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Purpose

1. To encourage graduate students to present their original research at the IAMFES annual meeting.
2. To foster professionalism in graduate students through contact with peers and professional members of IAMFES.
3. To encourage participation by graduate students in IAMFES and the annual meeting.

Who Is Eligible

Graduate students enrolled in M.S. or Ph.D. programs at accredited universities or colleges whose research deals with problems related to environmental, food and/or dairy sanitation, protection and safety. Candidates cannot have graduated more than one (1) year prior to the deadline for submitting abstracts.

Criteria

1. A short abstract of the paper must be submitted to the IAMFES office by January 10. (Use the blue abstract forms from the October issue, if possible).
2. The author must indicate on the abstract form the desire to be considered for the competition.
3. The paper and the student must be recommended and approved for the competition by the major professor or department head.
4. The paper must represent original research done by the student and must be presented by the student.
5. An extended abstract form will be sent to all who enter the competition, and must be completed and returned by the deadline date on that form.
6. Each student may enter only one (1) paper in the competition.
7. Papers are to be presented as oral papers and should be approximately fifteen (15) minutes in length with an additional five (5) minutes allowed for questions, for a total of twenty (20) minutes.
8. The use of slides or other visual aids is encouraged.
9. The papers will be judged by an independent panel of judges.
10. Winners are presented and honored at the annual Awards Banquet. All entrants will receive complimentary tickets and are expected to be present at the Banquet.

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Thoughts From the President . . .

By
Bob Sanders
IAMFES President

Here I am again sitting down to my computer trying to come up with some thoughts to bring you for this month. Actually I am sitting in a hotel room after a long day on the road participating in a training course on basic dairy farm sanitation. It seems like I have spent a lot of nights and days like this the past few years. I must admit though that I do enjoy this part of the job. Though I am helping as an instructor, I am still learning something new each day.

With the rapidly moving technology in the field of food sanitation, we as sanitarians must participate in training to keep ahead of the coming changes. I would encourage you to take advantage of every opportunity to attend and participate in training courses to further your knowledge and increase your skills in the sanitation field. Many colleges offer specialized short courses, seminars and even at home study courses for you to benefit yourself and improve your job performance.

The IAMFES Executive Board will be meeting the last weekend in October for its annual fall board meeting. One topic to be discussed will be the program for the 78th IAMFES meeting in Louisville, Kentucky. If any member has a suggested topic for an invited speaker or for a symposium, please contact Damien Gabis, Program committee chairperson, or me. If you have a particular program or research project that you have been working on and would like to share with other members, now is the time to submit it for consideration as a presented paper for the 78th annual meeting. Forms for submission of papers are included in this journal.

If any IAMFES committee chairperson has any committee business that they wish to have considered by the Board, please submit it in writing to me or to Steve Halstead so that it can be placed on the agenda for the meeting. I will have more to report on discussions and decisions from the October Board meeting in another column at a later date.

The committee appointed to study the name change, under the leadership of Mike Doyle, has been hard at work. They have decided to send a ballot to all members asking that each member vote on whether they wish to change the name of the association and if so what would be a suggested new name. If the majority of the ballots cast are in favor of the existing name, then the issue will be settled at that point. That is, there will be no change in the name.

If however, a majority of the ballots are in favor of a name change, the committee will propose several names at the 1991 Annual Meeting for input as they seek to narrow the selection to two names.

These two names will be submitted to a vote of the membership in December, 1991. The winning name would then be incorporated as a constitutional change at the 1992 Annual Meeting. This constitutional change is the final step.

I encourage each and every one of the members to give this matter some serious thought when you receive the ballot and make sure you fill it in and send it back. The members of the study committee and the executive board have tried to remain neutral on this issue and will abide by the wishes of a majority of our members.

I probably will not be writing a column for the next month's Journal. The November issue will be devoted to the 77th annual meeting and my column will be replaced by President Case's Presidential Address.

See you again in December!

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Trends Affecting the Foodservice Industry in the 1990's

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The much heralded 21st century, a time that has long stood as a symbol of the future, is rapidly approaching. Several authors have already begun identifying trends for the upcoming decade (1,2). According to the authors of *Megatrends 2000*, trends are the gateways to the 21st century (2). This report identifies trends likely to influence actions of foodservice managers in the coming decade. Some of these trends also have implications for sanitarians. Trends are grouped into the following four categories: Political, Economical, Technological and Social.

Political

The foodservice industry of the 1990s and beyond will be subjected to more, not less, government regulation. Many of these regulations will have serious consequences for the foodservice industry. Some political trends that will affect the foodservice industry throughout the 1990s are shown in Table 1.

Table 1. Political trends affecting the foodservice industry in the 1990s.

LABOR LEGISLATION
Americans with Disabilities Act
Parental Leave
Child Care
Health Benefit
FOOD RELATED REGULATIONS
Labeling
Unicode
Certification
Sous Vide
ENVIRONMENTAL LEGISLATION
Environmental Protection Agency
State & Local Governments

Labor Legislation

A number of labor legislative issues that directly affect the foodservice industry, but failed to gain Congressional support in the 1980s, have been reintroduced into Congress. The Americans with Disabilities Act, a civil rights bill for people with disabilities, prohibits discrimination against disabled individuals in employment and requires that foodservice facilities be accessible to disabled customers (3). Two versions of the ADA bill are currently in the House-Senate conference committee and once a compromise is reached, the final bill will be sent back to Congress for a final vote (4).

A parental leave bill requiring companies to provide up to 12 weeks of unpaid leave a year to workers for childbirth, adoption or serious family illnesses was recently vetoed by President Bush (5). The President has also threatened to veto the House and Senate's version of a child care bill designed primarily to aid low income families (6). A child care bill for low income families will probably be passed early in the 1990s (1). However, child care legislation that will benefit children at all income levels will be passed by the year 2000 (1).

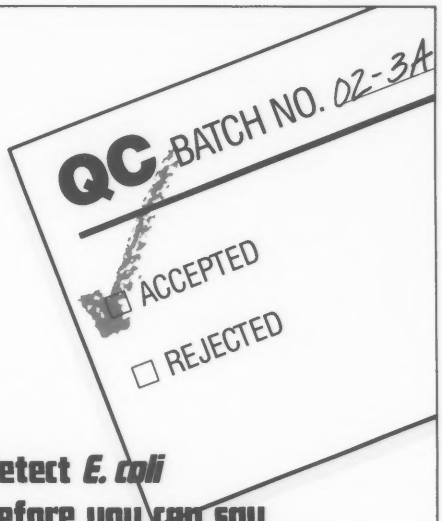
Mandated health-benefit bills will also resurface during the '90s. According to previous bills introduced into Congress, employers will be required to provide a package of minimum health benefits to all employees working more than 17 1/2 hours a week regardless of a preexisting medical condition (7). Sometime during the '90s a mandatory health bill will be passed by Congress.

Food Related Regulations

A renewed focus on the use of food labeling in the 1990s is expected. Three labeling bills currently under congressional consideration exempt ingredient labeling for foodservice establishments (8). However, the Food and Drug Administration (FDA) recently issued a call for public comment on mandatory labeling for fast foods (9). Such legislation would prove costly to the government, the fast food industry and the consumer.

In 1986 the FDA issued a proposed Food Protection Unicode. This updated compendium of food protection and sanitation provisions consolidates several separate model codes covering foodservice, food vending and retail stores, to eliminate inconsistencies and duplications (10). But the proposed unicode has been widely criticized for being inconsistent and unreliable (10-12). Given the number of negative comments, it is conceivable that the proposed unicode will be extensively reworked before it is ready for implementation sometime in the 1990s.

In recent years outbreaks of foodborne illnesses attributed to foodservices have received much attention in the popular press (13-15). This problem has been attributed to the foodservice industry's high turnover rate and lack of on-the-job training programs and is further compounded by workers



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who have no concept of personal hygiene (12). To alleviate the public's fears, the state of Florida recently enacted legislation that requires every foodservice facility in that state to have at least one manager on duty who has passed a basic food sanitation exam (16). Throughout the coming decade we will see other states moving toward certification.

Sous vide (French for under vacuum) is a cooking process widely used by restaurants throughout Europe (17). Restaurants in the United States, but not food processing companies, are barred from using this process by the United States 1976 Food Sanitation Code (18). This code specifically prevents the foodservice industry from using foods in hermetically sealed containers that are not prepared in food processing plants (19). However, Louisiana is one state that does not prevent foodservices from using sous vide (20).

Sous vide involves vacuum packaging partially cooked ingredients in an impermeable plastic pouch, cooking ingredients in the vacuum package at low temperatures, holding the cooked product under refrigeration for a number of days and then reheating the product prior to service (21).

Sous vide can reduce labor and food costs, increase the shelf life of the product (18) and produce menu items of consistent quality (22). However sous vide is also a process fraught with problems. According to the FDA, this process has the potential to harbor pathogenic bacteria (*Clostridium botulinum, Listeria monocytogenes* and *Yersinia enterocolitica*) if strict time/temperature controls are not followed (23). Researchers are currently exploring methods that would control microbiological contamination in products prepared by the sous vide methods (24).

Environmental Legislation

Our throwaway mentality has created a serious and growing solid waste problem. Americans generate more solid waste per person than any other industrialized nation (1). In 1986, it was estimated that each American discarded 3.5 pounds of trash a day (25). Eighty percent of this waste is sent to landfills; 10 percent is recycled; and the remaining ten percent is incinerated (25).

In 1980 there were an estimated 10,000 landfills in the United States (26). This number was reduced to 6,500 by 1987 (26). Some estimate that 1/3 of our landfills will be full within the next five years (25,26). Americans discard 160 million tons of garbage each year (25). If Americans continue discarding garbage at this rate this number will increase to 193 million tons of garbage per year by the year 2000 (25).

The Environmental Protection Agency (EPA) suggests the use of integrated waste management to safely and effectively handle the solid waste stream (25). Integrated waste management includes source reduction, recycling, incineration and landfilling. Source reduction refers to a decrease in the total amount of material used, while recycling not only saves energy and natural resources, but also provides useful products from discarded materials. The EPA believes that source reduction and recycling are the preferred options (25).

The gaily decorated containers and wrappers used by fast food restaurants are very noticeable when discarded. For this reason, the American public attributes much of the solid waste problem to the foodservice industry (27,28). However, the head of the University of Arizona's Garbage Project reported that foodservice packaging makes up less than one percent of the total landfill input (29). Both state and local governments have passed laws to enforce recycling and/or removal of plastics and polystyrene products from the solid waste stream (30,31). Those foodservices that use these products will be hardest hit. Between January and September of 1989 legislators in 38 states passed 125 different bills dealing with recycling (31).

Economic

Over the next decade we will see the gradual globalization of the United States. This move toward a global economy will provide the foodservice industry with more challenges and opportunities than ever before. Five economic trends that will influence the foodservice industry in the 1990s are listed in Table 2.

Table 2. Economic trends affecting the foodservice industry in the 1990s

European Economic Community (EEC)
Perestroika and Glasnost
Food Costs
Competition
Labor Shortages

European Economic Community (EEC)

In 1985 twelve countries of the EEC joined together to achieve a true common market. Their intent was to remove the physical, technical and economic barriers that prevented the EEC from achieving greater economic efficiency and benefits (32). Their goal should be achieved by 1992.

Some perceive the EEC as a threat, while others view it as a challenge. U.S. food companies already completely or partially own 12 of the largest food companies in the EEC (32). These companies stand to profit when borders are eliminated. In addition, it will be easier to deal with one rather than twelve economic units.

McDonald's and Walt Disney are two American companies that already offer countries belonging to the EEC a taste of American dining fare (33). With over 320 million perspective customers, there is an opportunity for more American foodservices to enter the Western European Market (32).

Perestroika and Glasnost

Lifting of the "iron curtain" in Poland, Rumania, Czechoslovakia... will provide new markets for American foodservices. Over the next decade we will see more fast food chains opening restaurants in these East European nations (34). Perestroika is affecting the ethnic food market in the United States as more Americans visit East European countries and more people from these countries emigrate to the United States.

Food Costs

Stricter controls on pesticides coupled with an expanding focus on health will increase food prices 35 percent by the year

2000 (35). With the trend toward global warming (36,37), droughts similar to the one in 1988 (37) could reoccur. Since grain products are most severely affected by drought, prices for bakery products, cereals, vegetable oils and margarine made with vegetable oil will increase (38). Lower yields of corn will drive up prices for meat and dairy products while eggs, indirectly affected by drought, will also command higher prices in the '90s (38).

Competition

Foodservices will not only compete with other foodservice operations but also with grocery and convenience stores (24). Supermarkets will intensify their efforts for a greater share of the consumer's food dollar by building food courts (39,40) and designating special checkout lanes for prepared foods (40). They will also prepare foods for specific groups such as diabetics and the lactose and glucose intolerant (40). As a result the foodservice industry will have to work harder for a share of the consumer's food dollar.

Labor Shortages

Because there is a decreasing number of teenagers (41) and because of the low wages and lack of benefits traditionally paid to foodservice workers (42), there will be a chronic labor shortage in the foodservice industry. However, the number of minorities (Hispanics, Asians and Blacks) and the number of elderly is increasing (42-44). Recruitment for future foodservice workers will be from these groups.

Technological

Computers, robots and labor saving equipment are three technological trends that will help solve the anticipated labor shortages of the 1990s. Technological trends that will affect the foodservice industry in the 1990s are presented in Table 3.

Table 3. Technological trends affecting the foodservice industry in the 1990s.

Computer software
Food products
Equipment
Robotics

Computer Software

Computers will be used more frequently in foodservice operations. Information systems that automate much of the routine processing of financial information in offices are already in place (45). More software packages, designed specifically for the needs of foodservice departments are being developed and will be available in the early 1990s (46). By the year 2000, computerization will impact every aspect of foodservice (47).

Food Products

An obsession with health and body image is forcing the food processing industry to develop, and the foodservice industry to serve, food products that are healthier and lower in calories. A process called supercritical fluid extraction removes cholesterol from milk without altering the nutritional content of the product (46). Foodservice operators serving cholesterol conscious consumers may soon be able to offer reduced cholesterol milk, butter and other dairy products.

Scientists are currently working to identify compounds in fruits, vegetables and grains thought to prevent the development of cancer or arrest a cancerous condition once it develops. Once identified, these compounds will be incorporated into "designer foods" that people will eat as part of their normal diet (48).

Meanwhile, our search for new sugar substitutes continues unabated. Researchers are working on a natural low-calorie sweetener extracted from Stevia reboundiana, a plant found in the tropics (24,49). Because of its remarkable sweetening ability (400 times sweeter than sucrose) and its ability to withstand heat, experts predict that this sugar substitute will be introduced within the next five years (24).

Equipment

Food preparation equipment will be easier to clean (50) and will have more labor saving features (24). The use of microwave ovens in foodservice kitchens is expected to increase (51). However, bacteria have been reported to survive in foods after microwave heating (52).

Robotics

Robots are relatively new to the foodservice industry but with the anticipated labor shortage, use of robots will increase (53). Robotic arms and fetch-and-carry robots have been used on a limited scale in some healthcare foodservices (45,54). McDonald's in New York has a robot that replaced 9 full-time equivalent positions (51). Work is currently in progress on assembling a robotic system that can be used to assemble airline meal trays (53).

Social

"Crack" cocaine, Acquired Immunodeficiency Syndrome (AIDS) and Alzheimer's disease are synonymous with the 80's. These and other social trends that will continue to influence the foodservice industry in the 1990s are presented in Table 4.

Table 4. Social trends affecting the foodservice industry in the 1990s.

Elderly
Acquired Immunodeficiency Syndrome (AIDS)
Substance abuse
Focus on the home
Health and nutrition
Women in the workplace

Elderly

The number of elderly is increasing. Today 29 million Americans are over the age of 65 (55). By the year 2050 there will be more than 20 million Americans over the age of 85 and this trend is expected to continue (56). The growth of this

segment of the population will put enormous stress on public and private resources for food and services.

Recent studies (57-59) have identified issues in feeding individuals with diseases common to the elderly - such as Alzheimer's disease and other types of dementia. Currently only 4 percent of those 65 years of age and older live in institutions (56). Soon we will see increases in day care, homecare, meals-on-wheels, assisted living and personal care centers for the elderly with the affluent elderly living in life care centers located in one complex or building (60).

Focus on the Home

The home will become a refuge from employment and other outside pressures. The home will provide a sense of stability, security and sanctuary from the outside world (61). Consequently more home delivery and food carryout services will be needed.

When consumers leave their homes to dine out, they will expect service to be more than just politeness. Foodservice managers have to retrain workers to discern consumers' unspoken wants and needs (62). Opportunities will exist for foodservices to cater to these needs.

Health and Nutrition

Since the early '70s Americans have been health conscious. However, consumers tend to have a split personality when it comes to eating healthier foods. Although they are eating more poultry, fish, fresh fruit and fresh vegetables, they are also eating more dairy products, using more oil and drinking more coffee and tea (63).

