; one reported headache; and one reported abdominal cramps. Onset of illness ranged from 30 minutes to 5 hours (mean 1 hour, 23 minutes) after eating at the restaurant. Duration of illness ranged from 5 hours to several days, except for two individuals still symptomatic with diarrhea 2 weeks after dining at the restaurant. Ten persons sought medical treatment at local emergency rooms on September 22; two ultimately required hospitalization for rehydration.

Analysis of the association of food consumption with illness was not instructive, since all persons consumed the same food items: Chicken soup; fried shrimp; stir-fried rice; fried zucchini, onions, and bean sprouts; cucumber, cabbage, and lettuce salad; ginger salad dressing; hibachi chicken and steak; and tea. Five persons ordered hibachi scallops, and one person ordered hibachi swordfish. However, most individuals sampled each other's entrees.

One vomitus specimen and two stool specimens from three separate individuals yielded an overgrowth of *Bacillus cereus* organisms. The hibachi steak was also culture-positive for *B. cereus,* although an accurate bacterial count could not be made because an inadequate amount of the steak remained for laboratory analysis. No growth of *B. cereus* was reported from the fried rice, mixed fried vegetables, or hibachi chicken.

According to the owner, all meat was delivered 2-3 times a week from a local meat supplier and refrigerated until ordered by restaurant patrons. The meat was seasoned with soy sauce, salt, and white pepper, open containers of which had been used for at least 2 months by the restaurant. The hibachi steak was served immediately after cooking.

The fried rice served with the meal was reportedly customarily made from leftover boiled rice. It could not be established whether the boiled rice had been stored refrigerated or at room temperature.

Editorial Note: *B. cereus* is an anaerobic, spore-forming, gram-positive rod with an ubiquitous distribution in the environment. Spores of *B. cereus* have been found in a wide variety of cereals, pulses, vegetables, spices, and pasteurized fresh and powdered milk. Food poisoning can result from toxins elaborated by germinating organisms, which most commonly follows from inadequate refrigeration and subsequent reheating of foods that have already been cooked.

Two different clinical syndromes appear to be associated with *B. cereus* food poisoning, which correspond to two different toxins elaborated by the bacteria. A diarrheal syndrome similar to *Campylobacter perfringens* food poisoning with an average incubation period of 10-12 hours has been associated with a heat-labile toxin elaborated by *B. cereus*. An emetic syndrome similar to staphylococcal food poisoning, with an average incubation period of 1-6 hours, has been associated with a heat-stable toxin from *B. cereus*.

The emetic syndrome has almost always been associated with fried rice served in Oriental restaurants. The common practice of storing boiled rice at room temperature for subsequent preparation of fried rice has generally been implicated in such outbreaks. However, a recent, well-documented outbreak of the emetic syndrome of *B. cereus* in a British prison implicated beef stew. This was thought to be caused by adding to the stew vegetables that were cooked a day earlier.

Fresh meat cooked rapidly, then eaten immediately, seems an unlikely vehicle for *B. cereus* food poisoning. The laboratory finding of *B. cereus* in a foodstuff without quantitative cultures and without accompanying epidemiologic data is insufficient to establish its role in the outbreak. A negative culture of fried rice eaten with the meat does not exclude the obvious vehicle; reheating during preparation may eliminate the bacteria in the food without decreasing the activity of the heat-stable toxin. While the question of the specific vehicle remains incompletely resolved, the clinical laboratory findings substantially support *B. cereus* as the cause of the outbreak.

Most episodes of food poisoning undoubtedly go unreported, and in most of those reported, the specific pathogens are never identified. Alert recognition of the clinical syndrome and appropriate laboratory work permitted identification of the role of *B. cereus* in this outbreak.

-MMWR, 6/27/86

A CASE OF TETANUS - QUEBEC

A 43-year-old male, with an unremarkable history was admitted to the hospital on 28 October 1985 with abdominal and lumbar muscle spasms which had developed gradually over the previous 10 days, bilateral jaw pain, and inability to open his mouth.

Approximately 2 weeks earlier, he had sustained cuts under the nail of the second finger and to the side of the third finger of his right hand from a lawnmower. His physician had sutured the lacerations in the emergency clinic, and an X-ray taken at that time had revealed a fracture at the base of the distal phalanx of the second finger. Primary immunization appeared to have been inadequate and the patient had not received any tetanus toxoid for more than 20 years. Following the administration of 1 dose of tetanus toxoid and immobilization of the second finger, he was released. Eleven days later he noted a dull pain in his right shoulder blade radiating downward towards the right flank, spreading gradually with time and accompanied by bilateral maxillary pain exacerbated by movement or palpation. He was unable to eat. On admission, the abdominal and lumbar muscle spasms were constant and accompanied by trismus with the typical risus sardonicus. Vital signs were normal and there were no respiratory, digestive or urinary problems.

Hematology results, including serum calcium were normal. A presumptive diagnosis of tetanus was made and 5000 units of tetanus immune globulin were immediately administered in a single dose intramuscularly. The wound in the second finger was thoroughly debrided, the nail removed, and a culture taken for *Clostridium tetanus*.The patient was given potassium penicillin G (2 million units I.V. q.6h. for 10 days), diazepam (10 mg I.V. q.3-6h.) and admitted to intensive care for close monitoring of cardiorespiratory parameters. A few days later, because the maxillary spasm persisted, I.V. hyperalimentation was begun. The patient began to recover slowly and was released on 27 November following the administration of a second dose of tetanus toxoid. He was advised to be certain to complete his tetanus immunization. The culture of *C. tetani* was negative.

-Can. Dis. Weekly Report, 6-28-86

A CASE OF TETANUS - BRITISH COLUMBIA

In January 1985, while watching television, a 23-year-old male in Fort St. James developed a spasm of his tongue, neck, facial and jaw muscles, together with difficulty speaking. This episode lasted 30 minutes after which the patient visited the local hospital emergency department where another episode occurred. The episodes continued and he was transferred to the Prince George Regional Hospital.

As an infant the patient had received 2 half doses of DPT vaccine in 1961, and subsequent full doses of DT vaccine in 1968 and 1972, but none since then.

In 1982 his left index finger was ripped open by a marten, but he did not receive any tetanus prophylaxis. Approximately one week prior to the January 1985 incident, a needle had penetrated his right big toe while he

was walking in the living room in his stocking feet. The needle apparently had entered the bone and had to be removed with a pair of pliers.

A physical examination did not reveal any puncture wound in the right foot, but the patient exhibited the risus sardonicus of tetanus. Marked increase in tone was noted in his paracervical and sternocleidomastoid muscles. The rest of the examination was unremarkable.

He was admitted to the Intensive Care Unit, heavily sedated with diazepam and phenobarbital for 48 hours, and received 5000 units of tetanus immune globulin, tetanus toxoid and parenteral penicillin. When the phenobarbital was discontinued after 48 hours, he began to have facial contractions, so the diazepam dosage was adjusted upwards. The penicillin was continued for 1 week.

Laboratory analyses showed normal red and white cell counts and differential, sedimentation rate, serum proteins, calcium, magnesium, phosphorus, electrolytes, BUN, creatinine, and urinalysis.

He was discharged home on diazepam 5 mg q.i.d. p.r.n., and arrangements were made for him to receive 2 further doses of tetanus toxoid.