A recent study conducted by the National Restaurant Association (64) indicated that 88 percent of the customers questioned agreed that diet and nutrition are involved in disease prevention. Of the 88 percent, only 40 percent ate healthier foods when dining out. Overall, older customers were found to be more health and nutrition conscious than younger customers and the baby boom generation tended to have an above average interest in nutrition when dining out.

Acquired Immunodeficiency Syndrome (AIDS)

The first case of AIDS was diagnosed in 1981 (65). Since then 58,014 Americans have died from this disease (66). Last year state health departments reported 35,238 cases of AIDS to the Centers for Disease Control in Atlanta, Georgia (67). This figure is 9 percent higher than the number of cases reported in 1988 (67). Unless a vaccine is discovered soon, the full impact of AIDS on our society will exceed that of any war in our country's history (1).

Individuals with AIDS are not prohibited from working in the foodservice industry unless they have a secondary infectious disease such as tuberculosis (68). Therefore, it is imperative that foodservice managers provide training programs that include procedures to follow when injuries occur during food preparation and service.

Substance abuse

There are 3 million cocaine users, 11.6 million marijuana users and between 15 and 20 million current or recovering alcoholics in the United States today (69). Americans spend 100 billion dollars a year on illegal drugs (1). The foodservice industry alone loses 8.6 billion dollars a year in employee theft and a large proportion of these dollars is thought to be used for the purchase of illegal drugs (69).

The foodservice industry, with its characteristic low pay and unskilled labor force, primarily attracts young people between the ages of 18 and 25. Sixty-five percent of this population has used drugs (69). The National Institute on Drug Abuse has warned that the drug of choice for the 1990s may be methamphetamine, also known on the street as speed (1).

Foodservices will have to develop strong anti-drug policies. Management needs to be trained to recognize the signs of substance abuse. Drug testing is not likely to become commonplace in the majority of foodservices - only in large companies and healthcare facilities (69). Foodservice managers will have to do more pre-employment screening, such as checking references more carefully and giving more paper and pencil tests.

Women in the Work Place

By the year 2000 more than 65.6 million women will be in the labor force - a 12 percent increase from 1986 (24). The majority (44.8 million) of these women will be in their childbearing years (70). The full impact of an increased number of working women will be profound with daycare and preschool education more heavily subsidized by employers and government, a less flexible work force as two career families become less willing to move and an increase in part-time, flexible and stay-at-home jobs (24).

Summary

The foodservice industry of the 21st century will be different from what it is today. Government efforts to regulate the industry will intensify. Competition will also be more intense - both at home and abroad. Although more minorities and women with children will be working, labor shortages will exist. These shortages will force foodservices to rely more and more on computers and robots. Americans will be eating healthier and more nutritious menu items. These menu items will be purchased in and served on biodegradable and recyclable materials. However, global warming and the decreased use of pesticides will increase food costs. Finally, Alzheimer's disease and AIDS will be among the top social/ethical concerns at the turn of the century.

Trends discussed in this report have implications for sanitarians as well as foodservice managers. New food processes, new food products and an increase in the use of microwave ovens in foodservices are three major trends of special concern to sanitarians. Foodservice managers and sanitarians must work closely together to serve food that is safe and nutritious, thereby continuing to insure the health and well being of the American population as the 21st century approaches.

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A 12-Month Study of Freezing Point of Regional Raw Milk Supplies within the State of Minnesota

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Abstract

During deliberations of a Task Force of the National Conference of Interstate Milk Shipments to consider the feasibility of establishing a universal freezing point base for raw milk, a 12-month study was undertaken to survey the freezing point of raw milk in five regions within the state of Minnesota. Over 1,100 analyses of incoming producer samples per region were made each month by four industry laboratories. The samples were a part of on-going operations and not previously screened to ensure absence of added water. Sample numbers were large enough, however, to provide valid evidence of existing trends, and obviously so, in terms of unusually low freezing point values. The data from these analyses were compared to those of Henningson (2), whose research on "unwatered" milk samples of 1968 currently serves as the basis for freezing point standards applied in the United States. The percentage of samples at -0.530°H and above was less than one-third that found by Henningson, i.e. 1.5 vs 5.5%. Where Henningson found 44.8% and 3.9% of samples with freezing points of -0.541 to -0.550°H and -0.551°H and below, respectively, the present survey found 57.2% and 20.2%. The average freezing point in the Henningson study was -0.5404°H and for this study, -0.5452°H. Regional differences as high as -0.0073°H were noted among the five regions within the state. Seasonal differences in freezing point of milk went from an average low of -0.5472°H during April to an average high of -0.5428°H during August, a difference of 0.0044°H. The grand average standard deviation for these samples was 0.00639. Using the average freezing point and standard deviation found in this survey, the calculated upper freezing point base becomes -0.530°H. The upper base calculated from the Henningson data is -0.525°H. For Minnesota milk supplies, therefore, the Henningson findings no longer appear appropriate. At the same time, application of a single universal freezing point base would appear to be unacceptable.

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Introduction

Freezing point of milk is used by the dairy industry and regulatory agencies to determine possible presence of added water. Standards used in this process include an average freezing point and a calculated upper base. Both standards are derived from data obtained by Henningson during 1968 and reported in 1969 (2). Both standards are yet published in Official Methods of Analysis of the Association of Official Analytical Chemists (1). As such, they remain in effect today as the officially recognized bases upon which legal action may be taken in cases of adulteration of milk with water.

Although data were presented in degrees centigrade, the Henningson study actually determined freezing point by the incorrect temperature standard applied by Hortvet in 1923. Because the Hortvet standard yet remains by far the predominant measure, the authors of the present study have chosen to report all data as degrees Hortvet (°H), including those taken from the Henningson study.

Henningson reported the average freezing point of pooled herd milk samples obtained in the United States (and for North America as a whole) as -0.5404°H. Samples obtained in the United States were found to have a standard deviation of 0.00676. Using 2.326 times this value above the average, the calculated upper base becomes -0.525°H. This value reflects 99% of the population of naturally occurring ("unwatered") pooled herd raw milk at 95% confidence. In other words, no natural milk supply would be expected to exceed -0.525 °H 95 times out of 100 in 99% of samples. This latter value, then, has been used by regulatory agencies to prosecute cases of gross adulteration of milk with water. This upper base is a less useful tool for industry application because it allows, for milk actually testing at the average (-0.5404°H), nearly 3.0% added water prior to taking action. Cost of this much water at milk prices and cost of transporting and processing this much water out of milk and dairy products would add greatly to the cost of operation. For this reason, the authors have recommended use of a "working" factor (3) for evaluation of raw milk supplies, one that reflects a single standard deviation above the average freezing point.

Considering efforts made by dairy farmers to breed for higher percentages of fat and, to an extent, solids-not-fat of

milk over the years from 1968 to present, there is good reason to believe that the Henningson data may now be out of date. Not only breeding practices but also improvement in mastitis control (with concomitant increase in lactose content) would be expected to alter freezing point. Both factors have been cited by the authors in a 10-year historical study of freezing point data obtained by Dairy Quality Control Institute, Inc. (4). Indeed, the stated study found evidence of a consistent trend to lower freezing points of raw milk over the years 1979-88. However, a larger study seemed in order, one that would reflect (1) possible regional differences (even individual plant supply differences) in freezing point, and (2) a broader base of milk supplies as that base might more precisely gauge the average freezing point, range in freezing point, seasonal variations and standard deviation of current milk supplies, at least within Minnesota.

It is also of interest to note that neither Minnesota nor Wisconsin milk was evaluated in the Henningson survey, even though these two states provide a large proportion of the total milk produced in the United States. And though there is no intent to infer that data from the present study reflect the national milk supply, they can be used to determine trends in at least one region of the nation and to provide further evidence for considering the application of a universal freezing point base. Perhaps even more importantly, the data can serve to indicate whether or not the Henningson data should yet be used as a basis for setting freezing point standards.

Materials and Methods

Four industrial laboratories agreed to provide the authors with freezing point data of raw milk supplies from five different supply areas. Supply sites were specifically chosen to reflect different regions within the state of Minnesota. All laboratories were using thermistor cryoscopes calibrated to the Hortvet standard. All data were reported to the authors in degrees Hortvet, and all data reported in this paper, including Henningson's, which were measured using the Hortvet standard and reported as centigrade, are cited as Hortvet readings.

Each laboratory analyzed producer milk supplies each month over one year, starting in May 1989 and running through April 1990. A total of over 1,100 analyses were made each month.

All data reflected on-going operations of the dairy plant. That is, no attempt was made to secure samples known not to contain added water. Because sample numbers were large, average values must be considered to reflect closely the freezing point of natural (unwatered) raw milk supplies. While added water can cause an increase in freezing point of milk, it cannot cause a decrease. Freezing point averages below those observed by Henningson would therefore have to be considered valid. In addition, to discount obvious vagaries in analytical data, freezing point values falling above -0.513°H (the highest value found by Henningson) and below -0.570°H were excluded from the statistical evaluation. The latter value falls outside the normal distribution of the data reported herein, and freezing point values below this limit can be considered to be outliers. Percentage of data excluded by the limits thus imposed was 0.16% for analyses falling above the upper limit and 0.11% for those falling below the lower limit.

Results and Discussion

Data in Table 1 provide average monthly freezing point values and standard deviations of raw milk supplies originating in five different locations in Minnesota. Significant regional differences exist, and within a fairly confined overall area. Interestingly enough, freezing point of milk seems to increase the more southerly the location of sampling within the state. To some extent this fact coincides with feeding conditions that tend toward lower roughage intake in the areas of highest freezing point.

Table 1. Monthly mean and grand mean freezing point values of regional supplies of Minnesota Raw milk over one year, May 1989-April 1990[1]

	Region					
Month	N. West	N.Cent.	Central	W. Cent.	S. East	Gr'd Mean
	(Freezing Point - Hortvet)					
May	-.545	-.545	-.547	-.546	-.541	-.5448
June	-.547	-.542	-.544	-.545	-.541	-.5438
July	-.546	-.545	-.540	-.546	-.540	-.5434
Aug	-.545	-.544	-.542	-.543	-.540	-.5428
Sept	-.549	-.549	-.545	-.547	-.542	-.5464
Oct	-.550	-.547	-.543	-.541	-.541	-.5444
Nov	-.549	-.547	-.545	-.540	-.543	-.5448
Dec	-.552	-.550	-.547	-.544	-.541	-.5468
Jan	-.549	-.547	-.548	-.543	-.540	-.5454
Feb	-.548	-.548	-.549	-.547	-.541	-.5466
Mar	-.549	-.550	-.547	-.545	-.540	-.5462
Apr	-.550	-.549	-.549	-.546	-.542	-.5472
Gr'd Avg	-.5483	-.5469	-.5455	-.5444	-.5410	-.5452
Std. Dev.	0.00700	0.00720	0.00563	0.00654	0.00559	0.00639

[1]The grand mean values reflect over 1,100 freezing point analyses each month divided by region.

The freezing point of Minnesota milk supplies varied from an average annual high of -0.5410°H in the southeastern area of the state to a low of -0.5483 °H in the northwest, a difference of 0.0073°H. These are not insignificant differences. Based on the Henningson data, for example, each 0.001°H increase in freezing point is equivalent to 0.185% added water for milk supplies carrying the average freezing point [i.e. (0.5404-0.5394) /0.5404 x 100 = 0.185%]. By this standard, therefore, a difference of 0.0073°H is equivalent to 1.35% added water (7.3 x 0.185 = 1.35).

Expressing these facts differently, consider the level of added water allowed in milk supplies of average freezing point using the Henningson (AOAC) upper freezing point base and each of the above two freezing point averages. With a freezing point of -0.5401°H (and -0.525°H upper base), 2.96% added water would be allowed prior to regulatory/industry action (0.5410 - 0.525/0.5410 x 100 = 2.96). A milk supply averaging -0.5483°H, on the other hand, would contain 4.25% added water prior to action being taken. These facts represent a sizable inequity in regulatory control. They also suggest a potential for very uneven control of added water in industry applications.

The grand average freezing point of these Minnesota milk supplies for the 12-month period is -0.5452°H. The grand average standard deviation is 0.00639. In the Henningson study, these two values were found to be, respectively, -0.5404 °H and 0.00676. Again, milk supplies represented by the present investigation were not necessarily free of added water; however, water can only raise the freezing point, not lower it. Hence, Minnesota milk supplies are no longer accurately represented by the Henningson data (and AOAC standards). It is also reasonable to assume that the national average freezing point of milk is lower now than at the time of the Henningson study. To the extent that the Henningson (AOAC) upper base is yet used, present milk supplies are allowed to contain that much more added water prior to action being taken.

Data in Table 1 also indicate seasonal differences in freezing point of milk, the highest grand average value, -0.5428°H, found in August and the lowest, -0.5472°H, in April, a difference of 0.0044°H. The difference is equivalent to 0.8% added water if the Henningson average freezing point is taken as the base. It is one of the reasons why, if unaccounted for, producer milk supplies appear to breach allowable levels of added water far more frequently in summer than winter months. Certainly this difference should be taken into consideration in industry premium payment programs using level of added water as one of the prerequisites in assessing price of milk. The authors are aware that some such programs demand "no added water" for eligibility for the highest premium paid to producers. The question then becomes what base is used to assess presence of added water. If an average value is taken, is this average the one observed by Henningson? If an "upper base" is used, is this base calculated from the Henningson data (the current standard) or is it established based on individual plant differences in freezing point of milk supplies?

Data in Table 2 show a breakdown of percentage of milk supplies in various freezing point ranges by region within Minnesota. Each region may in fact be considered to reflect an individual dairy plant supply of milk, hence differences on a plant-by-plant basis. The region/plant averaging the lowest freezing point (northwest) shows a somewhat lower percentage of samples at the highest freezing point range than the region/plant averaging the highest value (southeast). The major difference in these two areas lies in the much higher percentage of samples in the lowest freezing point range (-0.551°H and lower) in the supply area of lowest average freezing point, i.e. 39.6% vs 2.2%. As in the data shown in Table 1, data in Table 2 suggest very real differences in milk supplies, differences that would have to be taken into account to more precisely monitor level of added water in milk.

Table 3 provides data that compare the present study to the study done by Henningson (2). Percentage of milk samples in various freezing point ranges is shown. Please note that the Henningson study was undertaken in its entirety during the month of June. For this reason, data from that same month taken from the current study are provided for comparison purposes. In addition, the 12-month average percentages from this study are provided.

Table 2. Percentage of raw milk supplies freezing at various ranges in five regions within Minnesota, May 1989-April 1990.

	Freezing Point Range (-H)			
Region	0.530 and above	0.531 to 0.540	0.541 to 0.550	0.551 and below
	(percent)			
Northwest	1.2	9.6	49.7	39.6
North Central	2.1	13.1	55.5	29.3
Central	1.1	15.5	67.5	15.9
West Central	1.0	24.8	60.4	13.9
South East	2.2	42.6	53.0	2.2

Table 3. Percentage of Minnesota raw milk samples freezing at various ranges in this 1989090 survey compared to values reported for hte United States by Henningson for data obtainedin 1968.[1,2]

	Freezing Point Range (-H)			
	0.530 and above	0.531 to 0.540	0.541 to 0.550	0.551 and below
	(percent)			
United States (June 1968)[1]	5.5	45.8	44.8	3.9
Minnesota (June 1989)	1.8	23.5	64.8	9.9
Minnesota, 12-month average (May 1989-Apr 1990)	1.5	21.1	57.2	20.2

[1]Henningson, R. 1969. JAOAC 52:142-151.
[2]The Henningson data was obtained on samples known not to contain added water and on samples taken during June 1968. For comparison purposes, two percentages are given for the Minnesota Data, one an average of percentages obtained during June 1989 and also the 12-month average, May 1989-April 1990.

First, a considerably smaller percentage of Minnesota milk supplies is found in the highest freezing point range (-0.530°H and above) than was observed by Henningson, this though the Minnesota supplies were not necessarily free of added water. Either Minnesota supplies never averaged as high as those surveyed by Henningson or they have trended lower over the years since Henningson did his work. A previous study by the authors (4) suggests that the latter has indeed taken place. Because no Minnesota milk was evaluated by Henningson, the average freezing point of this milk for 1968 is not known. However, this is a moot issue in that present supplies are significantly different from what Henningson found, and data from his study would not appear to properly represent these supplies at the present time.

In addition, the Henningson survey involved only 620 analyses within the United States. Only 22 states were involved and three of those states were divided into two sections, with each section being surveyed independently. Sampling was also unevenly distributed among states, with as few as 10 samples derived from some and over 50 derived from others. Whether the sampling was truly representative, therefore, is open to question.

In all ranges, data in Table 3 reflect a shift to lower freezing point values than those found by Henningson. They also suggest a significant difference between values obtained in June as compared to those averaged over one year. Indeed, only 9.9% of Minnesota milk supplies averaged -0.551°H or lower during June of 1989. The overall annual average, however, placed 20.2% of Minnesota milk in this category. It seems plausible, therefore, to assume that the Henningson data, all derived during June, may not adequately reflect seasonal variations.

Table 4 provides a side-by-side comparison of data from this vs the Henningson study. It characterizes the nature of the data in the two studies. It is also presented to provide a better assessment of the appropriateness of (1) the use of a single, "universal" freezing point average for national milk supplies and (2) the continued use of the Henningson data as a basis for standards applied in determination of level of added water in milk.

Table 4. Summary of findings of Henningson vs Minnesota Study of Freezing point of raw milk supplies.

Item:	Henningson Study	Present Study
Date of study	June 1968	May '89-Apr '90
Duration of sampling	One month	12 months
Region	United States (22 states, not including MN, WI)	Minnesota
Number of samples	690	13,876
Kind of samples	"Authentic," either a.m. or p.m. milking, average herd size of 72.4 cows, single- and-mixed breed herds	Regular farm supplies from routine testing
Freezing point range	-0.513 to -0.560°H	----------
Mean freezing point	-0.5404°H	-0.5452°H
Regional differences:		
United States		
High = Florida	-0.5356°H	
Low = Mass.	-0.5455°H	
Minnesota		
High = S.E.		-0.541°H
Low = N.W.		-0.548°H
Seasonal variation	----------	0.0044°H
Standard deviation	0.00676	0.00639
Calc. upper base 99% of samples, 95% confidence	-0.525°H (using -0.5404 as avg.)	-0.530°H (using -0.5452 as avg.)
% of samples at -0.530°H and above	5.5	1.5
% of samples at -0.551°H and lower	3.9	20.2

Recommendations

Based upon these and findings of a previous study (4), the authors would like to suggest the following recommendations:

First, and to the extent that it is desirable to tighten control over water added to milk, adoption of a single universal freezing point average (base) for the United States appears to be inappropriate, particularly so if based upon the Henningson data, now dated by over twenty years. At the same time, it should not be assumed that AOAC standards, based upon the Henningson data, are valid for present milk supplies. Certainly it seems advisable for individual states to verify the appropriateness of these standards in terms of future applications. If, in fact, as this study suggests, the average freezing point of milk has decreased, use of the AOAC upper base represents an unwarranted leniency in assessing need for action in cases of gross adulteration.

Because a number of states were excluded from the Henningson study and because sample numbers were small, state regulatory agencies should consider doing an annual survey of a representative sampling of "unwatered" milk supplies. Although this would require milking-time visits to oversee milking conditions, sample numbers would not have to be great. In addition, the effort would best be served if spread out over the year, with a small number of samples taken on a monthly basis in order to account for seasonal variations, and with action possibly based upon a month-by-month average freezing point thus obtained. Perhaps the least that should be considered is a one-time sampling done during a month that falls between those in which the highest and lowest freezing points might be expected. For the data reported herein, those months fall between August and April. Freezing point values from both November and January fall close to the annual average.

Data from this study also suggest that dairy plants would be well served by assessing the average freezing point and calculating some "actionable" value on a plant-by-plant basis. Monthly averages could be determined during routine sampling and testing and without regard to presence or lack of added water. Data that fall outside some preset limits could be calculated by the plant. For Minnesota processors, based upon this study, extreme values would appear to be those falling above -0.513 or below -0.570°H. A close look at data taken from the recent past would readily indicate what limits might be most appropriate.

Using on-going freezing point analytical data, plants could set standards on a month-by-month basis to avoid seasonal variations. The standard could be set at a level that would exclude 99% of natural variations in freezing point or at some lower level. These values are derived from two readily obtainable statistics, the average freezing point and the standard deviation. The upper base that excludes 99% of "natural" milk supplies at 95% confidence is calculated as follows:

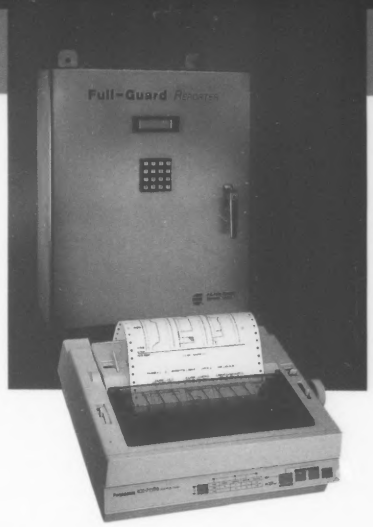
$$\text{Upper base} = \text{average freezing point} + (2.326 \times \text{standard deviation})$$

Using data from this study as an example, the upper base of Minnesota milk supplies would be:

$$\begin{aligned}\text{Upper base} &= -0.5452 + (2.326 \times 0.00639) \\ &= -0.5452 + (0.01486) \\ &= -0.530°\text{H}\end{aligned}$$

Cost of added water at the price of milk, the high cost of transportation and the high cost of processing water out of milk are important incentives for closely monitoring milk supplies

Con't. on p. 606



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Dairy, Food and Environmental Sanitation, Vol. 10, No. 10, Pages 602-606

Tracking Down "Typhoid Mary"

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Introduction

George Albert Soper (1872-1948), son of George A. and Georgianna Lydia (Bucknam), was born on February 3, 1870, and died June 17, 1948. He received a B.S. degree from Renssalear Polytechnic Institute in 1895 and A.M. and Ph.D. degrees from Columbia in 1898 and 1899 respectively. In 1902 he began work for the New York City Department of Health as a Sanitary Engineer and soon established a reputation as an expert in typhoid fever control. He was called upon by the New York State Department of Health to investigate and help control outbreaks of typhoid fever throughout the state (1). In 1903 he helped suppress an outbreak in Ithaca, NY, which involved 1,300 cases, and a few years later he helped control an outbreak in Watertown, NY, which involved 600 cases (11).

In the winter of 1906-07, he investigated an outbreak of typhoid fever which lead him to the discovery of "Typhoid Mary." He discussed the circumstances surrounding her curious case in three articles which were published in 1907 (10), 1919 (11), and 1939 (12).

Oyster Bay, NY Outbreak

During the winter of 1906-07, Dr. Soper was asked by Mr. George Thompson of New York City, to investigate an outbreak of typhoid fever that occurred the previous summer in a country house that he owned in Oyster Bay, NY. The house had been rented by a New York banker and his family for the summer season. The renter was not identified by name in Dr. Soper's initial publication but was identified as Mr. Charles Henry Warren in the second paper and as General William Henry Warren in the third.

The Warren household consisted of 11 people, four family members and seven servants. Six individuals became ill with typhoid between August 27 and September 3, 1906. The outbreak had been investigated after it occurred by health officials who concluded that the water supply to the house was probably the source of introducing the contagium into the household (10).

A 167 foot driven well 210 feet away from the house supplied the water. Water samples were collected during the month of September and were subjected to bacteriological and chemical analyses. In addition fluorescein percolation tests were carried out. All of these tests indicated that the water was not polluted. However, it was still felt that the water could have been contaminated, perhaps intermittently, and thereby the source of infection (10).

Mr. Thompson felt that if the circumstances surrounding the outbreak could not be more specifically defined, he might have trouble subsequently renting out the house (11).

Dr. Soper did not accept the contaminated water theory. He felt that it was more likely that some person or item of food introduced the disease into the household. He found that the family liked to eat soft clams which were usually purchased from an Indian woman who lived on the beach near the house. If the clams were the vehicle, more cases should have developed in the area since others purchased them from this source. There were no other cases in the area at the time of the Warren outbreak. In addition he found that the family had last eaten clams from this source on July 15, 1906, and the cases occurred between August 27 and September 3, 1906, which was too long an incubation period for them to have been the source of infection (10).

He then focused his attention on the history of events that occurred within the Warren household prior to the outbreak. He found that no person that became ill was away from Oyster Bay for several weeks prior to becoming ill which excluded the possibility of their contracting the illness outside of the area. He learned that on August 6, 1906, a new cook named Mary Mallon had been hired by the family. He did not learn much about her background except that she was an Irish woman, appeared to be in good health, and had been hired through a New York City employment agency that specialized in domestic help. She did not remain in the employ of the family very long in that she left three weeks after the disease broke out (10,11).

Dr. Soper did not reveal her name in the first article that he wrote in 1907 but did name her in his second article in 1919. By this time her identity was well known since she had been named several years earlier in newspaper articles which were written about her case. It is interesting that he waited until his third article, which was written in 1939, to put in writing what he felt the vehicle of infection was in this outbreak when he wrote:

It was at first not clear how the family could have been infected from the cook, granting that she was a carrier, for where there are so many servants, there is little food that a cook handles which is not subsequently raised to a temperature sufficient to make it harmless. I found, however, that on a certain Sunday there was a dessert which Mary prepared and of which everybody present was extremely fond. This was ice cream with fresh peaches cut up and frozen in it. I suppose no

better way could be found to cleanse her hand of microbes and infect a family (12).

Dr. Soper's Hunt to Locate Mary Mallon

Since Mary was no longer in the employ of the family, he felt that it was essential to locate her and question her about her typhoid fever history and her work record to determine if other cases of typhoid were associated with her past employment. He set out on what turned out to be a four month long trek before he finally located her. He interviewed past employers and co-workers as well as proprietors of private employment agencies through which she obtained some of her positions (11). He could not completely trace her work record because some of her positions were obtained through newspaper ads (12). Her employment history as uncovered by him follows:

Mamaroneck, NY (1897-1900). The earliest record of her employment found by Dr. Soper was with a family who had a summer residence in Mamaroneck, NY. A young man who was a guest of the family became ill on September 4, 1900. Before visiting them, he spent two weeks in East Hampton, NY. It was felt that he contracted the disease in East Hampton since Montauk Army Camp in that area had experienced a typhoid outbreak at that time. Mary had been with the family for three years without any typhoid having occurred but left within a few days after the onset of this case (10,12).

New York City, NY (1901-1902). Next, Dr. Soper found that during 1901 and 1902 Mary worked for a family in New York City for 11 months. One month after she began employment there, the laundress developed typhoid and was hospitalized on December 9, 1901. This case had not been epidemiologically investigated at the time it occurred (10).

Dark Harbor, Maine (1902). Chronologically, her employment was next traced to the household of a New York City attorney named Coleman Drayton who had rented a summer home in Dark Harbor, Maine, for the summer of 1902 (11). The household consisted of four family members and five servants. Mary joined the household in New York City three weeks before they left for Maine. The first case occurred on June 17, 1902, two weeks after they arrived in Maine. The remaining cases followed rapidly thereafter. Only two escaped infection. Those were Mr. Drayton, who had typhoid several years earlier, and Mary, the cook. Mr. Drayton was so pleased with Mary's help during the episode that he rewarded her with a $50 bonus when the outbreak was over (10).

Upon investigation by health authorities, it was felt that the infection was probably introduced into the household by the first three cases that occurred. It was felt that they contracted the contagium either in New York City prior to departure or else somewhere en route to Maine since there were no other cases in Dark Harbor at that time. The house that the Draytons occupied in Dark Harbor was newly constructed and had not been lived in previously. From the time this incident occurred in 1902 until Dr. Soper wrote his first article in 1907, the house remained unrented (10).

Sands Point, Long Island, NY (1904). Her employment was next traced to the household of Henry Gilsey, Esq. who spent the summer of 1904 in a vacation home in Sands Point, Long Island. They arrived there on June 1, 1904, and a case of typhoid occurred in the household seven days later. Within three weeks, four cases of typhoid occurred. The household consisted of four family members and seven servants. The outbreak was restricted to the servants in that no family members became ill. The servants were quartered in a house separate from the family. The cook, Mary, had been in the employ of the family for nine months before the first case occurred. The outbreak was restricted to the Gilsey household. No other cases occurred in the Sands Point community at that time (10).

The health authorities that investigated the outbreak felt that the infection was probably introduced into the household by the laundress who became ill with typhoid ten days after she began work in the Gilsey household (12). It was felt that she probably became infected in her last place of employment (10).

Oyster Bay, NY (1906). Chronologically, her employment with the Warren family in Oyster Bay, NY, in 1906 was next in line. This outbreak was discussed earlier in this article. She left this position in September, 1906.

Tuxedo, NY (1906). After she left the Warren household, Mary accepted a position with a family in Tuxedo, NY, where she worked approximately one month. Fourteen days after she began work for this family, the laundress developed typhoid fever. The physician that attended the case told Dr. Soper that this was the first case of typhoid that occurred there in several years. The source of the laundress' infection had not been established (10).

New York City, NY (1907). Four months after Mr. Thompson engaged Dr. Soper to investigate the Oyster Bay outbreak he finally located Mary working for a family that lived in New York City on Park Avenue near Sixtieth Street (12). Two cases of typhoid occurred in this household two months after Mary began working for them. The first case was a chambermaid who became ill on January 23, 1907, and the second was a young girl in the family who became ill on February 8 and died 15 days later. These two cases were investigated by the New York City Department of Health who ascribed the episode to the public water supply (10).

Dr. Soper Interviews Mary

To this point in time Dr. Soper had uncovered several cases of typhoid and one death in households where Mary had worked (10). They all occurred in single household episodes in communities which were not experiencing community-wide outbreaks. And now he finally had a chance to interview her in person and question her about her work background and her personal typhoid history.

He tried on two separate occasions to interview her and convince her to submit blood, urine and fecal specimens for examination for the typhoid organism. His first meeting with her was in the kitchen of the residence where she worked. She became so upset when he suggested that she was responsible for making people ill that she seized a carving fork and came in his direction at which time he made a hasty exit (12). It is interesting that although he discussed the kitchen interview in his first two articles, he did not write about the carving fork aspect until his third article which was published 32 years after the incident occurred.

His second meeting with Mary was arranged by a male friend of hers who lived in a rooming house on Third Avenue. This man's days were usually spent in a local saloon, and Mary often visited him in the evening. Dr. Soper befriended him in an attempt to once again make contact with Mary. Once this was accomplished he arranged for Dr. Soper and a former assistant of his named Dr. B. Raymond Hoobler to be at his place one night when Mary arrived. When she got there, both men tried to convince her that they meant no harm, that they only wanted to learn about her typhoid history, get her to agree to submit specimens for typhoid examination, and to try to help control the situation if in fact she was shedding the organism (11,12).

She was upset at their being there. She told them that she never had typhoid and resented being accused of spreading it. She added that she worked hard in caring for the many victims of the disease in households where she worked. She reminded them that she was rewarded by Mr. Drayton with a $50 bonus for her work in caring for the ill in his household in Dark Harbor. They left when it became clear that she was not about to cooperate (11,12).

Mary is Taken into Custody

Dr. Soper learned that Mary was about to leave her Park Avenue position. If in fact she did, he probably would have had a difficult time in trying to locate her once more. Faced with this possibility and feeling that she was a menace to the health of the public, on March 11, 1907, he recommended to Dr. Herman M. Briggs, Medical Officer, New York City Department of Health, that she be taken into custody by the Health Department and examined to determine her role as a typhoid carrier (10,11).

In an attempt to obtain specimens from her in a more peaceful manner, Dr. S. Josephine Baker, an inspector from the New York City Department of Health, was dispatched to the Park Avenue residence. However, she was no more successful than Dr. Soper in that Mary slammed the door closed in her face when she realized the purpose of Dr. Baker's visit (12).

Dr. Baker was sent back the following day, March 19, 1907, in an ambulance along with two policemen. They were instructed to obtain specimens from Mary in a voluntary manner, and if this was not possible to bring her into the Department of Health by force (12). Mary answered the door and when she saw Dr. Baker, she attempted to close the door but was prevented by the foot of one of the policemen. Mary quickly disappeared into the house. Her co-workers were of no assistance in helping locate her. After a three hour search of the house and neighborhood she was finally found hiding in an outside closet in the rear of the house next door (12).

Regarding the incident, Dr. Soper quoted Dr. Baker as follows:

She fought and struggled and cursed. I tried to explain to her that I only wanted the specimens and then she could go back home. She again refused and I told the policemen to pick her up and put her in the ambulance. This we did and the ride down to the hospital was quite a wild one (12).

Involuntary Confinement

Mary's involuntary confinement lasted for two years and eleven months. She was initially held in a hospital for contagious diseases at the foot of Sixteenth Street. A few weeks after her arrival at this hospital Dr. Soper had his third and final interview with Mary. By this time bacteriological examinations of her stool samples indicated that she was indeed shedding the typhoid organism (12).

She sat in silence as Dr. Soper explained what this meant and also how important it was for her to wash her hands especially after she went to the bathroom and before she prepared food. He also recommended that she have her gall bladder removed since that was where the organisms were probably established. He pleaded with her for information about how many cases she had seen. He promised that if she cooperated with him he would do everything possible to obtain her release. He also promised that with her help he would write a book about her case keeping her identity hidden; also he would see to it that she would receive all of the profits from the book - if she would only supply him with the information he sought (12). Throughout his entire discourse, she remained silent. Finally, she rose and without saying a word, went into the bathroom and slammed the door closed. With that Dr. Soper left (12).