Comment: Serological surveys undertaken in the United States since 1977 indicate that 11% of adults 18-39 years of age and 49-66% of those 60 years of age or older, lack protective levels of circulating antitoxin against tetanus. Similarly, a recent Danish study found that 11% of a randomly selected group of persons 25-30 years of age had antitoxin titres below the level required for protection, with an exponential fall off in immunity seen in those who had only received primary immunization. The same situation has been found for diphtheria: 62% of U.S. adults 18-39 years of age and 41-84% of those 60 or older lack protective levels of circulating antitoxin, and in Denmark, 22% of those who received only primary immunization had antitoxin titres below the protective level. Similar problems have been identified in Canadian serological surveys.

It appears that a renewed focus on adult immunization is indicated, and both the Canadian and United States expert advisory committees on immunization recommend that boosters of tetanus and diphtheria toxoids should be given at 10-year intervals in adult life.

-Can. Dis. Weekly Report, 6-28-86

Importance of Proper Protective Clothing During Cleanup of a Hazardous Waste Site - Pennsylvania

The unauthorized dumping of hazardous-waste materials at various locations through the country has resulted in toxic exposures in the surrounding areas. On October 11, 1983, three workers employed to clean up a hazardous-waste dump site in Pennsylvania complained of dizziness, nausea, and headaches. One of the workers was hospitalized for observation and was later released. The Environmental Protection Agency (EPA) requested an investigation by the National Institute for Occupational Safety and Health (NIOSH).

This site contained approximately 650 55-gallon drums that had been dumped without authorization at a former municipal landfill in the state. At the time of cleanup, most drums were crushed, perforated, riddled with bullet holes, and in various stages of decay. The cleanup involved removing these drums to an area where their contents could be tested for further disposal.

During the cleanup operation, each worker wore borrowed polyvinyl chloride (PVC) clothing and a self-contained breathing apparatus (SCBA) for protection. All three workers noticed a "sweet" smell as they worked. The SCBAs were new, and in a thorough evaluation after the incident, each was found to be functioning properly.

On October 12, analytical chemists from NIOSH evaluated several specimens from the outside of the protective clothing of the hospitalized worker. The primary contaminants were identified as methyl ethyl ketone, methyl isobutyl ketone, toluene, and xylene. Swab samples from inside this worker's protective clothing showed the presence of MIBK. Based on these findings, NIOSH recommended that a less permeable type of protective clothing be used. The recommendation was implemented and no further incidents were reported.

Editorial Note: Such unauthorized dumping of hazardous-waste materials as reported here results in toxic exposures, not only to the surrounding community, but also to workers employed to clean up these sites. To protect workers at hazardous-waste sites, an extensive health and safety program is required that includes environmental monitoring, proper use of protective equipment, good work practices, selected engineering controls, and appropriate medical monitoring. As part of an interagency agreement with the Agency for Toxic Substances and Disease Registry, NIOSH evaluates occupation safety and health programs that have been implemented for selected hazardous-waste sites around the country. The cleanup personnel at the site discussed above were under contract with EPA.

Previous studies by NIOSH at hazardous-waste sites have documented only low-level air exposures to a variety of contaminants. These evaluations, however, did not assess high, short-term air and skin exposures from splashing.

During this cleanup all three workers were wearing PVC protective clothing that has been shown to be quite permeable to most organic solvents. Therefore, the repeated contact with the solvents present at this site probably led to their permeating the clothing and being absorbed through the skin. The symptoms (dizziness, nausea, headaches) these workers experienced are compatible with acute exposure to these solvents. Additionally, although the SCBAs used in the present incident were working properly, improper wearing or fitting of the devices may have resulted in leakage of air contaminants around the mask and into the workers' breathing zones.

-MMWR, 7-11-86

How To Protect Your Restaurant Against Foodborne Illness

A new approach to sanitation inspection

by Robert E. Harrington
Assistant Director of Technical Services and Public Health and Safety for the National Restaurant Association

Reprinted with permission from the National Restaurant Association magazine *Restaurants USA* (formerly *NRA News*). This begins a five-part series on SAFE (Sanitary Assessment of Food Environment).

Someday soon, representatives of your local health department may contact you to arrange an inspection of your restaurant. Instead of the traditional 20 or 30-minute overview of general cleanliness, they may, following guidelines commonplace in the food processing industry, ask to review your menus, recipes and step-by-step preparation schedules and examine orders and invoices from your wholesale suppliers. Then, they may want to arrange a 12 to 18-hour inspection of the kitchen, taking samples for laboratory analysis, measuring different food acidities and recording food temperatures every 30 minutes.

This is all part of a new approach to sanitation inspection called Hazard Analysis/Critical Control Point (HACCP). Actually, the concept of monitoring food handling at critical control points is not new. It has been used in major food processing firms since the 1970s. Using chemistry and bacteriology to identify which specific foods are at greatest risk and flow charts to identify the specific locations in the processing line where food hazards are likely to occur, the system establishes critical control points to ensure that any hazards have been corrected. After some experimental surveys in restaurants, several local regulatory jurisdictions, such as those in New York state, are now gearing up to implement the technique in their restaurant inspection programs. Why the change? And what will it mean for your operation?

Traditionally, inspection programs have focused on construction details and aesthetic appearance - an approach that has paid off in enhanced maintenance and cleaning.

The new approach...

But these past successes may not suffice today. A restaurant could conceivably score a high grade for clean floors, walls and ceilings on a "traditional" inspection but still have dangerous defects in food handling. Investigation of foodborne disease outbreaks consistently reveals that the major factors which cause bacterial illnesses are:

- food preparation several hours or more in advance of service
- inadequate hot storage of foods
- inadequate cooling of foods
- inadequate reheating of foods
- contamination of foods by infected workers or other sources.

That is why you should consider a new approach to inspection - one that is based on monitoring the food preparation process. This approach should not only help reduce the risk of an outbreak at your facility but should also put you one or two steps ahead of the regulators.

This series will work toward such a program, which streamlines the formal academic approach to hazard analysis. It will be called SAFE - an acronym for Sanitary Assessment of Food Environment.

The strict regulatory program calls for health departments to concentrate their inspection efforts on "high risk" establishments (based on type of menu, volume of meals served and past history) and to further concentrate on *potentially hazardous foods* which are particularly sensitive to mishandling. The sanitarian might ask to review your menu, and then might diagram your entire preparation process to identify *critical control points* for monitoring. Then, on subsequent inspections he may simply check to see if you have monitored those control points and what corrections you have made.

The concept is really nothing more than what many good sanitarians and conscientious restaurant operators have been doing for generations. It is just more structured and formalized, and like any new system, it can initially appear a little overwhelming.

With 45 billion meals eaten in restaurants, schools and work cafeterias each year, the annual incidence of foodborne disease attributable to foodservice establishments is very low. Overall the industry is doing a good job of preventing foodborne diseases. But outbreaks do occur, and when they do, they are expensive.

Cost analysis of foodborne diseases shows that the average outbreak costs an implicated restaurant $73,858 in medical charges, lost wages, lost business, etc. Lawyers' fees and legal claims make up a large part of these costs. Since ill customers are likely to sue the restaurant for damages in today's climate of high judgments, this leads to further increases in liability insurance premiums or cancellation of insurance coverage.

How SAFE Works...

With the SAFE approach, you can monitor and reduce risks. You can review your menu yourself, select one or two "high risk" foods and then follow those foods throughout the entire handling and preparation process--from delivery by the vendor to service at the table. As you follow food items through each preparation step, you can identify *critical points*

where the food might become contaminated, where bacteria might survive cooking temperatures and where bacteria might grow if food is held at incorrect temperatures. Once you identify these *critical points,* you can devise corrective techniques and instruct your staff how to monitor those points for consistency, high quality and safety. When new menu items are introduced or when emergencies force a change in your processing schedule, you will be able to spot potential problems before they occur and make the necessary adjustments.