Mary was transferred to Riverside Hospital on North Brother Island located in the East River. Here she was given comfortable living quarters which consisted of a little bungalow that was built for the director of nurses and was located on the river's bank next to a church (12).

Legal Action

During the month of July, 1909, Mary sued the City of New York in an attempt to regain her freedom. She was represented by attorney George Francis O'Neil who was a medico-legal specialist. In court she and her attorney argued that she never had typhoid fever and therefore could not transmit the disease. They indicated that she was being mistreated in that she was forced to live alone. They also argued that she was being treated like an outcast in that her food was brought to her three times a day and left at her door, and the person who brought it would then hurry away (4).

Her case was heard in the New York Supreme Court. Justice Mitchell Louis Erlanger, who served on the New York Supreme Court from 1907 to 1927 (13), felt that her release would pose a definite threat to the community and in handing down his decision stated:

While the court deeply sympathizes with this unfortunate woman, it must protect the community against a recurrence of spreading the disease. Every opportunity should, however, be afforded her to establish if she can, that she is fully cured, and she may, after further examination, renew the application, or, if she prefers the matter may be sent to a referee (2).

Release

Finally in late February, 1910, Dr. Ernest Lederle, who was then the New York City Commissioner of Health, released

her from detention. Regarding her release he stated:

She has been released because she has been shut up long enough to learn the precautions to take. As long as she observes them I have little fear that she will be a danger to her neighbors. The chief points that she must observe are personal cleanliness and the keeping away from the preparation of other persons' food. She has promised to report to me regularly and not to take another position as a cook. I am going to do all I can to help her (3).

In further discussing her release he expressed the opinion that there were probably other carriers about who posed as much, if not more, of a threat to their neighbors than Mary, therefore he felt that she should not be singled out for quarantine (3). Consequently, in late February, 1910, Mary regained her freedom promising to return to the Department of Health every three months for a check up (12).

Threat of Another Law Suit and Disappearance

Thirteen months after her release, an article appeared in a newspaper which reported that Mary was about to sue the New York City Health Department for $50,000 for illegally detaining her for approximately three years. In addition she claimed that since she was prevented from pursuing her career as a cook, her chances of making a living had been greatly reduced (4). However, this law suit was not followed through (5).

A job as a laundress was obtained for her which she did not keep very long. In violation of the terms of her release, Mary disappeared (7). During this period of liberty, she worked in New York City and vicinity as a cook using the assumed name of Marie Breshof or Mrs. Brown in restaurants, hotels, and sanatoria (12). The number of cases of typhoid fever associated with her during this period of time will never be known.

Mary Resurfaces

Her whereabouts did not come to light again until March, 1915. The circumstances surrounding her rediscovery centered on an outbreak of typhoid fever which occurred in Sloane Hospital for Women which was located at Fiftyninth Street and Amsterdam in New York City. Mary worked there as a cook when the outbreak occurred. However, her true identity was not know since she used an assumed name (5,12).

Dr. Edward B. Cragin of Sloane Hospital called upon Dr. Soper to help determine the source of the outbreak. The situation involved approximately 25 cases out of 281 patients and hospital staff. Only one patient developed typhoid fever. The rest of the cases were among the hospital staff (5).

The cook was not at the hospital when Dr. Soper arrived. However, he readily identified her as Mary Mallon from a sample of her handwriting and from her physical description as given by Dr. Cragin (12). Not knowing her true identity, some of her hospital co-workers jokingly referred to her as "Typhoid Mary," a name which had been applied to Mary Mallon in newspaper articles on several occasions in the past (12).

She was traced through friends to a house in Corona, NY, where she was apprehended by police and Health Department personnel. They were not willingly admitted into the house but did gain entrance through an upper floor window by using a ladder. Mary readily surrendered and admitted her true identity (5).

Reconfinement

Mary was sent back to North Brother Island where she spent the next 23 years (12). The New York City Board of Health approved her indefinite detention until such time that she no longer represented a menace to the public (6). She was given a job in the hospital laboratory where she was trained to perform simple tests. She was paid for her work. She had a comfortable place to live and was allowed occasionally to leave the island to visit the city. She always returned and never tried to escape (12).

Final Days

On December 25, 1932, she suffered a stroke which paralyzed her. She never walked again and spent the next six years being cared for in the hospital. She died at the age of 70 on November 11, 1938 (1,12).

Funeral services were held on November 12, 1938, in St. Luke's Roman Catholic Church, 623 East 138th Street. The priests from St. Luke's often visited her during her confinement looking out after her spiritual and religious needs (8). A requiem mass was offered for the repose of her soul by the Right Reverend Vincent McCambley. She was buried in St. Raymond's Cemetery in the Bronx. Her funeral was attended by nine individuals - three women, three men and three children, none of whom would identify themselves when questioned by newspaper reporters (9).

Dr. Soper observed, "Of all those city employees who had known Mary Mallon and had seen her come and go so many years, there was not one who followed her to her grave" (12).

Final Accounting

Several attempts were made to cure her, but they all failed. She refused to have her gall bladder removed which might have cured her. Bacteriological examinations of her stools were discussed in Dr. Soper's first two articles. Results indicated that she shed the agent in fewer numbers to none at all in the summer months, only to have it reappear in greater numbers in the fall and winter months. No autopsy was performed. Fifty three cases, including three deaths, were traced directly to her (10 -12).

A Historical Perspective on Carriers

Dr. Soper's work on tracking down Mary Mallon firmly established and dramatically emphasized the role of healthy carriers of typhoid in the United States. Investigations on carriers of typhoid were previously published in Europe. Horton-Smith was first to suggest the role of human typhoid carriers in England in 1900. The following year, Robert Koch in Germany stressed the role of patients and convalescents in disseminating typhoid. In 1903, also in Germany, Frosch speculated that typhoid organisms could establish a saprophitic existence in man. This hypothesis was proven by Drigalski, also in Germany, in 1904 (1).

These findings laid the foundation for further work on typhoid carriers, though Dr. Soper was not fully aware of most of them until he completed his work on her (12).

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Packard and Ginn, *con't. from p. 600*

for added water. In addition, federal drinking water standards now allow presence at some "tolerance" level of a number of pesticides, industrial pollutants and other chemicals, some of which may enter milk whenever water is added. Minimizing presence of these compounds adds also to the importance of avoiding or minimizing contamination of milk with water.

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Survey of Bottled Waters Sold in Connecticut

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Abstract

Bottled waters sold in Connecticut were surveyed for organic contamination. Volatile organics were analyzed by purge and trap with a flame ionization detector while pesticides were analyzed by solid phase extraction followed by gas chromatography with electron capture detection. With the exception of recalled bottles of Perrier Sparkling Water, no contamination was found above EPA maximum allowable contaminant levels for drinking water.

Introduction

People are becoming more concerned with the quality of the food they eat and the water they drink. One example of this awareness is seen in the growth of the bottled water industry; the per capita consumption in the United States increased by an average of 13.6% per year during the 1980's (1). Thus, the recent recall of millions of bottles of Perrier Sparkling Water by the Food & Drug Administration because of contamination with benzene (2) raises additional concern about the quality of the bottled waters sold to consumers. To answer these concerns about bottled water quality we have conducted a screening study of the bottled waters sold in the State of Connecticut for contamination with organic compounds.

Methods

Bottled waters were collected at food stores from February through May 1990, by inspectors of the Food Division of the Connecticut Department of Consumer Protection. Bottle sizes ranged from 6 1/2 oz to one gallon, in both glass and plastic containers. Bottles remained sealed until they were opened for analysis of volatile organic compounds (VOC). The remaining water in the bottles was used for pesticide analyses. Analyses for VOC were performed by purge and trap gas chromatography with flame ionization detection (FID) (3,4). Pesticides were analyzed by solid phase extraction (SPE) followed by GC with an electron capture detector (ECD) (5).

The VOC analyses were performed as follows: A 5 mL aliquot was withdrawn from a freshly opened bottle with a disposable glass pipet. The aliquot was transferred to a clean purge and trap sampling test tube, which was screwed into a Hewlett-Packard 7675A purge and trap sampler interfaced to an HP 5840A GC with a flame ionization detector. The sample was purged with He for 11 min at 40 mL/min and desorbed from the trap at 250°C for 4 min. The GC was operated with a 30 m x 0.32 mm Supelcowax-10 id column. The initial GC temperature was 40°C and, after 5 min, the GC was ramped at 10°C/min to 140°C. The FID was operated with a make up gas of 5% methane in argon. Peak areas were quantitated using a 5840A GC terminal.

Stock standard solutions of VOC were prepared by dissolving 0.5 mL of each standard compound in 200 mL of methanol. Working standards were prepared daily by serial dilution of the stock standard in distilled water. The primary working standard used was a solution of 20 ppb each benzene and toluene. Other VOC compounds tested with the method were: 1,1-dichloroethane, trichloroethylene, tetrachloroethylene, 1,1,2-trichloroethane, and 1,4-dichlorobutane. The detection limit for this method with our equipment is approximately 2 ppb. This is the same as the listed practical quantitation limit for this method in ground water (4).

The bottled water samples were tested for pesticides using the J. T. Baker SPE-500 method (5). Briefly, 200 mL of water was forced via a vacuum column processor through the SPE cartridge. After the sample had completely passed through the cartridge, the elution of pesticide compounds was accomplished with 2.0 mL of hexane. Analysis of the extract was performed with a Hewlett-Packard 5890A GC with electron capture detection. Specific conditions were: column DB-608, 30m x 0.53mm, initial temp. of 175°C, ramp 2°C/min, final temp. of 250°C. Carrier gas He at 4mL/min, make up 5% methane in argon at 20 mL/min. Peak areas were collected and integrated on a Hewlett-Packard 3356 integrator.

Results and Discussion

A typical calibration plot for benzene and toluene is shown in Figure 1. There is good linearity and sufficient sensitivity for a detection limit of 2 ppb. The average relative standard deviation (RSD) of area counts for a series of three aliquots of the same sample is 13%. This is within the 20% limit given by the EPA test method (4). Quantitation was based on an external standard since the exact purge flow rate had some small daily variations. A single working standard was prepared, analyzed and used for response factors whenever samples were tested.

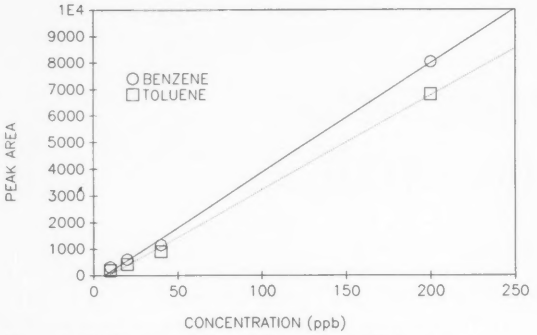

Figure 1. *Calibration Curves for Benzene and Toluene.*

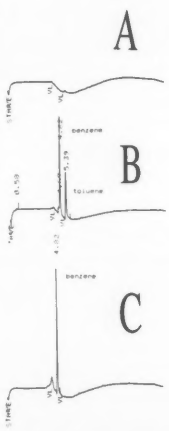

Figure 2. *Chromatograms of: A. Distilled water blank. B. 20 ppb benzene (RT=4.82) and 20 ppb toluene (RT=5.39) standards. C. Perrier Sparkling Water, Lot DU92N (25 ppb benzene).*

Figure 2 shows typical chromatograms for a distilled water blank, a 20 ppb toluene and 20 ppb benzene standard, and a sample of Perrier Sparkling Water from the contaminated lots. There is good peak shape and an exact retention time match for the benzene in the Perrier Water sample with the standard. This particular sample was found to have 25 ppb of benzene. The average benzene concentration found in the four contaminated bottles tested (representing two recalled lots) was 27 ppb.

The bottled waters which were sampled are listed in Table 1. No detectable levels of pesticides were found in any sample. VOC were found in a total of seven samples. Three of these (sample #'s 3, 33 and 38) were of flavored waters. These samples underwent a gas chromatography/mass spectrometry analysis of a methylene chloride liquid-liquid extract. The largest chromatographic peaks were identified as limonene, terpineol, citronellal, and citral (identification based on mass spectral library search); all of which are listed as flavor aromatic chemicals in the Food Chemicals Index (6). Thus, the VOC detected by the purge and trap method can be explained as flavor components. The other four samples with detectable VOC came from the contaminated lots of Perrier Sparkling Water. Samples of Perrier Sparkling Water taken after its reintroduction to the market had no detectable VOC.

Table 1. Bottled water samples tested.

Brand	Origin	Date Collected
1. Hepburn Spa	Australia	4/2/90
2. SPA	Belgium	4/12/90
3. Clearly Canadian*	Canada	5/18/90
4. Naya	Canada	3/28/90
5. North Country	Canada	4/12/90
6. Ramlosa	Canada	4/12/90
7. Roman Springs	Canada	4/12/90
8. Saint Justin	Canada	4/12/90
9. Sparcal	Canada, Nova Scotia	4/12/90
10. Alet	France	4/12/90
11. Cristallene	France	4/2/90
12. Evian	France	3/28/90
13. Martinique	France	3/27/90
14. Perrier#	France	2/9/90
15. Perrier#	France	2/9/90
16. Perrier#	France	2/9/90
17. Perrier#	France	2/9/90
18. Perrier	France	4/19/90
19. Perrier	France	4/19/90
20. Perrier	France	4/19/90
21. Perrier	France	4/19/90
22. Perrier	France	4/19/90
23. Perrier	France	4/19/90
24. Volvic	France	4/12/90
25. Appollinaris	Germany	3/28/90
26. Gerolsteiner Sprudel	Germany	4/26/90
27. Eden	Israel	4/18/90
28. Fonteviva	Italy	4/12/90
29. San Pellegrino	Italy	3/28/90
30. Fonte Santa Rita	Spain	4/18/90
31. Minalba	Spain	3/13/90
32. Pedras Delagas	Spain	3/13/90
33. Henniez*	Switzerland	3/13/90
34. Poland Springs	USA, Maine	4/2/90
35. Aqua Cool	USA, Massachusetts	3/28/90
36. Paradise	USA, Massachusetts	3/26/90
37. ShopRite	USA, Pennsylvania	3/22/90
38. Quibell*	USA, Virginia	3/13/90

* Flavored water
\# From recalled lots

The results from the contaminated bottles of Perrier Water show that the method had a sufficient sensitivity to detect ppb levels of VOC. While the RSD for a given sample was larger than desired, though still within EPA limits (4), the ease of analysis (no sample preparation required) and the need for a rapid sample turnaround made this the method of choice for a screening study. Flavored waters provide interferences in the FID purge and trap analysis requiring the use of alternate methods.

The results from this study were compared to previous surveys by the New York State Department of Health (7) and the Massachusetts Department of Public Health (8). The New York State study did find some VOC in approximately half of their samples while the Massachusetts study had detectable VOC in one fourth of the samples. However, the majority of the detectable VOC in both these studies were for values at or near the detection limit of 1 ppb.

There might be two causes for the lack of any detectable VOC in the current study. The most likely cause is that, in the current study a detection limit of 2 ppb was used as compared to the 1 ppb limit of the other studies. It is also possible that the bottled water industry has improved its quality control techniques in the several years since the New York and Massachusetts studies were completed.

The current study provides assurance that the bottled waters sold in Connecticut are satisfactory. The maximum EPA contaminant levels (MCL) for VOC in drinking water are 5 ppb or larger (except for vinyl chloride at 2 ppb) (9). This study's detection limit was 2 ppb. Thus, contaminant concentrations above these MCL would have been detected.

The results of this study indicate that the bottled drinking water sold in the State of Connecticut does not contain organic chemical contamination above allowable EPA levels. These results are, however, specifically tied to the actual sample lots studied. As demonstrated by the case with Perrier Sparkling Water, bottled water quality can change. Thus, continued random sampling of bottled waters for organic chemicals should be continued.

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News

New Catalogue of Animal Viruses & Antisera, Chlamydiae & Rickettsiae

The American Type Culture Collection (ATCC) has published a new catalogue, "Animal Viruses & Antisera, Chlamydiae & Rickettsiae, 6th edition, 1990." This 216 page reference catalogue lists over 2,000 strains and antisera.

The catalogue provides strain descriptions which include source of isolation, references, host range and host of choice, a virus clone index, and a Mab index of hybridomas producing antiviral antibodies. Also included are descriptions of virus preparations and conditions for propagation.

This publication is available free-of-charge in the USA, $5 in Canada and Mexico, and $9 elsewhere.

Copies can be obtained from: ATCC Marketing, 12301 Parklawn Drive, Rockville, MD 20852, USA (301)881-2600; FAX (301)231-5826.

Dairy Remembrance Fund Officers, Directors Elected

James Click, Maryland-Virginia Milk Producers Association, was re-elected President of the Dairy Remembrance Fund at the DRF Annual Meeting in June.

Also re-elected were: Dr. D.V. Josephson, Delegate-At-Large, Vice President, and John M. Martin, Dairy and Food Industries Supply Association, Executive Director.

Elected to fill new vacancies were: Dr. Mark Keeney, Delegate-At-Large, Vice President, George Weigold, Dairy Society International, Secretary, and Bob Kies, Delegate-At-Large, Treasurer. Weigold is replacing the late William Dean who had served as Secretary for the last decade.

The Dairy Remembrance Fund was established to provide low interest loans to students but with the addition of the recently announced $200,000 M.E. Franks Trust Fund for scholarships, the DRF Council of Delegates voted to change the name of DRF to Dairy Recognition and Education Foundation. Amendments to the DRF Bylaws will be prepared for distribution to all organizations which support DRF for action.

Following are the members of the Board of Directors for the Dairy Remembrance Fund:

Serving until 1991
John J. Beatty III
John Broussard
Warren S. Clark
Floyd Gaibler
Barney Meredith
Austin Rhoads

Serving until 1992
James E. Click
Carl J. Huber
Philip Keeney
D.V. Josephson
Jerry Kozak
George W. Weigold

Serving until 1993
Wayne Allen
Tom Balmer
W.F. Darnell
Herb Forest
Peter Holm
Mark Keeney
John M. Martin

The Dairy Remembrance Fund, the national organization which operates solely on voluntary contributions, was founded as a means of strengthening the dairy industry, primarily through loans to worthy students in dairy or food science. Voluntary personal or company contributions entirely support the non-profit DRF. For further information, please contact: The Dairy Remembrance Fund, 6245 Executive Boulevard, Rockville, MD 20852-3938, (301)984-1444.

Cyanamid Signs Agreements with Imcera's Pitman-Moore Animal Health Unit

American Cyanamid Company announced today that it had signed agreements with Imcera Group, Inc.'s Pitman-Moore animal health unit. Under one agreement, Cyanamid will receive exclusive rights to market BACIFERM[1] brand zinc bacitracin in the U.S. BACIFERM will continue to be manufactured by Pitman-Moore. Under a separate agreement, Pitman-Moore will acquire Cyanamid's TRAMISOL* brand levamisole anthelmintic business. TRAMISOL will continue to be manufactured by Cyanamid.

Officials of the companies said these agreements would allow each company to concentrate on segments of animal agriculture in which they have existing strengths, enabling Cyanamid and Pitman-Moore to provide improved product lines and services to their customers.

Levamisol, sold under the trademarks TRAMISOL by Cyanamid, and LEVASOLE[1] and TOTALON[1] by Pitman-Moore, is one of the broadest spectrum anthelmintics on the market. It has uses in swine, cattle and sheep.

Zinc bacitracin, sold under the trademark BACIFERM by Pitman-Moore, is used in poultry and swine production to enhance growth and feed conversion. Worldwide, it is one of the most popular growth promotants in use today.

"We intend to be a major supplier of productivity enhancers to the feed manufacturing and poultry industries," said Kenneth L. Schuttler, General Manager of Cyanamid's Animal Nutrition and Health Department. "BACIFERM zinc bacitracin fits our strategic business direction. In turn, Cyanamid's successful TRAMISOL line, which now will be marketed by Pitman-Moore, fits their current market and distribution strengths. We believe this exchange will allow both companies to concentrate their efforts in an increasingly competitive and consolidating animal health market."

Financial terms of the agreement were not disclosed.

Cyanamid is a research-based biotechnology and chemical company which develops medical, agricultural and chemical products and manufactures and markets them throughout the world.

For more information contact: Nicholas B. Kalm, Cyanamid at (201)831-3877 or Fred Stresen-Reuter, Pitman-Moore at (708)949-3446.

AFFI Challenges USDA's Reproposal for Uncured Meat Patties

A reproposal to further regulate the heat processing procedures, cooking instructions, and cooling, handling and storage requirements for uncured meat patties is overly prescriptive and would allow manufacturers minimum innovation, according to the American Frozen Food Institute (AFFI).

AFFI recently expressed its concerns with the reproposed rule in comments to the United States Department of Agriculture's (USDA) Food Safety & Inspection Service (FSIS). "The reproposal contains several serious problems which would result in a less than optimal regulatory approach in this area," stated AFFI President Steven C. Anderson in the comments.

While supporting the HACCP principles to ensure food safety, AFFI feels that the reproposal undermines the HACCP approach by designating all points of manufacture and processing as Critical Control Points (CCP) and not making use of Control Point (CP) designations.

AFFI noted that a CCP is defined as "any point or procedure in a specific food system where loss of control may result in an unacceptable health risk." Among the CCPs listed in the reproposal, AFFI referred to time-temperature of heat processing for fully cooked patties, cooling of patties, sanitary storage of fully cooked patties to obviate cross-contamination, and refrigerated storage of all heat-processed patties as true CCPs.

However, AFFI suggested that several CCPs in the reproposal become CPs. "This reclassification would ensure product safety consistent with HACCP principles, while permitting flexible, efficient manufacture and processing of uncured meat patties," said Anderson.

As for other aspects of the ruling, AFFI proposed the following:

•**Heat processing and handling** - There should be an alternative process to the heat processing requirements which would improve pattie quality, reduce yield losses and prevent the need to change the shape or size of the patties and replace the forming plates.

•**Cooling** - Two hours cooling time to reach 40°F is too restrictive for fully cooked patties that have been subjected to a bacteria-killing process. "This requirement would cause substantial costs and is unnecessary from a health and science standpoint for this type of product," said Anderson.

•**Appropriate manufacturing practices** - These requirements are already covered in other documents and regulations and should be eliminated from this reproposal.

•**Novel garment restrictions** - Based on scientific principles, there should be no distinction between thawed meat and refrigerated previously unfrozen meat. "To ensure proper guidance to the food industry," stated Anderson, "we urge FSIS to propose a uniform definition of the term *thawed*." Furthermore, "thawed" meat should not be confused with "tempered" meat.

•**Cooking instructions labeling** - AFFI urges FSIS to delete "For Safety" from the following requirements for cooking instructions on labels: "Partially Cooked: For safety, cook until well done (until juices run clear)." Inclusion of the "For Safety" warning raises unnecessary alarm to consumers who may conclude that the meat product is unsafe, Anderson stated. "The cooking instructions as proposed may well make it difficult, if not impossible, for manufacturers to market meat pattie products to consumers."

AFFI concluded by urging FSIS to revise the proposed rule, and offered its assistance in the review process.

AFFI is the national nonprofit trade association that has represented the interests of the frozen food industry for nearly 50 years.

For more information contact: Traci D. Vasilik at (703)821-0770.

CMS Gilbreth Appoints New Vice Presidents

C. Ashton Thumm, formerly a Director of Systems Marketing Development for CMS Gilbreth Packaging Systems, has been named Vice President of Sales.

Thumm will have overall responsibility for both domestic and international sales of materials and machinery. In addition, he will implement sales development programs for the sales organization concentrating on shrink sleeves, multi-color promotional sleeves and dairy film.

Before joining GMS Gilbreth in 1989, Thumm held various sales and marketing positions for Owens Brockway-Label Operations, and Coca Cola, USA.

"Ash has a solid sales and marketing background as well as labeling knowledge. He will service CMS Gilbreth well as Vice President of Sales," said Bill Brown, President.

Thumm earned a BBA from Fairfield University in Connecticut.

He resides in Berwyn, PA, with his wife and three children.

Donald C. Kirk, formerly Director of Systems Marketing Development for CMS Gilbreth Packaging Systems, has been named Vice President, Product & Market Development.

Kirk will lead all of CMS Gilbreth's Market Development activities as well as new product development for its heat-shrinkable labeling and tamper evident systems.

Before joining GMS Gilbreth in 1989, Kirk served as Vice President of Sales and Marketing for Betts Packaging, Inc., a division of Courtauld's Packaging, Florence, Kentucky. He was responsible for directing all sales, marketing and customer service functions for the division.

In addition, Kirk held various management positions with Specialty Packaging Products Inc. and Ethyl Corp., both of Richmond, Virginia.

"Don's extensive packaging background has enabled him to take a leadership role in the marketing of our new products as well as penetration of key target markets," said Bill Brown, president of the company.

Kirk earned an M.B.A. from the University of New Haven, New Haven, CT, and has a B.S. in Mechanical Engineering from Bridgeport Engineering Institute, Bridgeport, CT.

He resides in Richboro, PA with his wife and two children.

Headquartered in Trevose, PA, CMS Gilbreth Packaging Systems is the manufacturer of heat-shrinkable labels and tamper-evident seals as well as a complete line of applicating machinery.

For more information contact: Colleen Prendergast at (215)244-2410.

1989 Dry Milk Census and Whey Products Survey Results Now Available

The American Dairy Products Institute, national trade association of the processed dairy products industry, is pleased to announce the availability of its "*Census of 1989 Dry Milk Distribution and Production Trends*." Copies of the publication may be purchased from the Institute. This publication contains comprehensive industry data and reliably reflects domestic sales and specific markets of utilization for nonfat dry milk, dry whole milk, and dry buttermilk. Data on the utilization of concentrated forms of these milk products also are presented. The survey included American Dairy Products Institute members, other cooperating processors, and resellers, and reflects approximately 91% of the total domestic dry milk distribution.

Another new publication, "Whey Products, A Survey of Utilization and Production Trends - 1989," is now available. Copies of the publication may be purchased from the Institute.

Data assembled and presented in this publication reflect the results of the Institute's fifteenth industry-wide survey of end-uses for whey products. The survey included American Dairy Products Institute members, other cooperating processors, and resellers, and reflects approximately 89% of the USDA-reported whey solids processed during 1989.

Additional information of interest to condensed and dry milk processors, whey processors, marketers/distributors and users has been included in these 1989 publications. The inclusion of such information presents a more complete picture of the manufactured milk products industry and whey products industry by providing cognizance of supply-demand patterns and their relationship to overall marketing. Continued market research and the development of new uses for the various condensed and dry milk products and whey products are necessary for continuing expansion of these segments of the dairy industry. To that end the American Dairy Products Institute was founded and is dedicated.

For further information about these publications, contact the American Dairy Products Institute, 130 North Franklin Street, Chicago, IL 60606. Telephone: (312)782-4888/5455. FAX (312)782-5299.

Updates . . .

Candidate Search for Food Engineering Award Begins

Nominations for the 1991 Food Engineering Award are now being accepted by the Foundation of Dairy and Food Industries Supply Association and American Society of Agricultural Engineers, sponsors of the award. Deadline for nominations is November 1, 1990.

The award is presented biennially for original contributions in research, development, design, management of food processing equipment, or for techniques having significant economic value to the food industry and the public. The award consists of a gold medal and a $2,000 cash stipend.

Candidates will be evaluated for their performance and progress in food engineering and technology, development of equipment, processes or methods for the food industry, and leadership in the professional development of the food industry.

Nominations should include a 500-word statement describing the nominee's achievements and recognition in the food industry. The entry should include: how the award criteria was met, professional and business history, published works, educational background, organizational memberships and three supporting letters.

Nominations may be made by letter or on the official form available from Roger Castenson, ASAE executive secretary, 2950 Niles Road, St. Joseph, Michigan 49085-9659, (616)429-0300.

Previous award winners are: Dr. Arthur W. Farrall, Michigan State University; Robert P. Graham, U.S. Department of Agriculture; Dr. Walter M. Urbain, Michigan State University; Dr. Judson M. Harper, Colorado State University; Dr. Henry G. Schwartzberg, University of Massachusetts; Dr. Daryl Lund, Rutgers University; and Roger Dickerson, retired from the Food and Drug Administration.

10th Annual Pacific Northwest Food Sanitation Workshop

October 30-31. 10th Annual Pacific Northwest Food Sanitation Workshop. Red Lion Inn, Lloyd Center, Portland, OR. For registration information contact Floyd W. Bodyfelt or June Daley, Department of Food Science and Technology, Oregon State University, Corvallis, OR 97331 (503)737-3463.

Expanded Program at NFI Convention Seminar Added on Proposed FDA Labeling Requirements

Registration Deadline October 22

In an exciting new development in the program for the National Fisheries Institute (NFI)'s 45th Annual Convention on November 4-7, 1990, Executive Vice President Lee Weddig announced the addition of a seminar on the proposed FDA nutrition labeling requirements.

The seminar, which will be held on the afternoon of Monday, November 5, will feature a panel discussion of FDA officials, industry leaders, and the NFI Science and Technology staff. The speakers will focus on the implications of the proposed nutrition labeling requirements in the context of the fish and seafood industry. The seminar will be interactive -- convention attendees are encouraged to bring questions for the panel participants.

"The proposed labeling requirements are 72 pages long," said Weddig. "Our members and the industry need to know *now* how these changes might affect their businesses. This seminar is designed to respond to their concerns."

The FDA labeling seminar is part of a four-day schedule of events addressing all segments of the fish and seafood industry, under the umbrella theme of "20 BY 2000: On to the Millennium! Focus on Seafood's Growth." Featured on the program is the noted global futurist Frank Feather, along with Dr. Steve Taylor of Age Wave, Inc., a mature audience marketing expert. NFI members will be treated to a look at the changing trends in the global marketplace, with an eye to increasing per capita consumption of seafood to 20 pounds by the Year 2000.

Other convention seminars and programs will concentrate on marketing fish and seafood in the retail and foodservice sectors. Richard Marriott, vice chairman of the Marriott Corporation, will talk about the importance of quality and freshness in selling to consumers. Leading retailers and experts in retail marketing will hold a panel discussion on building and maintaining vital buyer/seller relationships in the retail marketplace.

"This convention program will hit on all of the major issues faced by the fish and seafood industry from 1990 to 2000," continued Weddig. "It will be a very exciting four days."

The 45th Annual NFI Convention will be held at the San Francisco Marriott. For registration information, write to: Pat McCoy, NFI Convention, National Fisheries Institute, 1525 Wilson Boulevard, Suite 500, Arlington, VA 22209, (703)524-8882.

Food and Environmental Hazards to Health

Rabies in a Llama - Oklahoma

On November 28, 1989, the first reported case of rabies in a llama in the United States occurred in Oklahoma in a 10-year-old male llama. Approximately four weeks before onset of symptoms, the llama was brought to southern Oklahoma from northern Texas, where it had been kept in a pasture for two years. On November 21, the llama had onset of ataxia, aggressive behavior, and progressive hind-leg paralysis; the animal died November 27. Rabies was diagnosed by fluorescent antibody test of brain tissue. Monoclonal antibody testing showed that the virus was identical to the antigenically distinct group of viruses found in skunks from the south-central United States.

Two dogs, four llamas, and 46 Angora goats have been quarantined for six months' observation because of possible exposure to the rabid llama; these animals had shared a pasture in Oklahoma. Rabies prophylaxis was administered to 13 persons, including the owner and his family, a veterinarian, a veterinarian aide, caretakers, and family friends who were exposed to the llama during the illness or two weeks before onset of illness.

Of 3,163 animal specimens submitted for rabies testing to the Oklahoma State Department of Health in 1989, 102 (3%) were positive for rabies, including specimens from 74 skunks, seven cattle, six bats, six cats, four dogs, three horses, one raccoon, and one llama. In 1989, two rabid skunks were identified in the Oklahoma county and two in the Texas county where the llama had been kept.

Editorial Note: Llamas (members of the ungulate family) have become increasingly popular domesticated animals. Approximately 20,000 llamas are currently registered in the United States (International Llama Registry, unpublished data), with approximately 200 being kept in Oklahoma; most of these animals are kept for breeding and showing. The potential for human exposure to rabies from infected llamas at fairs, petting zoos, and parades is a public health concern because of the llama's defensive spitting behavior. No rabies vaccine is licensed for use in llamas.

Virtually all mammals are susceptible to rabies virus infection. In the United States, four wild animal groups (bats, foxes, raccoons, and skunks) accounted for at least 85% of reported rabies cases during 1980-1988. Most animals that develop rabies in Oklahoma are believed to be infected from skunks.

In recent years, rabies has been reported for the first time in javelinas and armadillos. Rabies must be considered in the differential diagnosis of any mammal with unexplained neurologic illness.

MMWR 3/30/90

Recommendations for the Prevention of Malaria Among Travelers

Recommendations for the prevention of malaria among travelers have been developed by CDC in consultation with representatives from the Offices of Medical Services of the Department of State and the Peace Corps; the Division of Experimental Therapeutics of the Walter Reed Army Institute of Research; the Office of the Surgeon General, U.S. Army; the Office of the Surgeon General, U.S. Air Force; and the Bureau of Medicine and Surgery, U.S. Navy.