Although industrial monitoring requires fairly sophisticated field equipment and laboratory analysis, a basic SAFE survey of your operation involves almost no equipment and very little cash expense. You will need two or three good quality dial-indicating probe-type thermometers, with stems long enough to reach the *center* of large food masses, such as roasts or foods in stockpots. (It might be a good idea to get several different lengths for different food volumes.) Use only the dial-indicating thermometers - liquid-filled glass columns can easily break, contaminating foods with glass and mercury.

You also will need some basic information about bacteria and food chemistry to help you identify potentially hazardous foods and the controls you can apply during preparation and processing. We will discuss these topics next month in the second part of this series.

But most importantly, you will need to invest your time and commitment. Time is necessary because you must directly observe the entire preparation process. Commitment is vital because you must be willing to recognize potential hazards and make the appropriate corrections in your program.

SAFE monitors three key areas...

Being SAFE involves monitoring three general areas of food protection: "Keep it Clean" (prevents contamination of foods) and "Keep it Hot" and "Keep it Cold" (kills or inhibits bacteria through temperature control).

Chances are, you already address these areas with some common sense procedures.

For example, when you purchase turkey from a reputable supplier, you are *preventing contamination* because you are using foods from inspected, approved sources.

When you inspect the shipment for soundness at delivery (no damage or odor), you are also *preventing contamination* by ensuring that only food in the best condition comes to your kitchen.

When you cook the turkey thoroughly (165°F in the center), you are using *high temperature* to *kill* bacteria.

When you use clean, sanitized utensils to bone the meat and when your employees wash their hands before handling the cooked product, you are *preventing cross-contamination.*

And when you chill the boned meat rapidly, you are using *temperature control* to *inhibit bacterial growth.*

Of course, this is an over-simplified view, but it does illustrate how the SAFE process works:

(1) Identify potentially hazardous foods.

(2) Observe those foods throughout your preparation, holding and serving process to identify critical points in the line.

(3) Establish control procedures and monitor those critical points to guarantee safe handling of the food.

Some of these critical control points may seem so obvious that it is almost insulting to include them in your observations. But remember that most foodborne illnesses are caused by *human error,* as when people take shortcuts or bypass the proper procedures.

For example, consider the cook who cut up raw chicken, then used the same knife and cutting board to prepare salad. Cooking killed the *Salmonella* in the chicken, but salad customers were infected.

When you look critically at your operation, you will find many more control points, including quality control points as well as sanitary control points. You can monitor staff accountability, product consistency and portion control and establish process safeguards to make your operation safe from an outbreak of foodborne illness.

Next month: *Basics of bacterial growth, food chemistry and the interacting conditions that make some foods potentially hazardous.*

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AIMFES Spring Educational Seminar

The Associated Illinois Milk, Food and Environmental Sanitarians Spring Educational Seminar, a joint conference with the Chicago Dairy Technology Society, will be held on April 28, 1987 at the Holiday Inn in Rolling Meadows, IL. The theme for the conference is "Managing for Food Qaulity". Registration will begin at 12:30 p.m.

For more information contact Dr. Clem Honer, Gorman Publishing Company, 8750 West Bryn Mawr Ave., Chicago, IL 60631. 312-693-3200.

AIMFES Fall Seminar and Annual Meeting

The Associated Illinois Milk, Food and Environmental Sanitarians Fall Seminar and Annual Meeting will be held on September 14 and 15, 1987 at the Ramada Inn, Champaign, IL. Registration will begin at 1 p.m. on the 14th and the meeting will last until noon of the 15th. Further information will be furnished upon request to: Dr. Clem Honer, Secretary AIMFES, Gorman Publishing Co., 8750 W. Bryn Mawr, Chicago, IL 60631. 312-693-3200.

Affiliate Calendar

1987

March 18, INDIANA DAIRY INDUSTRY CONFERENCE. For more information contact: James V. Chambers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN 47907. 317-494-8279.

March 25-27, MICHIGAN ENVIRONMENTAL HEALTH ASSOCIATION ANNUAL MEETING, to be held at the Hilton Hotel, 28th St., Grand Rapids, MI. For more information contact: Ike Volkers, Environmental Health, Michigan Dept. of Health, 3500 N. Logan, Lansing, MI 48909. 517-335-8268.

April 6-8, FLORIDA ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC., EDUCATIONAL CONFERENCE, to be held at the Gainesville Hilton, Gainesville, FL. For more information contact: Dr. Franklin Barber at 904-428-1628.

April 8-10, MISSOURI MILK, FOOD, AND ENVIRONMENTAL HEALTH ASSOCIATION 1987 ANNUAL EDUCATIONAL CONFERENCE, to be held at the (New) Hilton Inn, Columbia, MO. For more information contact: The National Environmental Health Association, 1200 Lincoln St., Suite 704, Denver, CO 80203.

April 8-10, SOUTH DAKOTA ENVIRONMENTAL HEALTH ASSOCIATION ANNUAL MEETING, to be held in Aberdeen, SD. For more information contact: Stan Iwagoshi, South Dakota Dept. of Health, 1320 S. Minnesota Ave., Suite A, Sioux Falls, SD 57105. 605-335-5037.

April 28, ASSOCIATED ILLINOIS MILK, FOOD AND ENVIRONMENTAL SANITARIANS SPRING EDUCATION SEMINAR, a joint conference with the Chicago Dairy Technology Society, to be held at The Holiday Inn, Rolling Meadows, IL 60008. 312-259-5000. For more information contact: Dr. Clem Honer, Gorman Publishing Company, 8750 West Bryn Mawr Ave., Chicago, IL 60631. 312-693-3200.

May 18-20, THE PA DAIRY SANITARIANS & LABORATORY DIRECTORS ANNUAL MEETING, to be held at Penn State University, J. O. Keller Convention Center, State College, PA. For more information contact: Sidney Barnard. 814-863-3915.

August 2-7, CALIFORNIA ASSN. OF DAIRY & MILK SANITARIANS BUSINESS MEETING, to be held at the Disneyland Hotel in Anaheim, CA. For more information contact: Richard Harrell at 213-757-9719 or Austin Olinger at 818-968-9621.

September 17-18, MINNESOTA SANITARIANS ASSOCIATION, to be held at the Earle Brown Center, Univ. of Minnesota, St. Paul Campus. For more information contact: Roy E. Ginn, Dary Quality Control Inst., 2353 N. Rice St., Room 110, St. Paul, MN 55113. 612-484-7269.

September 21-23, NEW YORK STATE ASSOCIATION OF MILK & FOOD SANITARIANS ANNUAL MEETING, to be held at the Sheraton Inn Syracuse, (Liverpool, NY). For more information contact: Paul J. Dersam. 716-937-3432.

September 30-October 2, KANSAS ASSOCIATION OF SANITARIANS ANNUAL MEETING, to be held at the Holidome in Lawrence, Kansas. For more information contact: John M. Davis. 316-268-8351.

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Dairy and Food Sanitation Instructions for Authors

Nature of the Magazine

Dairy and Food Sanitation is a monthly publication of the International Association of Milk, Food and Environmental Sanitarians, Inc. (IAMFES). It is targeted for persons working in industry, regulatory agencies, or teaching in milk, food and environmental protection.

The major emphases include: 1) practical articles in milk, food and environmental protection, 2) new product information, 3) news of activities and individuals in the field, 4) news of IAMFES affiliate groups and their members, 5) 3-A and E-3-A Sanitary Standards, amendments, and lists of symbol holders, 6) excerpts of articles and information from other publications of interest to the readership.

Anyone with questions about the suitability of material for publication should contact the editor.

Submitting Articles

All manuscripts and letters should be submitted to the Editor, Kathy R. Hathaway, IAMFES, P.O. Box 701, Ames, Iowa 50010.

Articles are reviewed by two members of the editorial board. After review, the article is generally returned to the author for revision in accordance with reviewer's suggestions. Authors can hasten publication of their articles by revising and returning them promptly. With authors' cooperation articles are usually published within three to six months after they are received and may appear sooner.

Membership in IAMFES is not a prerequisite for acceptance of an article.

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Types of Articles

Dairy and Food Sanitation readers include persons working as sanitarians, fieldmen or quality control persons for industry, regulatory agencies, or in education. *Dairy and Food Sanitation* serves this readership by publishing a variety of papers of interest and usefulness to these persons. The following types of articles and information are acceptable for publication in *Dairy and Food Sanitation*.

General Interest

Dairy and Food Sanitation regularly publishes nontechnical articles as a service to those readers who are not involved in the technical aspects of milk, food and environmental protection. These articles deal with such topics as the organization and application of a milk or food control program or quality control program, ways of solving a particular problem in the field, organization and application of an educational program, management skills, use of visual aids, and similar subjects. Often talks and presentations given at meetings of affiliate groups and other gatherings can be modified sufficiently to make them appropriate for publication. Authors planning to prepare general interest nontechnical articles are invited to correspond with the editor if they have questions about the suitability of their material.

Book Reviews

Authors and publishers of books in the fields covered by *Dairy and Food Sanitation* are invited to submit their books to the editor. Books will then be reviewed and published in an issue of *Dairy and Food Sanitation*.

Preparation of Articles

All manuscripts should be typed, double-spaced, on 8½ by 11 inch paper. Side margins should be one inch wide.

The title of the article should appear at the top of the first page. It should be as brief as possible and contain no abbreviations.

Names of authors and their professions should follow under the title. If an author has changed location since the article was completed, his new address should be given in a footnote.

Illustrations, Photographs, Figures

Wherever possible, submission of photos, graphics, or drawings to illustrate the article will help the article. The nature of *Dairy and Food Sanitation* allows liberal use of such illustrations, and interesting photographs or drawings often increase the number of persons who are attracted to and read the article.

Photographs which are submitted should have sharp images, with good contrast.

Examples of Proper Bibliographic Citations

Paper in a journal

Alderman, G. G. and E. H. Marth. 1974. Experimental production of aflatoxin in citrus juice and peel. J. Milk Food Technol. 37:308-313.

Paper in a book

Marth E. H. 1974. Fermentations. pp. 771-882. In B. H. Webb, A. H. Johnson, and J. A. Alford (eds.) Fundamentals of dairy chemistry (2nd ed.), AVI Publishing Co., Westport, CT.

Book

Fennema, O. R., W. D. Powrie, and E. H. Marth. 1973. Low-temperature preservation of foods and living matter. Marcel Dekker, Inc., New York. 598 p.

Patent

Hussong, R. V., E. H. Marth, and D. G. Vakaleris. 1964. Manufacture of cottage cheese. U.S. Pat. 3,117,870. Jan. 14.

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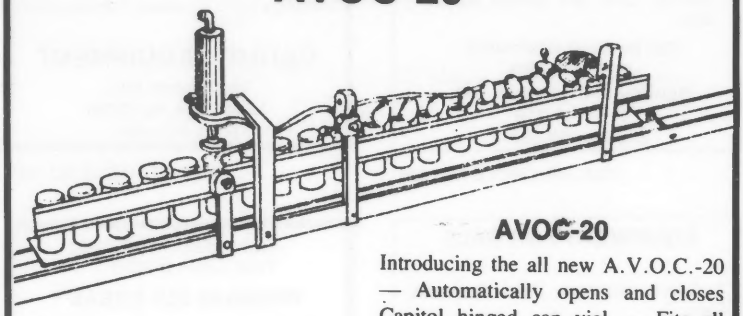

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Abstracts of papers in the March Journal of Food Protection

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

***Listeria monocytogenes* in Raw Milk: Detection, Incidence, and Pathogenicity,** J. Lovett, D. W. Francis, and J. M. Hunt, Division of Microbiology, Food and Drug Administration, 1090 Tusculum Avenue, Cincinnati, Ohio 45226

J. Food Prot. 50:188-192

To determine the incidence of *Listeria monocytogenes* in raw milk, an isolation method was evaluated and used to analyze milk from three areas of the United States. The incidence varied by area from 0% in California to 7% in Massachusetts, with an overall incidence of 4.2%. The highest incidence found in any area during a single sampling period was 12% in Massachusetts in March 1985. During that same sampling, the incidence for all *Listeria* species was 26%. Of the 27 *L. monocytogenes* strains isolated during the survey, 25 were pathogenic in adult mice. One of three *Listeria ivanovii* isolated was pathogenic. No other isolates demonstrated pathogenicity.

Yeasts as Primary Contaminants in Yogurts Produced Commercially in Lagos, Nigeria, Minabelema Dublin Green and Stella N. Ibe, Department of Biological Sciences, University of Lagos, Akoka-Yaba, Lagos, Nigeria

J. Food Prot. 50:193-198

Yogurt samples purchased from a dairy industry, retail outlets, and hawkers in Lagos, Nigeria, were plated on potato dextrose agar containing 100 µg of chloramphenicol/ml and found to contain *Candida lusitaniae, C. krusei, C. rugosa, Kluveromyces fragilis,* and *Saccharomyces cerevisiae* as the primary yeast contaminants. Sixty-seven percent of the samples had yeast counts in the range of 10^4-10^6 cfu/ml. *C. lusitaniae, K. fragilis* and *C. krusei* had the highest counts and occurrence of 65, 48 and 51%, respectively, in 100 random yogurt samples. *C. lusitaniae* attained the highest count in yogurts stored at 10°C and *C. krusei* in those at 30°C.

Ninety percent of the samples had less than 10 coliforms or staphylococci per ml, whereas 20% had over 10^3 psychrotrophic bacteria per ml. Molds of *Aspergillus* sp. and *Neurospora* sp. were isolated mainly from the strawberry-fluid yogurt. The starter cultures, *Lactobacillus bulgaricus* and *Streptococcus thermophilus,* were present in the ratio of 1:1 and reached maximum growth levels of 10^7 to 10^8 cfu/ml after 4 to 8 d of storage at 10°C, whereas the yeast continued to increase beyond this level by the 12th day. The extent of contamination observed suggests high initial contamination level and improper refrigeration of yogurts marketed.