Resistance of *Plasmodium falciparum* to chloroquine has spread to most areas with malaria. Alternative drugs to chloroquine are either associated with adverse reactions, are of limited efficacy, or require complex and detailed instructions for use that reduce compliance. These factors have contributed to a threefold increase in the number of reported *P. falciparum* infections among U.S. travelers to malarious areas since 1980.

A new drug, mefloquine (Lariam®), is expected to be highly effective against both chloroquine-resistant and Fansidar®-resistant *P. falciparum* infections. Mefloquine is now recommended as the drug of choice for travelers at risk of infection with chloroquine-resistant *P. falciparum*. Alternative drugs for travelers who cannot take mefloquine include 1) doxycycline alone or 2) chloroquine alone, with Fansidar® available for standby treatment while medical care is sought for evaluation of febrile illness when travelers are in a malarious area. Prospective travelers and health-care providers are advised to call the CDC Malaria Hotline at (404)332-4555 for detailed recommendations for the prevention of malaria.

These recommendations replace the guidelines for malaria prevention published in Health Information for International Travel 1989. The new recommendations were developed by CDC in consultation with representatives from the Offices of Medical Services of the Department of State and the Peace Corps; the Division of Experimental Therapeutics of the Walter Reed Army Institute of Research; the Office of the Surgeon General, U.S. Army; the Office of the Surgeon General, U.S. Air Force; and the Bureau of Medicine and Surgery, U.S. Navy.

Copies of the complete report can be purchased from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9371. Telephone (202)783-3238.

MMWR 3/9/90

CALL FOR PAPERS

IAMFES 78th Annual Meeting

July 21-24, 1991

Louisville, Kentucky

Instructions to Prepare Abstracts

Procedure

- ☐ Use the printed Abstract form that appears on the other side of this page.
- ☐ Type in the title, Capitalize the first letter of the first word and proper nouns.
- ☐ List the names of authors and institution(s). Capitalize first letters and initials.
- ☐ Give the name, title, mailing address and the office telephone number of the author who will present the paper.
- ☐ If the paper is to be presented by a graduate student entered in The Developing Scientist Award Competition, check the box to indicate this and have the form signed by your major professor or department head.
- ☐ Check the most appropriate box to indicate the general subject area of the paper. Indicate subject if checking other.

Type the abstract *double-spaced*, in the space provided on the abstract form.

Mail *two* copies of the abstract before January 10, 1991 to:

Steven K. Halstead
Executive Manager, IAMFES
502 E. Lincoln Way
Ames, IA 50010-6666

Enclose *two* stamped, self-addressed post cards. Two cards must be included with *each* abstract that is submitted. One will be returned to acknowledge receipt of the abstract and the other to notify the presenter of the time the paper is to be presented.

Content of the Abstract

The abstract should describe briefly: *(a)* the problem studied, *(b)* methods applied, *(c)* essential results, and *(d)* conclusions.

Presentations Format:

Papers may be presented orally or by poster format at the discretion of the Program Committee. Oral presentations will be scheduled so a speaker has a maximum of 15 minutes, including a 2-4 minute discussion. Carousel projectors for 35 mm slides will be available. **Overhead projectors are not to be used and none will be available.**

Subject Matter for Papers

Papers should report the results of applied research on: food, dairy, and environmental sanitation; foodborne pathogens; food and dairy microbiology; food and dairy engineering; food and dairy chemistry; food additives and residues; food and dairy technology; food service and food administration; quality assurance/control; mastitis; environmental health; waste management and water quality.

Developing Scientist Award Competition

Open to students enrolled in M.S. or Ph.D. programs at accredited universities or colleges who will present their own original research. Candidates will have graduated no more than one year prior to the deadline for submission of abstracts. The abstract form must be signed by the student's major professor or department head. Entrants are required to complete an extended abstract. Such forms are available upon request from Mr. Halstead at the above address.

Winners are presented and honored at the annual Awards Banquet. All entrants will receive complimentary tickets and are expected to be present at the Banquet.

Additional Abstract Forms

Extra copies of the abstract forms may be obtained from Steven K. Halstead, Executive Manager, or you may photo copy this one.

Membership in IAMFES

Membership in IAMFES is NOT a requirement for presenting a paper at the IAMFES Annual Meeting.

(OVER)

IAMFES Abstract Form
DEADLINE: JANUARY 10, 1991

Title of Paper _____

_____

Authors _____

_____

Name and Title of Presenter _____

_____

Institution and Address of Presenter _____

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Office Phone Number (_____)_____-_____

General Subject Area

- ☐ Quality Assurance/Control
- ☐ Food Microbiology
- ☐ Dairy Microbiology
- ☐ Waste Management
- ☐ Lab Methods
- ☐ Foodborne Pathogens
- ☐ Chemical Residues
- ☐ Environmental Health
- ☐ Food Service
- ☐ Sanitation
- ☐ Food Safety
- ☐ Processing
- ☐ Epidemiology
- ☐ Other _____

Check the presentation format you prefer.

☐ Oral ☐ Poster ☐ No Preference

Developing Scientist Award Competition ☐ Yes ☐ No An Extended Abstract Form will be sent.

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

Please type abstract, double-spaced, in the space provided here.

Selected presentations, with permission, will be recorded (audio or video).

I authorize IAMFES to record my presentation.

Signature _____ Date: _____

I do not wish to be recorded.

Signature _____ Date: _____

CALL FOR PAPERS

IAMFES 78th Annual Meeting

July 21-24, 1991
Louisville, Kentucky

Instructions to Prepare Abstracts

Procedure

- ☐ Use the printed Abstract form that appears on the other side of this page.
- ☐ Type in the title, Capitalize the first letter of the first word and proper nouns.
- ☐ List the names of authors and institution(s). Capitalize first letters and initials.
- ☐ Give the name, title, mailing address and the office telephone number of the author who will present the paper.
- ☐ If the paper is to be presented by a graduate student entered in The Developing Scientist Award Competition, check the box to indicate this and have the form signed by your major professor or department head.
- ☐ Check the most appropriate box to indicate the general subject area of the paper. Indicate subject if checking other.

Type the abstract *double-spaced*, in the space provided on the abstract form.

Mail *two* copies of the abstract before January 10, 1991 to:

Steven K. Halstead
Executive Manager, IAMFES
502 E. Lincoln Way
Ames, IA 50010-6666

Enclose *two* stamped, self-addressed post cards. Two cards must be included with *each* abstract that is submitted. One will be returned to acknowledge receipt of the abstract and the other to notify the presenter of the time the paper is to be presented.

Content of the Abstract

The abstract should describe briefly: *(a)* the problem studied, *(b)* methods applied, *(c)* essential results, and *(d)* conclusions.

Presentations Format:

Papers may be presented orally or by poster format at the discretion of the Program Committee. Oral presentations will be scheduled so a speaker has a maximum of 15 minutes, including a 2-4 minute discussion. Carousel projectors for 35 mm slides will be available. **Overhead projectors are not to be used and none will be available.**

Subject Matter for Papers

Papers should report the results of applied research on: food, dairy, and environmental sanitation; foodborne pathogens; food and dairy microbiology; food and dairy engineering; food and dairy chemistry; food additives and residues; food and dairy technology; food service and food administration; quality assurance/control; mastitis; environmental health; waste management and water quality.

Developing Scientist Award Competition

Open to students enrolled in M.S. or Ph.D. programs at accredited universities or colleges who will present their own original research. Candidates will have graduated no more than one year prior to the deadline for submission of abstracts. The abstract form must be signed by the student's major professor or department head. Entrants are required to complete an extended abstract. Such forms are available upon request from Mr. Halstead at the above address.

Winners are presented and honored at the annual Awards Banquet. All entrants will receive complimentary tickets and are expected to be present at the Banquet.

Additional Abstract Forms

Extra copies of the abstract forms may be obtained from Steven K. Halstead, Executive Manager, or you may photo copy this one.

Membership in IAMFES

Membership in IAMFES is NOT a requirement for presenting a paper at the IAMFES Annual Meeting.

(OVER)

IAMFES Abstract Form
DEADLINE: JANUARY 10, 1991

Title of Paper _____

_____

Authors _____

_____

Name and Title of Presenter _____

_____

Institution and Address of Presenter _____

_____

Office Phone Number (_____)_____-_____

General Subject Area

- ☐ Quality Assurance/Control
- ☐ Food Microbiology
- ☐ Dairy Microbiology
- ☐ Waste Management
- ☐ Lab Methods
- ☐ Foodborne Pathogens
- ☐ Chemical Residues
- ☐ Environmental Health
- ☐ Food Service
- ☐ Sanitation
- ☐ Food Safety
- ☐ Processing
- ☐ Epidemiology
- ☐ Other _____

Check the presentation format you prefer.

☐ Oral ☐ Poster ☐ No Preference

Developing Scientist Award Competition ☐ Yes ☐ No An Extended Abstract Form will be sent.

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

Please type abstract, double-spaced, in the space provided here.

Selected presentations, with permission, will be recorded (audio or video).

I authorize IAMFES to record my presentation.

Signature _____ Date: _____

I do not wish to be recorded.

Signature _____ Date: _____

Industry Products

Pall Corporation Describes Product Ratings, Materials of Construction and Filter Applications

Pall Corporation has just released a 48-page brochure that describes the broad application of Pall products for the Food & Beverage Industry. This 48-page brochure is a compendium of information divided into several distinct sections as outlined in the table of contents.

The brochure follows a logical progression starting with a description of Pall media, ratings and materials of construction in the first section.

The second section contains detailed information on Pall filter element configurations and operating characteristics. The next section deals with housing design and construction to meet the special needs of the Food & Beverage industry.

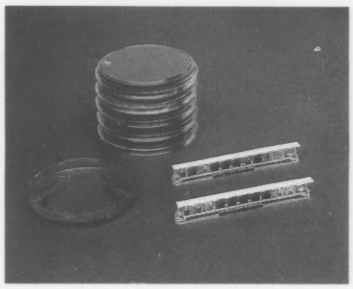
The fourth and largest section in the brochure details Pall filter applications common to the Food and Beverage industry. Process schematics are designed to clearly display areas for applications of the entire range of Pall products.

The final section has ordering information for the products documented in the brochure and general information on Pall Scientific and Laboratory Services group and world wide service capabilities of the company.

For additional information or to receive a free copy of the new Food and Beverage brochure.

Pall Ultrafine Filration Company - East Hills, NY

Please circle No. 258 on your Reader Service Card



Two Hour Identification of Pathogenic Neisseria

The API quadFERM+™ System is a rapid miniaturized test system for the identification of certain species of *Neisseria* and *Branhamella*. The system consists of utilization tests for glucose, maltose, lactose, and sucrose; a carbohydrate control and a test for penicillinase and DNase activity. These 7 test substrates are dried in an unique plastic carrier that provides easy and convenient handling of the test product. The test substrates are rehydrated by adding a saline suspension of the test organism. The carrier is sealed and incubated at 35-37°C for two hours. For product efficiency and your convenience, the reactions are then read without the addition of any reagents.

Using the API quadFERM+™ reactions, *Neisseria meningitidis*, *Neisseria gonorrhoeae*, and *Neisseria lactamica* can be identified based on their unique carbohydrate degradation patterns. The questionable results sometimes seen with conventional CTA sugars are not exhibited when using quadFERM+™. The positive and negative results are clearly defined.

In addition to identification, the API quadFERM+™ test product conveniently supplies information concerning penicillinase and DNase activity. The determination of penicillinase producing *Neisseria* is of valuable diagnostic assistance in the appropriate treatment of penicillin resistant organisms. The determination of DNase activity is important in identifying *Branhamella Catarrhalis*.

For your convenience and cost effectiveness, the quadFERM+™ product (Product No. 8886-076010) is pouched three (3) strips to a pouch, ten (10) pouches to a box. Each product kit contains a total of thirty (30) test strips.

Analytical Products - Plainview, NY

Please circle No. 259 on your Reader Service Card

Introducing the All New High Performance Laboratory X-Ray Fluorescence Analyzer with Secondary Targets from ASOMA Instruments, Inc.

An all new high performance X-ray Fluorescence spectrometer, the ASOMA Instruments Model 6000, is offered for qualitative and quantitative measurement of atomic elements (sodium through uranium) in foods, pastes, foams, films, coatings, suspensions, slurries, liquids, solids, and powders.

Featuring dual 50 KV x-ray tubes, secondary target excitation and a high resolution Si(Li) detector, the Model 6000 offers enhanced selectivity and sensitivity for trace metal analysis in difficult matrices. In addition, dedicated tube secondary target excitation means enhanced reliability (fewer moving parts) and lower limits of detection than are achievable with a conventional ED-XRF. The standard 10-position sample changer is designed to accommodate either air, vacuum, or helium flush operation.

The 6000 can be configured to measure many elements simultaneously. Utilizing the power of a 286 (or 386) PC computer and a sophisticated color graphics display, user friendly intuitive operation was a principle design goal. Despite its sophistication, it is amazingly easy to use. Operating tasks are organized into menus, "soft-keys", and assistance lines; windows are used wherever more detailed instructions are required. To further enhance the power of the instrument, fundamental parameters software is an available option.

ASOMA Instruments, Inc. - Austin, TX

Please circle No. 260 on your Reader Service Card

There's a Solution to your Bird & Pest Problems within this new Bird-X Brochure

This new, handy 4-page brochure features the complete, unique line of Bird-X bird and pest control products.

Get fast results with low-cost, easily installed products which include sonic and ultrasonic repellers, non-toxic chemical and physical roost inhibitors, life-like replicas of natural predators, netting and other proven effective products that drive birds and other pests out ... and keep them out!

Ideal for manufacturing facilities, airports, public buildings, farm fields and anywhere that birds and pests are a problem.

Rout pests from your property, indoors and outdoors, with a complete range of products from Bird-X, the world's leading pest control specialists.

Bird-X, Inc. - Chicago, IL

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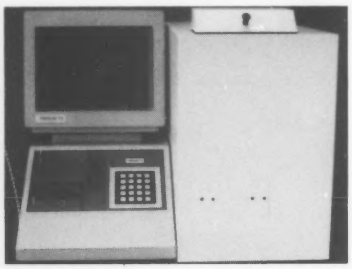
on your Reader Service Card



New NIR Instrument Technique from Trebor Speeds Lab Analysis

Using the new Trebor-70 NIR Analyzer from Trebor Industries, Inc., Gaithersburg, MD for analysis of protein, oil, moisture, sugar, aspartame, starch, fiber, sucrose, free fatty acids and other oganics is virtually instantaneous with infrared compared to laborious wet chemistry. Time consuming extractions, titrations and other lab processes or even just the set-up of chromatography can all be eliminated. Calibrating from HPLC is the latest speed-up technique for Food, Chemical, Medical and Research Laboratories in analyzing for specific organic components. Either a Trebor- or Customer-performed regression analysis comparing the output of the Trebor-70 to time-interval data from the HPLC column standardizes and calibrates the T-70 to the individual chemical's NIR signature. Then, using the T-70 NIR Analyzer gives answers in 30-seconds, a fraction of the time previously needed for HPLC ... and with no set-up, no liquifaction, no handling and virtually zero personnel training or manipulative laboratory skills required. In addition, the Trebor-70 can be used right on the processing floor.

Applications for the T-70 in industrial laboratories for foods and chemicals are too numerous to indicate but a few include specific sugars, sucrose, levulose, lactose in foods, citric acid in syrups, fiber in breads, oil in kernels, latex in glues, aniline dyes in colorants and phenol in solvents. In all these cases, HPLC would be able to determine the identical analyses, but the time needed would be much longer and set-up time, product handling and cleaning would all be required ... and all are unnecessary for NIR.

Trebor Industries, Inc. - Gaithersburg, MD

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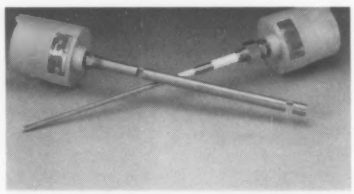
on your Reader Service Card



Left ***Levelmark*** **Model 606** **Right** ***Levelmark*** **Model 801**

Penberthy Has Two Levelmark Models

Levelmark, by Penbetrthy, offers two technologies to provide pump control circuitry and level indication. The Levelmark Model 606 Dual Point Ultrasonic Gap Switch is perfect for clean liquid level indication, and features an easily activated pump control circuit. The Levelmark Model 801 Capacitance Switch, when equipped with the Model 21-14 sensing element and optional adjustrable differential will provide pump-on/pump-off service in nearly any process material or condition.

Both the Levelmark Model 606 and 801 feature a wide variety of sensing element design and construction, adjustable time delay, and remote mounting options.

Penberthy - Prophetstown, IL

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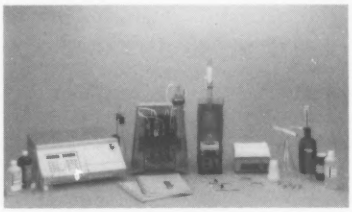
on your Reader Service Card



AOAC Approves Phosphorus Method for Meat and Cheese

A comprehensive study by Hach food scientists has yielded the Association of Official Analytical Chemists' (AOAC) Interim Official First Action Approval on a fast, accurate method for measuring phosphorus levels in meat and meat products. A similar method for cheese also has been granted approval. The methods specify that a sample be digested with hydrogen peroxide and sulfuric acid, and the digest analyzed colorimetrically to determine phosphorus concentration.