Characteristics of Selected Strains of *Bacillus cereus*, Kathleen T. Rajkowski and Emil M. Mikolajcik, U.S. Food and Drug Administration, Division of Microbiology, 1090 Tusculum Avenue, Cincinnati, Ohio 45226 and Department of Food Science and Nutrition, Ohio Agricultural Research and Development Center, The Ohio Stat University, 2121 Fyffe Road, Columbus, Ohio 43210

J. Food Prot. 50:199-205

Identification techniques for *Bacillus cereus* are unsettled even though there is an increased awareness of the organism's potential public health implications. Biochemical and morphological characteristics of 17 strains of *B. cereus*, including 10 isolated from confirmed foodborne outbreaks, were studied by routine methods. Of the characteristics attributed to *B. cereus*, two strains were negative for the Voges-Proskauer reaction and nitrate reduction; three did not utilize salicin; and five exhibited rhizoidal growth on nutrient agar. Heat resistance of the strains was determined using the serum bottle technique. In demineralized water D- values at 100°C ranged from 0.6 to 27 min, with z-values from 7.4 to 14.5°C. Mean growth constant (k/h) determined turbidimetrically in nutrient broth at 15, 21, 25, 35, 40, 45 and 50°C was 0.15, 0.39, 0.89, 1.54, 1.99, 2.54 and 2.08, respectively. No single feature typified pathogenic strains. At 7 or 11°C, sixteen strains produced hemolysin on blood agar plates, whereas at 45°C, only two strains were hemolytic. Phospholipase activity measured on egg yolk agar plates was evident for three strains at 7°C, for all strains at 35°C, and for only two strains at 45°C.

Germination and Outgrowth of *Bacillus subtilis* Spores in the Presence of Selected Antioxidants, Mohammed A. Al-Khayat, Greg Blank and Costas Biliaderis, Department of Food Science, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2

J. Food Prot. 50:206-211

Germination and outgrowth of *Bacillus subtilis* spores was investigated using laboratory media containing butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), tertiary butylhydroquinone (TBHQ) and propyl gallate (PG). Although all antioxidants inhibited or retarded germination initiation and outgrowth, only BHA and TBHQ were effective at relatively low concentrations (150 and 100 ppm, respectively). Furthermore, BHA and TBHQ (150 ppm) were also shown to reduce spore growth by approximately 1 and 4 $\log_{10}$ within 72 and 6 h, respectively. The difference in the number of survivors between thermally (10 min at 80°C) and BHA (150 ppm)-treated germinated spores indicated that the antioxidant was effective against only a certain portion of the total heat-sensitive spore population. Sporostasis caused by BHA appeared reversible by the addition of Tween 80.

Comparative Growth of Spoilage and Pathogenic Organisms on Modified Atmosphere-Packaged Cooked Beef, Carolyn B. Hintlian and Joseph H. Hotchkiss, Institute of Food Science, Department of Food Science, Cornell University, Ithaca, New York 14853

J. Food Prot. 50:218-223

The influence of CO_2 atmospheres on the growth of spoilage and pathogenic microorganisms on cooked, sliced roast beef was investigated. An atmosphere containing 75% CO_2, 15% N_2 and 10% O_2 was identified as the most effective in the simultaneous inhibition of *Pseudomonas fragi*, *Salmonella typhimurium*, *Staphylococcus aureus*, and *Clostridium perfringens*. Inoculated roast beef was exposed to two temperature abuse regimes to observe the resultant microbiological changes in air and three modified atmospheres containing 75% CO_2 and O, 5 or 10% O_2 (balance N_2). The modified atmospheres inhibited the growth of *S. aureus* during abusive storage, and atmospheres containing 5 or 10% O_2 inhibited the outgrowth of *C. perfringens*. The modified atmospheres were less effective in inhibiting the growth of *S. typhimurium*. However, high *Salmonella* counts were accompanied by high *Pseudomonas* counts. The concept of a Safety Index, which compares numbers of spoilage and pathogenic organisms, was developed to aid in the evaluation of modified atmospheres.

Effect of Salt Level and Nitrite on Toxin Production by *Clostridium boculinum* Type E Spores in Smoked Great Lakes Whitefish, S. L. Cuppett, J. I. Gray, J. J. Pestka, A. M. Booren, J. F. Price and C. L. Kutil, Department of Food Science and Human Nutrition, Michigan State University, East Lansing, Michigan 48824

J. Food Prot. 50:212-217

The effect of salt level and nitrite on botulinal safety of smoked whitefish was investigated. An average water-phase (wp) salt concentration of 4.4% inhibited outgrowth of *Clostridium botulinum* type E spores (10^3 spores/g) for over 35 d in temperature-abused (27°C) smoked whitefish. Incorporation of nitrite (220 mg/kg) during brining to the smoked salted (4.4%, wp) whitefish inhibited toxin production for 56 d at 27°C. An average salt concentration of 6.2% (wp), with or without nitrite, totally inhibited toxin production for the duration of the study (83 d). The effect of pH and water activity in temperature-abused smoked whitefish as a means of controlling toxin production by *C. botulinum* type E spores was evaluated.

Inhibition of Growth of *Staphylococcus aureus* during Production of Acidophilus Yogurt, R. Attaie, P. J. Whalen, K. M. Shahani and M. A. (Vic) Amer, Department of Food Science and Technology, University of Nebraska, Lincoln, Nebraska 68583-0919 and McGill University, Montreal, Canada

J. Food Prot. 50:224-228

Inhibition of growth of a pathogenic strain of *Staphylococcus aureus* and production of a metabolite, thermostable deoxyribonuclease (TDNase), in acidophilus yogurt and yogurt were investigated. The causative factors of inhibition (lactic acid, hydrogen peroxide and bacteriocin) were assessed. Accumulation of hydrogen peroxide after 2 h of fermentation was 0.88 µg/ml, which caused a significant difference in the population of *S. aureus* between yogurts with and without catalase. Growth of *S. aureus* in the acidified yogurt was reduced after 4 h of fermentation when the pH of the medium was 4.8 or lower. Significant differences were found for the *S. aureus* populations of the acidified treatment and acidophilus yogurt

with catalase suggesting that inhibition was due to bacteriocin(s) produced during the yogurt fermentation. The TDNase was significantly lower in the acidified yogurt and was totally inhibited in the three cultured yogurts during the fermentation period.

Extension of Shelf Life of Minced Beef by Storage in Vacuum Packages with Carbon Dioxide, R. H. Madden and B. Moss, Agriculture and Food Science Research Centre, The Queen's University of Belfast/Department of Agriculture for Northern Ireland, Newforge Lane, Belfast BT9 5PX, Northern Ireland

J. Food Prot. 50:229-233

Beef intended for production of mince (ground beef) was vacuum packed in minced and unminced form and in the presence and absence of solid CO_2. Subsequently the meat was displayed using overwrap-type packs to assess its shelf-life as beef mince. The total microbial load was reduced by mincing after storage and this also helped maintain the bloom in overwrap packs. Addition of CO_2 markedly reduced growth of aerobic spoilage organisms during storage and during subsequent display. Lactic acid bacteria were affected less than aerobes but levels of CO_2 above 2 g/kg of meat slowed their growth in the vacuum packages but not in overwrap packs. Overall, CO_2 addition helped maintain the bloom of the meat and reduced total microbial numbers. It thus reduced the adverse effects of storage in vacuum packages and could produce a product more stable, during display, than the fresh meat.