Hach's Digesdahl Digestion Apparatus is well suited for the digestion portion of this method. It digests samples in under 15 minutes using hydrogen peroxide and sulfuric acid. (No metal catalysts are required.) After digestion, Hach's microprocessor-controlled DR/3000 Spectrophotometer provides accurate colorimetric phosphorus measurement and displays results digitally.

Hach's Phosphorus Analysis Package includes all instruments and apparatus needed to perform the AOAC-approved method, including a Diluter-Dispenser for easy reagent addition, a Digesdahl Digestion Appartus, and a DR/3000 Spectrophotometer. Plus colorimetric reagents and hydrogen peroxide for 125 tests, as well as calibration standards. (Order sulfuric acid separately.)

Hach Company - Loveland, CO

Please circle No. 264
on your Reader Service Card

MBI Products Announces San Pan Sanitary Panel System

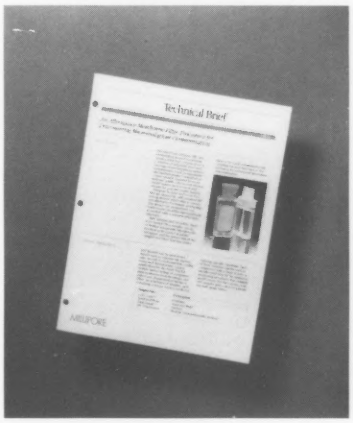
Metal Building Interior Products Company introduces its San Pan sanitary panel system. MBI San Pan can be used as an acoustical ceiling panel, with extrusions as an acoustical wall system or with grommets as a vertically hanging baffle system.

MBI San Pan is a sanitary USDA/FDA listed material that provides outstanding acoustical performance, is chemically and UV resistant and resists acids, bases and solvents. San Pan is the ideal acoustical material for controlling noise in food processing/preparation areas, cleanrooms and pharmaceutical manufacturing.

A complete catalogue and sample is available on request.

MBI Products Company - Cleveland, OH

Please circle No. 265
on your Reader Service Card



New Technical Brief Describes Membrane Filtration Testing Using Millipore Samplers

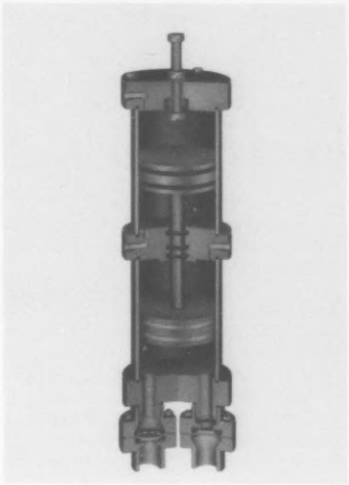
A new Technical Brief describes methods for microbiological monitoring using Millipore Samplers and Swab Test Kits. Millipore Samplers are disposable, presterilized, pocket-sized membrane filtration test devices which offer a convenient alternative for routine microbiological monitoring of water and other liquids.

Testing requires just three steps: the Sampler is dipped into the test fluid, it is then incubated and examined. Results are available in 24-72 hours, depending on the organism being cultured. No equipment set-up or clean-up is involved, and there are no funnel holders to sterilize.

The Brief also describes how Samplers can be combined with a swab in sterile buffer to test surfaces for microorganism contamination levels.

Millipore Corp. - Bedford, MA

Please circle No. 266
on your Reader Service Card



Ease of Adjustment Combined with High Accuracy Among Key Features of Unique Metering Pump

An increase in demand for adaptability while maintaining desired accuracy in industrial pump applications, is one of the reasons suggested by Plast-O-Matic Valves Inc. for the strong sales gains registered by their metering pump over the past year.

According to a company spokesperson these Series VPA dual cylinder pumps, which are manufactured to very exacting standards, are designed to dispense a precise quantity of highly corrosive or ultra-pure liquid and can be cycled up to 10 times per minute.

Stroke adjustability is one of several unique and patented features of these pumps. This permits the per-cycle discharge to be field-adjusted down to 20% of its maximum capacity. For example, the 128 oz. (1 gallon) model can be adjusted to discharge any amount between 25 and 128 ounces per stroke. Of equal importance, once a specific measure is set, the discharge repeatability performance of these metering pumps is consistently accurate within 1/2 of 1%.

These positive displacement pumps are also explosion-proof, self-priming, and feature the patented Fail Dry® safety design which permits continued functioning even after primary seal failure.

Standard material of construction is PVC with Polypropylene, Teflon® and PVDF (Kynar®) optional. These pumps are available with maximum per cycle capacities of 7, 10, 32 and 128 ounces.

Plast-O-Matic Valves, Inc. - Totowa, NJ

Please circle No. 267
on your Reader Service Card

New NMR System Revolutionizes Food Quality Control and Production Technology

An innovative new computerized nuclear magnetic resonance (NMR) quality control system offers food manufacturers such a dramatic increase in productivity that system designers predict many users will achieve up to 75 percent improvement in product yield.

The new product, called AdvanceTec-MRS, is a highly accurate and streamlined NMR system which combines a compact testing unit with a customized computer program to analyze multiple nuclei. The system weighs approximately two percent of current competitive technology. It offers a more sensitive and accurate high (one-half Hz) and low resolution chemical analysis of solids and liquids due to its breakthrough design.

The AdvanceTec-MRS system - which is cost-competitive with current NMR technology - is used in industrial on-line quality control and food product development.

The AdvanceTec-MRS is unique in that it easily adapts to the customer's existing production environment without necessitating costly changes.

Advanced Techtronics, Inc. - Downers Grove, IL

Please circle No. 268
on your Reader Service Card

Weber Scientific's NEW Dairy and Food Analysis Catalog

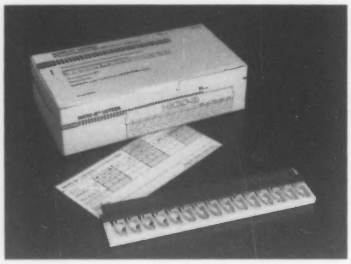
Weber Scientific announces the publication of their 1990/1991 Dairy and Food Analysis Catalog. Highlights include a comprehensive selection of antibiotic and mycotoxin residue tests for the detection of penicillin, sulfamethazine, neomycin, gentamicin and aflatoxin M_1, B_1, B_2 & G_1, and a newly introduced section devoted to food and dairy sanitarian supplies.

Also featured are apparatus and reagents for testing butterfat content (Gerber, Babcock and Mojonnier methods), bacteria count, acidity, solubility, sediment, moisture, mastitis and pasteurization efficiency.

The catalog also contains listings for sampling supplies, volumetric and gravimetric measuring equipment, glass and plastic labware, culture media and standardized reagents.

Weber Scientific - East Windsor, NJ

Please circle No. 269
on your Reader Service Card



Rapid Bacteria Tests

New generation products require new generation diagnostics. MoniTek rapid test system makes it quick and easy to screen for possibly harmful microorganisms.

MoniTek checks for potential pathogens. Simply rub test strip on surface or product, then add reagents. Positive reactions exhibit purple color, negative reactions remain colorless. Procedure takes 20 minutes, and requires no instrumentation or special training.

Different tests detect either total count or coliform levels at 10^3 or greater. Data obtained can be used for prevention and quality assurance, rather than problem resolution.

Diversified Diagnostics - Concord, CA

Please Circle No. 271
on your Reader Service Card

Atkins Series 396 Thermometer - Tougher Than Ever

Recent product innovations have made the Atkins rugged Series 396 hand-held digital thermometer tougher than ever. The thermometer is housed in tough ABS plastic and now features sealed membrane switches for greater durability and ease of use. These new switches make the thermometer more immune to moisture, dirt and damage from dropping than the slide switches used on previous models. At the push of a button turn the instrument on or off, or switch the reading between degrees Fahrenheit and degrees Celsius.

The Series 396 has an accuracy of plus-or-minus 1 percent of reading plus-or-minus one digit, and displays all readings under 200 degrees with 0.1 degree resolution. Readings 200 degrees or more are shown in 1 degree resolution. The display is 0.5 inches LCD, and battery life is 500 hours per nine-volt battery, with capacity for three batteries. The range for type K is minus 112.0 degrees to 1999 degrees Fahrenheit and the unit can be switched to read the degrees Celsius equivalent. Thermocouple types J and T are also available.

Atkins Technical Inc. - Gainesville, FL

Please circle No. 273
on your Reader Service Card

Organon Teknika Corp. Announces a Rapid Listeria monocytogenes Identification System

Organon Teknika Corporation announces the availability of a rapid *Listeria monocytogenes* identification system. Micro-ID® Listeria can eliminate suspect *L. monocytogenes* in just four hours, improving microbiological release times of presumptive positive samples. All species of *Listeria* can be differentially identified in 24 hours to quickly track their origin. An extremely easy procedure is utilized to streamline workflow and reduce special training needs. Excellent agreement with conventional systems ensures accuracy and confidence in the Micro-ID® Listeria result.

The format of the Micro-ID® Listeria assay is patterned after the company's current microbiological differentiation strip for *Enterobacteriaceae*, Micro-ID®. Filter-paper disks impregnated with biochemical substrates react in the presence of specific enzymes and/or metabolic products produced by *Listeria* species. These reactions form a readily identifiable color change. AOAC collaborative studies comparing Micro-ID® *Listeria* with conventional biochemical analyses are underway.

Organon Teknika Corp. - Durham, NC

Please circle No. 270
on your Reader Service Card

Real Time Factory Floor SPC System Announced by Stochos, Inc. - Provides Fast and Comprehensive Process Monitoring

The first real-time, on-line SPC program - which goes beyond monitoring variables individually to indicate overall process problems - has been announced by Stochos, Inc.

Called SPC DIRECT (TM), the powerful, general purpose, PC-based system statistically monitors each of up to 32 variables - along with the relationships between variables - bringing operators more comprehensive process monitoring. With SPC DIRECT, factory floor operators are quickly alerted to out-of-control conditions to allow for prompt process adjustment.

SPC DIRECT can be easily configured - in just minutes - to any factory floor application in which a given block of data is gathered for analysis.

Variable and attribute data can be entered in English or in most foreign languages. The standard package accommodates up to 32 variables and 32 attributes.

The operator can display all 32 variables in real time. When any variable goes out of control, one of several indicators appears to the left of the variable denoting a specific out-of-control condition.

Stochos, Inc. - Schenectady, NY

Please circle No. 272
on your Reader Service Card

*GENE-TRAK Systems Announces Availability of the Colorimetric GENE-TRAK® **Staphylococcus aureus** Assay*

GENE-TRAK Systems announced the immediate availability of a new, colorimetric DNA probe assay for the rapid detection of *Staphylococcus aureus* in processed food samples. The Colorimetric product line also includes tests for *Salmonella*, *Listeria* and *Escherichia coli*.

Staphylococcus aureus is a common food pathogen that is widely distributed in nature. The contamination of foods as a result of the presence of *Staphylococcus aureus* is a problem of increasing concern within the food industry. *Staphylococcus aureus* testing is one of the most frequent microbiological assays performed by major food producers and independent food laboratories.

The new GENE-TRAK Assay allows identification of *Staphylococcus aureus* within two days, compared to four days for conventional microbiological methods. This significant time savings is important because *Staphylococcus aureus* is isolated frequently from high-protein, processed foods such as ready-to-eat salads, meats and seafood. In addition to the time savings of this rapid method, the test is also more accurate in that it detects biochemically atypical, as well as normal strains of *Staphylococcus aureus*.

Patrick J. Connoy, president of GENE-TRAK Systems, commented, "We are very please to introduce this test as part of our product offering to the food microbiology industry. With the addition of the Colorimetric GENE-TRAK® *Staphylococcus aureus* test, we are now able to offer a more complete line of diagnostic products to help ensure food safety. The successful introduction of this new test demonstrates GENE-TRAK's commitment to provide innovative diagnostic products to the food industry."

GENE-TRAK Systems is a joint venture between Amoco Biotechnology Company and Genzyme Corporation (NASDAQ:GENZ) and represents one of the largest groups in the world dedicated to the development and commercializatoin of tests for food pathogens and infectious disease using nucleic acid probe technology. Currently, GENE-TRAK Systems is selling diagnostic tests to detect *Salmonella*, *Listeria* and *E. coli* to food processors and distributors. The company also sells research assays for HIV-1 (AIDS virus) and Cytomegalovirus (CMV). The company is developing a wide range of diagnostic tests for the clinical market, including an automated probe-based system for the rapid, accurate and cost-effective detection of bacterial, viral and fungal pathogens responsible for many important infectious diseases.

GENE-TRAK Systems - Framingham, MA

Please circle No. 274
on your Reader Service Card

New Stainless Steel High Pressure Pump

New from APV Crepaco, the Model HP-2A is a stainless steel centrifugal pump designed to operate within high pressure systems to 725 psi as a booster pump. Rated at 350 USgpm, its primary application is on reverse osmosis membrane systems. It is adaptable as a feed pump for filter and evaporator installations and is ideally suited for use in the food, dairy, beverage, and pharmaceutical industries where product purity is essential.

The HP-2A pump is a single-stage design with enclosed impeller. The single, balanced mechanical seal has Viton O-rings, silicon carbide faces and a flush option. The totally enclosed motor is furnished with heavy-duty, permanently sealed bearings that will withstand high suction pressures.

The pump meets 3-A standards for sanitary design as well as FDA material specifications and USDA requirements.

APV Crepaco, Inc. - Lake Mills, WI

Please circle No. 275
on your Reader Service Card

PS Forum For Professional Sanitarians

Has the towel been thrown in on handwashing? Some state health departments have admitted defeat in the war on handwashing, admitting that "the community standard - is that people don't wash their hands."

In an attempt to stop fecal-oral route disease outbreaks (e.g. Hepatitis A, typhoid) the mandatory use of plastic gloves is often required. Plastic gloves that are put on dirty hands, contaminated with feces, will also become contaminated with feces.

One argument for plastic gloves is that managers and inspectors can't determine if employees are washing their hands. Any manager with an insight to their operation will know their level of handwashing. You can also be sure that if the boss doesn't do it, employees won't. Inspectors who don't wash their hands before the inspection are sending out the message - "handwashing is not important."

We agree that inspectors armed with only a clipboard and a limited knowledge of food science, human behavior and common sense will have a difficult, if not impossible, mission. On the other hand, Sanitarians can be successful in the war on handwashing.

Sanitarians can determine the level of handwashing being practiced by evaluating handwashing facilities. Requirements for maintaining handwashing facilities in a clean condition and providing adequate supplies need to be strictly enforced. Food service facilities that continually fail to maintain handwashing facilities as required, may be guilty of preparing and serving foods under unsanitary conditions. Under current code definitions, menu items handled by employees in these facilities could be considered "adulterated." It would be interesting to know if any jurisdiction has taken enforcement action on establishments with a history of not maintaining handwashing facilities.

There are some success stories in this otherwise dirty war. In their August 8 issue, *Restaurants and Institutions* described how three institutions were winning their battle against unwashed hands. One manager moved the time clock next to a handwashing sink, another uses both signs from the health department plus handwritten signs from management.

New developments in technology can also help win the war. Electronic plumbing using active and passive infrared sensors can make handwashing an easier task. New soaps combined with hand lotions can influence employee handwashing practices. Hand sanitizers can be used to reduce cross contamination during food preparation and in temporary locations.

Minimizing hand contact of foods has always been a code requirement and should certainly be a critical item during inspections. The mandatory use of plastic gloves in a specific facility related to an outbreak of a fecal-oral foodborne disease may well be justified.

Requiring the mandatory use of plastic gloves by all foodhandlers reflects a lack of common sense about food preparation and knowledge of infection control. Gloves that are put on with unwashed hands will become contaminated in the process. The use of gloves must begin with handwashing.

Where health authorities are throwing in the towel on handwashing, it may be that the war wasn't lost, but never begun.

OFF THE CLIPBOARD: An array of milk and other dairy products are served on a complimentary basis during breaks at the IAMFES annual meeting. I've always wondered why complimentary coffee wasn't also served. Now I know!

- FDA has notified manufacturers of coffee urns that some units may have a problem with leaching lead. Preliminary studies by FDA indicate that some urns are capable of leaching amounts of lead into coffee that exceed current EPA standards for drinking water (50 ppb).

- If that's not bad enough, caffeine, the ingredient in coffee that wakes you up, has been found to be addictive in animal studies. During the 41st Annual Fall Meeting of the American Society for Pharmacology and Experimental Therapeutics, Gary B. Kaplan, MD, reported that caffeine fits the pattern of other drugs that cause chemical dependence.