Killer Toxins of Yeasts: Inhibitors of Fermentation and Their Adsorption, Ferdinand radler and Manfred Schmitt, Institut für Mikrobiologie und Weinforschung der Johannes Gutenberg-Universität Mainz, Postfach 3980, D-6500 Mainz, Federal Republic of Germany

J. Food Prot. 50:234-238

The killer toxin (KT 28), a glycoprotein of *Saccharomyces cerevisiae* strain 28, was almost completely adsorbed by bentonite, when applied at a concentration of 1 g per liter. No significant differences were found between several types of bentonite. Killer toxin KT 28 is similarly adsorbed by intact yeast cells or by a commercial preparation of yeast cell walls that has been recommended to prevent stuck fermentations. An investigation of the cell wall fractions revealed that the toxin KT 28 was mainly adsorbed by mannan, that removed the toxin completely. The alkali-soluble and the alkali-insoluble β-1,3- and β-1,6-D-glucans lowered the toxin concentration to one tenth of the original amount. The killer toxin of the type K_1 of *S. cerevisiae* was adsorbed much better by glucans than by mannan.

Thermal Stability of Staphylococcal Enterotoxins A, B and C in a Buffered System, A. Tibana, K. Rayman, M. Akhtar and R. Szabo, Food Directorate, health Protection Branch, Health and Welfare Canada, Tunney's Pasture, Ottawa, Ontario, Canada, K1A 0L2

J. Food Prot. 50:239-242

The heat stability of staphylococcal enterotoxins A, B and C (SEA, SEB, SEC) in phosphate buffered saline solution at a concentration of 100 ng per ml indicated that normal cooking times and temperatures are unlikely to completely inactivate the toxins. The order of heat resistance of the three toxins was SEC>SEB>SEA.

Identification of Foodborne Yeasts, Tibor Deák and Larry R. Beuchat, University of Georgia, College of Agriculture, Department of Food Science, Agricultural Experiment Station, Experiment, Georgia 30212-5099

J. Food Prot. 50;243-265

Improvements in identification procedures for yeasts lag behind recent developments in taxonomy. Sophisticated genetical and biochemical methods cannot be used in routine identification of yeasts. In foods representing specific and often selective ecological niches for yeasts, usually a restricted number of species are present, and for these a simplified identification key has been devised based only on 10 to 15 tests. Yeasts representing 215 species reported to be present in foods are included in a key, and methods of simplified identification are described.

Calendar

1987

March 15-18, 1987 ACDPI CONFERENCE, to be held at the Opryand Hotel, 2800 Opryland Drive, Nashville, Tennessee. For more information contact: Dr. C. Bronson Lane, ACDPI, P.O. Box 7813, Orlando, Florida 32854. 305-628-1266.

March 18-20, NATIONAL DIARY PROMOTION & RESEARCH BOARD, to be held in Boise, ID. For more information contact: Ron Hamel, 2111 Wilson Blvd., #600, Arlington, VA 22201

March 19-20, MOISTURE MANAGEMENT IN FOOD SYSTEMS, New Jersey. For more information contact: The Center for Professional Advancement, Box H, East Brunswick, New Jersey 08816-0257. 201-238-1600.

March 23-27, DEPT. OF FOOD SCIENCE & NUTRITION MID-WEST WORKSHOP IN FOOD SANITATION, Fawcett Center for Tomorrow, to be held at Ohio State University, Columbus, OH. For more information contact: John Lindamood, 2121 Fyffe Road, Columbus, OH 43210-1009

March 24-26, BASIC PASTEURIZATION COURSE, to be held at the Viscount Hotel in Dallas, Texas, 214-522-6650. For more information contact: Ms. Janie F. Park, TAMFES, P.O. Box 2363, Cedar Park, TX 78613-2363. 512-458-7281.

March 25-26, THE FOURTH ANNUAL CHEESE RESEARCH AND TECHNOLOGY CONFERENCE, to be held at the Dane County Forum and Sheraton Inn and Conference Center, Madison, Wisconsin. For program information contact: Mark E. Johnson, Department of Food Science, UW-Madison, 226 Babcock Hall, 1605 Linden Drive, Madison, WI 53706. 608-262-0275. For enrollment information contact: Agricultural Conference Office, Jorns Hall, 650 Babcock Drive, Madison, WI 53706. 608-263-1672.

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

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

April 3, INTRODUCTION TO MACHINE VISION, to be held at the Georgia Institute of Technology. For more information contact: Ann Harbert, Environmental, Health, and Safety Division, Georgia Tech Research Institute, Atlanta, GA 30332. 404-894-3806.

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

April 8-9, AMERICAN DAIRY PRODUCTS INSTITUTE ANNUAL MEETING, to be held at the Hyatt Regency O'Hare Hotel in Chicago, IL. For more information contact: Warren S. Clark, Jr., 130 N. Franklin St., Chicago, IL 60606

April 12-14, DAIRY PRODUCTS INSTITUTE OF TEXAS SPRING BOARD OUTING, to be held in Lake Buchanan, TX. For more information contact: Glenn R. Brown, 201 Vaughn Building, Austin, TX 78701.

April 22-24, NATIONAL DAIRY PROMOTION & RESEARCH BOARD ANNUAL MEETING, to be held in Washington, DC. For more information contact: Ron Hamel, 2111 Wilson Blvd., #600, Arlington, VA 22201.

April 26-28, LA-MS DAIRY PRODUCTS ASSOCIATIONS, INC. ANNUAL CONVENTION (JOINT), to be held at the Broadwater Beach Hotel, Biloxi, MS. For more information contact: Gerald Simmons, P.O. Box 1006, Baton Rouge, LA 70821 or Edward W. Custer, P.O. Drawer AX, Miss. State, MS 39762.

April 27-28, MOLD MONITORING AND CONTROL FOR FOOD PROCESSORS, to be held in Manhattan, Kansas. For more information contact: Office of Registrar, Sanitation Education Department, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502. 913-537-4750 or 800-633-5137.

April 27-30, AOAC SPRING TRAINING WORKSHOP AND EXPOSITION, to be held at the Skyline Hotel, 101 Lyon Street, Ottawa, Ontario, Canada. For more information contact: Graham MacEachern, Agriculture Canada, Laboratory Service Building 22, Central Experimental Farm, Ottawa, Ontario, Canada K1A-0C5 (613) 994-1991 or James Lawrence, Health & Welfare Canada, Health Protection Branch, Tunneys Pasture, Ottawa, Ontario, Canada K1A-0L2. 613-990-8495.

April 28, ASSOCIATED ILLINOIS MILK, FOOD AND ENVIRONMENTAL SANITARIANS SPRING EDUCATIONAL SEMINAR, a joint conference with the Chicago Dairy Technology Society, to be held at The Holiday Inn, Rolling Meadows, IL 60008. 312-259-5000. For more information contact: Dr. Clem Honer, Gorman Publishing Company, 8750 West Bryn Mawr Ave., Chicago, IL 60631. 312-693-3200.

April 29, FOOD SAFETY AND SANITATION WORKSHOP FOR THE FOOD PROCESSING AND FOOD SERVICE INDUSTRIES, to be held at the Inn at the Park, Anaheim, CA. For more information contact: Kathryn Boor, Food Science and Technology, UCD, Davis, CA 95616. 916-752-1478.

April 29, CORNELL'S INSTITUTE OF FOOD SCIENCE SPRING CONFERENCE, to be held at the White Plains Hotel in White Plains, NY. For more information contact: Dr. John Kinsella, Chairman, Institute of Food Science, Dept. of Food Science, Stocking Hall, Ithaca, NY 14853. 607-255-7616.

May 3-5, GEORGIA DAIRY PRODUCTS ASSOCIATION ANNUAL CONVENTION, to be held at the Callaway Gardens, Pine Mountain, GA. For more information contact: Pat Hamlin, P.O. Box 801, Macon, GA 31208

May 3-5, TENNESSEE - KENTUCKY DAIRY PRODUCTS ASSOCIATION ANNUAL CONVENTION, to be held at the Opryland Hotel, Nashville, TN. For more information contact: T. Harold Rose, Tenn. Dairy Products Assn., 4117 Crestridge Dr., Nashville, TN 37204.

May 4-6, TECHNIQUES IN MEASUREMENT, to be held in Palo Alto, California. Pre-registration required. For more information contact: Herbert Stone, President, Tragon Corporation, 365 Convention Way, Redwood City, CA 94063. 415-365-1833 or Telex WUI 6502215776 (access MCI).

May 4-8, NATIONAL CONFERENCE ON INTERSTATE MILK SHIPMENTS, to be held at the St. Louis Marriott, St. Louis, MO. For more information contact: Herb Vaux, 1235 Medinah Drive, Ft. Meyers, FL 33907.

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

May 11-14, PURDUE ASEPTIC PROCESSING AND PACKAGING WORKSHOP. For more information contact: James V. Chambers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN 47907. 317-494-8279.

May 11-15, APPLICATIONS AND TROUBLESHOOTING MICROPROCESSOR CONTROL CIRCUITS, to be held in Manhattan, Kansas. For more information contact: Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502. 913-537-4750 or 800-633-5137.

May 12-14, PENNSYLVANIA ASSOCIATION OF MILK DEALERS 1987 CONVENTION, to be held at the Hotel Hershey, Hershey, PA. For more information contact: Earl Fink, 100 Walnut Street, Harrisburg, PA 17101.

May 12-15, WORKSHOP IN INSTRUMENT SERVICE AND REPAIR, to be held at the Anderson training facility and dairy processing plant in Fultonville, NY. For more information contact: Michael D. Cunningham, Anderson Instrument Company, Inc., R.D. #1, Fultonville, NY 12072. Telephone: 518-922-5315.

May 17-20, CANADIAN INSTITUTE OF FOOD SCIENCE & TECHNOLOGY ANNUAL MEETING, to be held at the Hamilton Convention Centre, Hamilton, Ontario. Theme: Biotechnology - Challenge for the Food Industry. For more information contact: Dr. V. F. Rasper, Conference Chairman, Department of Food Science, University of Guelph, Guelph, Ontario N1G 2W1. 519-824-4120.

May 17-20, DAIRY INSTITUTE OF CALIFORNIA ANNUAL SPRING MEET-

ING, to be held at La Quinta Resort in Palm Springs, CA. For more information contact: Robert D. Boynton, Suite 718, 1127 - 11th Street, Sacramento, CA 95814.

May 19-21, BASIC PASTEURIZATION COURSE, to be held at the Travellodge in El Paso, Texas, 915-544-3333. For more information contact: Ms. Janie Park, TAMFES, P.O. Box 2363, Cedar Park, Texas 78613-2363. 512-458-7281.

May 31-June 3, NEW YORK STATE DAIRY FOODS INC. ANNUAL MEETING, to be held at the Nevele Country Club, Ellenville, NY. For more information contact: Edmund J. Towle, 41 State Street, Albany, NY 12207.

May 31-June 4, AMERICAN SOCIETY OF BREWING CHEMISTS 53RD ANNUAL MEETING, to be held at the Hyatt Regency in Cincinnati, Ohio. For more information contact: ASBC Headquarters, 3340 Pilot Knob Road, St. Paul, MN 55121. 612-454-7250 or Telex (MCI/WUI) 6502439657.

June 15-17, FLORIDA DAIRY PRODUCTS ASSOCIATION ANNUAL CONVENTION, to be held at the Boca Raton Hotel & Club, Boca Raton, FL. For more information contact: J. R. Antink, 14 E. Washington St., Suite 315, Orlando, FL 32801.

June 15-18, BASIC FOOD PLANT MICROBIOLOGY, to be held in Manhattan, Kansas. For more information contact: Melinda Enns at 1-800-633-5137 or write: Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, Kansas 66502.

June 17-19, ARKANSAS DAIRY PRODUCTS ASSOCIATION 52ND ANNUAL CONVENTION, to be held at the Holiday Inn Lake Hamilton, Hot Springs, AR. For more information contact: Floyd Smith, P.O. Box 4187, Asher Ave. Station, Little Rock, AR 72214.

July 10-18, SEVENTH INTERNATIONAL WORKSHOP ON RAPID METHODS AND AUTOMATION IN MICROBIOLOGY, to be held at Kansas State University, Manhattan, KS. For more information contact: Dr. Daniel Y.C. Fung, Director of the workshop. 913-532-5654.

July 14-16, BASIC PASTEURIZATION COURSE, to be held in San Antonio, Texas. Location to be announced. For more information contact: Ms. Janie F. Park, TAMFES, P.O. Box 2363, Cedar Park, Texas 78613-2363. 512-458-7281.

August 2-4, WEST VIRGINIA DAIRY PRODUCTS ASSOCIATION ANNUAL MEETING (75TH ANNIVERSARY), to be held at the Greenbrier, White Sulphur Springs, WV. For more information contact: Paul M. Smith, Room 1054 Ag. Sci. Bldg., Box 6108, Morgantown, WV 26506-6108.

August 2-6, IAMFES 74TH ANNUAL MEETING, to be held at the Disneyland Hotel, Anaheim, California. For more information contact Kathy R. Hathaway, IAMFES, Inc., PO Box 701, Ames, IA 50010. 800-525-5223, in Iowa 515-232-6699.

August 5-7, IOWA DAIRY FOODS ASSOCIATION ANNUAL CONVENTION, to be held at the Village West, Lake Okoboji, IA. For more information contact: John R. Brockway, 1805 74th Street, Des Moines, IA 50322.

August 9-14, ANNUAL MEETING OF THE SOCIETY FOR INDUSTRIAL MICROBIOLOGY, to be held at The Hyatt Regency Hotel, Baltimore, Maryland. For more information contact: Mrs. Ann Kulback, SIM, P.O. Box 12534, Arlington, VA 22209. 703-941-5373.

August 16-18, WISCONSIN DAIRY PRODUCTS ASSOCIATION, INC. JOINT ANNUAL MEETING & CONVENTION WITH MIDWEST DAIRY PRODUCTS ASSOCIATION, INC., to be held at The Abbey on Lake Geneva, Fontana, WI. For more information contact: Norm E. Kirschbaum, 1400 E. Washington Ave., Suite 185, Madison, WI 53703.

August 16-18, MICHIGAN DAIRY FOODS ASSOCIATION ANNUAL CONVENTION, to be held at Boyne Highlands Resort, Harbor Springs, MI. For more information contact: Frank Koval, 748 N. Cedar St., Lansing, MI 48906.

September 1-2, FOOD PROCESSING WASTE CONFERENCE, Radisson Hotel, Atlanta, GA. For more information contact: Edd Valentine or Chuck Ross, Georgia Tech Research Inst., Economic Development Laboratory, Environmental, Health and Safety Division, O'Keefe Building, Atlanta, GA 30332. 404-894-3412.

September 8-10, BASIC PASTEURIZATION COURSE, to be held at the Viscount Hotel in Houston, Texas, 713-526-4571. For more information contact: Ms. Janie F. Park, TAMFES, P.O. Box 2363, Cedar Park, TX 78613-2363. 512-458-7281.

September 9-10, NEBRASKA DAIRY INDUSTRIES ASSOCIATION ANNUAL CONVENTION, to be held at the Best Western Regency West, Omaha, NE. For more information contact: Michael Liewen, 134 Filley Hall, University of Nebraska, Lincoln, NE 68583-0919.

September 9-10, UNITED DAIRY INDUSTRY ASSOCIATION ANNUAL MEETING, to be held at the Marriott O'Hare, Chicago, IL. For more information contact: Edward A. Peterson, 6300 N. River Road, Rosemont, IL 60018.

September 14-15, ASSOCIATED ILLINOIS MILK, FOOD, AND ENVIRONMENTAL SANITARIANS FALL SEMINAR AND ANNUAL MEETING, a joint conference with the Chicago Dairy Technology Society. For more information contact: Dr. Clem Honer, Secretary Associated Milk, Food and Environmental Sanitarians, Gorman Publishing Co., 8750 W. Bryn Mawr, Chicago, IL 60631. 312-693-3200.

September 14-17, AOAC TO HOLD 101ST ANNUAL INTERNATIONAL MEETING, to be held at The Cathedral Hill Hotel, in San Francisco. For more information contact: the AAOAC office at 1111 N. 19th St., Suite 210, Arlington, VA 22209. 703-522-3032.

September 20-23, NATIONAL DAIRY COUNCIL OF CANADA 70TH ANNUAL CONVENTION, to be held at the Quebec Hilton, Quebec, Canada. For more information contact: Dale A. Tulloch, 141 Laurier Avenue West, Ottawa, Ontario, Canada K1P 5J3.

September 24-25, SWEETENERS IN FOODS: SENSORY, PROCESSING AND HEALTH ASPECTS, to be held at Kansas State Union, Kansas State University, Manhattan, KS. For more information contact: Dr. Carol Setser or Dr. Karen Penner, Department of Foods and Nutrition, Justin Hall, Kansas State University, Manhattan, KS. 913-532-5508.

October 5-9, 13TH INTERNATIONAL SYMPOSIUM OF THE IUMS-ICFMH & FECS-WPFC, "Toxins in Foodborne Disease" and "Microbiology of Drinking Water," to be held in Halkidiki, Greece. For more information contact: Prof. J. A. Papadakis, Omirou 24, 10672 Athens, Greece.

October 19-21, DESCRIPTIVE ANALYSIS, to be held in Palo Alto, California. Preregistration required. For more information contact: Herbert Stone, President, Tragon Corporation, 365 Convention Way, Redwood City, CA 94063. 415-365-1833 or Telex WUI 6502215776 (access MCI).

November 8-11, DAIRY INSTITUTE OF CALIFORNIA ANNUAL FALL MEETING, to be held at The Lodge, Pebble Beach, CA. For more information contact: Robert D. Boynton, Suite 718, 1127 - 11th Street, Sacramento, CA 95814.

November 10-12, BASIC PASTEURIZATION COURSE, to be held in Texarkana, Texas. Location to be announced. For more information contact: Ms. Janie F. Park, TAMFES, P.O. Box 2363, Cedar Park, Texas 78613-2363. 512-458-7281.

November 15-18, SOUTHERN ASSOCIATION OF DAIRY FOOD MFRS., INC. 73RD ANNUAL CONVENTION, to be held at Colonial Williamsburg Foundation, Williamsburg, VA. For more information contact: John E. Johnson, P.O. Box 10506, Raleigh, NC 27605

November 30-December 3, NATIONAL MILK PRODUCERS FEDERATION ANNUAL MEETING, to be held at the Hyatt Regency, New Orleans, LA. For more information contact: James C. Barr, 1840 Wilson Blvd., Arlington, VA 22201.

November 30-December 4, THE FIRST LATIN AMERICAN CONGRESS ON FOOD MICROBIOLOGY AND THE I ARGENTINE SYMPOSIUM ON PRESERVATION OF FOODS, to be held in Buenos Aires, Argentina. For more information contact: Dr. Ricardo Sobol, Secretary General, Bulnes 44 P.B. "B", 1176 Buenos Aires, Argentina. Additional information: Dr. Fernando Quevedo, 525 Twenty Third St., N.W., Washington, D.C. 20037.

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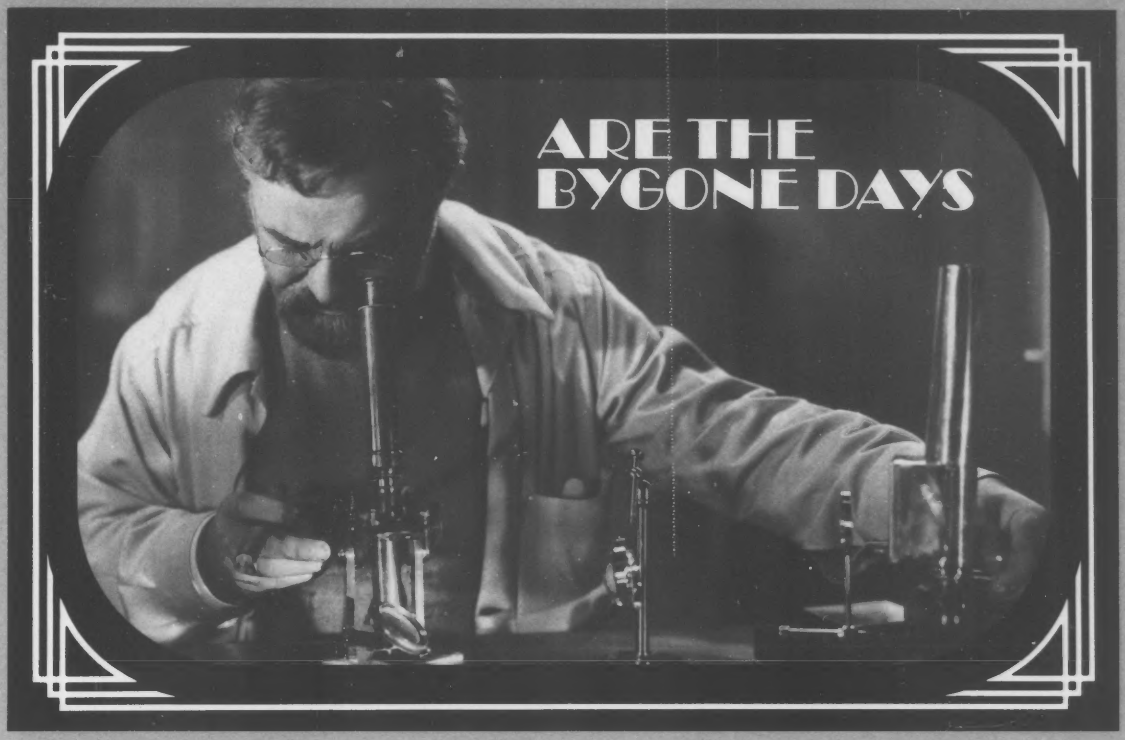

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ne Cow, One Cow, that father bought for two zuzim, One Cow, One Cow,

And the bug came
and infected the cow
that father bought
for two zuzim.
ONE COW, ONE COW.

And the tetracycline came
and killed the bug
that infected the cow
that my father bought
for two zuzim.

And the child came
and drank the milk
that contained the tet'
that killed the bug
that infected the cow
that my father bought
for two zuzim.

And the test was needed
to save the child
that drank the milk
that contained the tet'
that killed the bug
that infected the cow
that my father bought
for two zuzim.

And Stanley came
and invented the test
that saved the child
that drank the milk
that contained the tet'
that killed the bug
that infected the cow
that my father bought
for two zuzim.
ONE COW, ONE COW,