- Congratulations to Paulette Gardner, with SaniSafe and Associates, Inc. Last summer we announced the Great IAMFES Summer Fun FIQ Contest. A "Clean-Up America" Tee Shirt was to be awarded to the member submitting the best FIQ item. Paulette submitted a number of items that she uses in her manager certification training program in Illinois. SaniSafe also provides students in the course with an excellent food service sanitation training manual. Keep up the good work Paulette, your Tee Shirt is in the mail.

Homer C. Emery, RS
Chair, FDA Interpretations Committee

October Field Inspection Quiz

1. Trihalomethanes (THMs) occur in some public water systems as a byproduct of chlorine reacting with certain organics. THMs are a problem due to:
   A. color B. taste
   C. odor D. animal carcinogen

2. The trihalomethane that is of most concern is:
   A. TCE B. Methane
   C. dioxin D. Chloroform

3. The current EPA Maximum Contaminant Level (MCL) for THMs is:
   A. 50 ppm B. 10 ppm
   C. 100 ppb D. 50 ppb

4. At a temperature of 185°F the *Clostridium botulinum* neurotoxin can be destroyed in 5 minutes. How long would it take to destroy the toxin at a temperature of 174°F?
   A. 10 minutes B. 30 minutes
   C. 15 minutes D. 20 minutes

5. How many types of *Clostridium botulinum* can cause foodborne illness?
   A. 2 (Types A & B) B. 6 (Types A,B,C,D,E,F)
   C. 3 (Types A,B,C) D. 4 (Types A,B,E,F)

Answers to September FIQ: 1. (A), 2. (D), 3. (D), 4. (A), 5. (B).

Letter to the Editor

Dear Editor:

I am pleased to see that the issue of a possible change in the name of IAMFES again is being considered. Several years ago I was very disheartened when the clearly expressed wishes of an overwhelming majority of the members regarding the name of the Association were ignored. It is my understanding that one of the primary reasons why the wishes of the membership were ignored is because the officers of IAMFES were intimidated by a dairy-related organization that threatened to withdraw it's support of IAMFES if the name of the Association was changed. It is noteworthy that the organization in question formerly was, but is not now, and had not been, a sustaining member of IAMFES for more than one year even though the name of the Association was not changed. Hence, the threat and the argument advanced at that time have proven to be spurious. Thus threats and intimidation were not and are not good bases for reaching a decision.

A change in name is not new for IAMFES. Initially the name of the organization was the "International Association of Milk Inspectors." Some years later the name was changed to "International Association of Milk Sanitarians." Through the efforts of members of IAMS and others the almost overwhelming public health problems once associated with milk and milk products were largely solved. This meant that the duties of many IAMS members were broadened so hygienic practices could be applied to production, processing and distribution of foods other than milk and milk products. The IAMS recognized that this change had occurred in the professional life of many of its members and in 1947 adapted to the change by becoming the "International Association of Milk and Food Sanitarians."

In 1962 it became evident that IAMFS was no longer adequate for the Association and a resolution was introduced at the annual meeting of IAMFS to change its name to "International Association of Milk, Food and Environmental Sanitarians." This was prompted by the emergence of environmental problems that needed to be solved. The proposal to change the name of the Association was submitted to the membership for a vote. Of the members voting, 245 favored and 122 did not favor the change. Thus IAMFS became IAMFES and has been known by its current name since June 1963.

Three times in its history the Association that now is IAMFES saw the need to change its name because conditions had changed. Have conditions changed sufficiently since 1963 to warrant another change in the name of the Association? In my view, the answer is "YES." In fact, I came to that conclusion at least 10 years ago. What then, is wrong with the current name and how can it be fixed?

The name of an organization should be short and should effectively communicate to *non-members* (including potential members) what the organization is all about. The current name fails on both accounts. It is too long - this has been recognized by others and hence the acronym IAMFES has been used with ever greater frequency. But does the acronym communicate anything to the non-member? In most instances it does not. Members know about the Association, and thus the name needs to communicate to non-members. Aside from being too long, the name of the Association has other problems. "Milk *IS* Food," and hence "Food" is sufficient. Inclusion of "Environmental" in the name once may have seemed like a good idea. However, it really never "caught on" in IAMFES. Sessions at the annual meeting dealing with environmental topics always have suffered from poor attendance. Other organizations more effectively cater to the needs of the true environmentalist. Also, there are at least 20 research journals in which environmentalists can publish their findings. Perhaps "environmental" has outlived its usefulness in the name of the Association. Finally we come to the word "Sanitarian." This term suggests a specific position and serves to discourage persons not in such a position from seeking membership in IAMFES. Thus it might be better to have a term that describes a function rather than one that specifies a position.

The obvious remedy for the problems is to change the name of the Association. But, what should it be? Some years ago, after experiencing the benefits to the Journal that resulted when the name of the *Journal of Milk and Food Technology* was changed to *Journal of Food Protection*, I became convinced that IAMFES would benefit from a similar change in name. At that time I felt that "International Association for Food Protection" would be far better than IAMFES. I still think so, although there might be other equally suitable or superior names.

In my view, the entire matter of a name change should be reviewed carefully by your committee and by the executive board of IAMFES. Then the members of IAMFES should be afforded the opportunity to express their wishes regarding the name of the Association. Finally, this time the executive board of IAMFES should heed the voice of the membership and take the appropriate action if the members clearly indicate some action is needed.

Sincerely yours,

Elmer H. Marth, Ph.D., R.S.
Emeritus Professor of Food Science
and Bacteriology
University of Wisconsin-Madison

Affiliate News

Pennsylvania Association of Dairy Sanitarians and Dairy Laboratory Analysts

1990 Report to the Affiliate Council:

The PA Association of Dairy Sanitarians and Dairy Laboratory Analysts continues a backbone in the support of the Dairy Industry in PA. Our Association has approximately 350 members from regulatory, education, and industry and is flanked by four affiliate groups: Southeast, The Western Association, The Penn-York and the North Central. The Affiliate groups each have bi-monthly meetings.

The PA Association has three meetings yearly. An annual meeting held in May, and two committee meetings held in October and March. The Association has 12 active committees, covering Animal Disease Control, Auditing, Farm Practice, Lab Practice, Membership, Milk Haulers and Samplers, Nominating, Program, Publicity, Recognition, and Awards, Rural water and waste and a Standards Committee. All of which have the intent for better education and improvement to the Dairy Industry.

The membership supports State and Penn State programs. The programs include the Pasteurizer Workshop, the PA Approved Dairy Laboratory Workshop Program, the Milk Hauler and Milk Sampler Program, the Dairy Processor meetings, and Ag Progress Days.

The Association publishes a quarterly newsletter.

The Association continues to support education in sponsoring three - $500 scholarships to Penn State. Recipients are undergraduate Food Science students.

James A. DeTolla, President

Kentucky Association of Milk Food and Environmental Sanitarians

1990 Report to the Affiliate Council:

The Kentucky Association of Milk, Food and Environmental Sanitarians has a membership of 375. This is an increase of twelve new members from the previous year.

We were very please to have Steve Halstead attend our annual meeting in Louisville this past year. The conference theme was "Networking to Meet the Challenges of the 90's." This year's theme will be "The Challenge Ahead-Environmental Management."

The 1991 meeting of IAMFES will be held in Louisville, Kentucky at the Galt House Hotel. Some area attractions include: Riverboat cruises, a floating restaurant, horse racing, a beautiful river fountain, center for the arts, and shopping at the Galleria. We invite all members to share in our Southern hospitality and enjoy a beautiful week in Kentucky.

Submitted by
David W. Klee
Affiliate Representative

Upcoming IAMFES Affiliate Meetings

1990

NOVEMBER

•**14-15, Alabama Dairy Food Conference** to be held at the Howard Johnson Motor Lodge in Birmingham. For more information contact Tom McCaskey at (205)844-1518.

• **28, Ontario Food Protection Association Annual Meeting**, will be held at the Airport Hilton Hotel, Toronto, Ontario. The title of the all-day symposium is "FOOD PROTECTION: HOT TOPICS FOR THE '90's". For more information, please contact program convenors: Garth Sundeen (416)-239-8411 or FAX (416)239-2416 or Patrick Kwan (416)671-5080 or FAX (416)671-5176.

1991

JULY

•**21-24, 78th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians**, will be held at the Galt House Hotel in Louisville, Kentucky. For more information call the IAMFES office at (800)369-6337 or (515)232-6699.

New York State Association of Milk and Food Sanitarians

1990 Report to the Affiliate Council:

New York State Association of Milk and Food Sanitarians currently has 444 regular members, 15 student members, 87 honorary life members, and 93 sustaining members for a total of 638 members. This is an increase over 1989 of 39 members.

The Association holds their three day annual meeting in September and also holds a two day planning meeting for the annual meeting in April. We were privileged to have Steve Halstead, Executive Manager of IAMFES, attend our 1989 Annual Meeting. We had 330 registrants for the 1989 meeting and 285 attending the awards banquet. There are six board meetings held each year. The Association has a Farm Methods Committee, a Food Committee, and a Laboratory Committee each of which meets at least twice a year. The Laboratory Committee holds one-day Regional Laboratory Workshops in six locations in the state each year. This year they had a total attendance of 156 for the six meetings.

There are 14 affiliates of the State Association. Eric Dutton is the Council of Affiliates Chairman and has a minimum of two meetings of the Affiliate Delegates each year. The affiliates each hold from four to seven meetings annually.

The 1990 Annual Meeting was held September 17-19, 1990 at the Sheraton Inn, Liverpool, NY. We had an excellent program and we welcomed your attendance.

Abstract of Papers Presented at the Seventy-Seventh Annual Meeting of the IAMFES

Arlington Heights, IL, August 5-8, 1990

Abstracts of most papers submitted for presentation at the 77th Annual Meeting of the IAMFES appear on this and the following pages. The complete text of some of the papers will appear in future issues of the *Journal of Food Protection* or *Dairy, Food and Environmental Sanitation*.

DAIRY MICROBIOLOGY

BIFIDOBACTERIA - APPLICATIONS AND CURRENT USAGE

Hyung S. Kim, Ph.D., Miles Laboratories, Inc., Elkhart, IN

Since the new definition of bifidobacteria was established in 1900, possible benefits of consuming bifidobacteria have been investigated. In this review, research efforts on health of the newborn, growth promoting factors and roles in the intestinal tract of these microorganisms were discussed. Necessary characteristics of candidate organisms as dietary adjuncts as well as the current dairy products containing bifidobacteria were also reviewed. Commercial development of bifidobacteria and beneficial roles of consuming bifidobacteria were addressed. In conclusion, further considerations in the future research were suggested.

TRACKING *LISTERIA* IN THE ENVIRONMENT

Peter J. Slade* and David L. Collins-Thompson, University of Guelph, Guelph, Ontario, Canada

Many questions still remain regarding the transmission of listeriosis by food. Tracking *Listeria* spp. in the environment from primary producer, to processor through to potential victim draws on key elements of isolation, identification and typing. Methodology for optimal recovery of listeriae from food is still in a state of flux. Recovery of potentially injured *Listeria*, and the seemingly infrequent isolation of hemolytic species other than *L. monocytogenes*, namely *L. ivanovii* and *L. seeligeri*, are areas for investigation. Alternatives to traditional biotyping regimes for identification of pathogenic *Listeria* spp. have focused on development of DNA probes for detection of hemolysin determinants. Classical typing schemes (e.g. serotyping and phage typing) have been augmented by multilocus enzyme electrophoresis (MEE), and plasmid profiling and fingerprinting. The potential for chromosomal DNA fingerprinting and restriction fragment length polymorphism (RFLP) analysis, and the novel technique of low molecular weight (LMW) RNA profiling have not been addressed.

Benefits of improved tracking systems and alternative typing schemes for *Listeria* spp. include: (a) advances in taxonomy, which may identify reservoirs of strains potentially pathogenic to man, (b) design of comprehensive HACCP programs, and (c) facilitated epidemiological investigations.

THE STUDY OF BACTERIOCINS OBTAINED FROM BACTERIAL SPECIES UTILIZED IN FOOD FERMENTATIONS AND THEIR POTENTIAL USE FOR IMPROVED FOOD SAFETY

Gary W. Stoddard, Department of Food Science & Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108.

Researchers throughout the world are searching for and investigating the presence of bacteriocins (antagonistic proteins) in a wide variety of industrially important bacterial genera. Lactic acid bacteria used in a variety of food fermentations have attracted a great deal of attention and numerous bacteriocins produced by them have been extensively studied. These "food grade" bacteriocins have shown great diversity in their inhibitory effects towards both closely related and unrelated bacterial species. Several of these bacteriocins have demonstrated potent inhibitory effects in host range studies. The study and legalization of bacteriocins in food systems has centered on the bacteriocin, nisin. There appears to be limitless potential for using a variety of specific bacteriocins in extending shelf life, reducing spoilage and increasing food safety. This potential is enhanced by available methods in genetic and protein engineering for increasing or decreasing host range and specificity.

CHEESE RIPENING MICROBIOLOGY

Raj Nath, Kraft General Foods, 801 Waukegan Road, Glenview, IL 60025.

Cheese manufacturing is a process of dehydration of milk where rennet enzymes, acid development by starter cultures and application of heat aid the expulsion of moisture. Application of rennet enzymes is common to all natural cheeses but, it is in the use of different cultures coupled with different manufacturing steps that yield different cheese types.

Limited, but essential, proteolysis of milk protein by rennet enzymes augments the shift of microbial populations, which in turn, are pressed into summoning those metabolic activities, which must transform the milk components simply to survive. In doing so, the chemical entities generated interact among themselves and the microbial populations to result in a more flavorful and preserved milk.

Lactic starter cultures are added to vat milk to give about 10^6-10^7 cfu/ml. The amount and type of starter may vary significantly depending on the type of cheese and characteristics desired. In cheese, the primary culture (lactic cultures) decline with age whereas, secondary cultures such as propionibacteria in Swiss cheese and brevibacteria in Brick cheese and the adventitious lactobacilli thrive. Factors leading to microbial shifts during cheese ripening are discussed.

SAFETY OF CHEESE MADE WITH HEAT TREATED MILK

Vincent L. Zehren, Schreiber Foods, Inc., P.O. Box 19010, Green Bay, WI 54307-9010.

In the winter of 1987, the members of the National Cheese Institute were concerned about the possible demise of the widely used heat treatment procedure, if the 60-day hold provision was repealed. The effectiveness of heat treatment and the legal required 60-day hold was ill defined and questioned.

Drs. John Nelson, Mark Johnson and Eric Johnson, at the University of Wisconsin-Madison, were commissioned by the National Cheese Institute to prepare a white paper. Their treatise explores the effectiveness of the heat treatment of raw milk that assures the microbiological safety of cheese. Alternative techniques for the treatment of raw milk were also explored.

Recent research has affirmed that milk treated at 65-65.5°C (149-150°F) for 16-18 seconds virtually destroys all pathogenic microorganisms which are a major threat to the safety of cheese. *Salmonella*, *Listeria monocytogenes* and enteropathogenic *Escherichia coli* are judged major threats to the cheese industry. *Staphylococcus aureus* is considered low risk because it is readily controlled by modern lactic acid culture technology and acidity (pH) control in the cheese.

It was shown that there are a multiplicity of factors other than pasteurization that contribute significantly to the safety of cheese. These include milk quality management, heat treatment, hydrogen peroxide/catalase treatment, bactofugation, lactic culture management, pH control, salt addition and controlled curing conditions. Other opportunities such as the activation of natural inhibitory substances in milk and use of antibacterial substances, as nisin and lyzozyme, have potential application. It is imperative to research and to develop the relationships and synergistic behavior of all the different food safety technologies to establish effective food safety procedures. Neither pasteurization nor any other single technology can assure the safety of cheese.

BIOFILMS

BIOFILMS: AN OVERVIEW OF WHAT THEY ARE, THEIR SIGNIFICANCE

J.W. Costerton, Biological Sciences, University of Calgary, 2500 University Drive NW, Calgary, Alberta T2N 1N4, Canada

Bacteria show a very pronounced tendency to adhere to available surfaces in aquatic ecosystems and this adhesion leads to the formation of microbial biofilms within which the proliferating adherent cells are enclosed in a copious matrix of secreted exopolysaccharid. The adhesion event exerts a profound effect on bacteria in that it alters their physiological processes, their surface structures, and their relationships to the bulk fluid environment. Generally, biofilm bacteria are protected from physical and chemical antibacterial factors such as drying, sonication, irradiation, surfactants and toxic biocides and all modern disinfection techniques are invalid for use in the food industry unless they are shown to be effective against biofilm bacteria. When we test cleaning and disinfection methods against well-protected biofilm bacteria, we can be confident that they will be effective in real systems.

DEVELOPMENT OF BIOFILMS IN FOOD PROCESSING ENVIRONMENTS

Edmund A. Zottola, Department of Food Science & Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108

Biofilms are microcolonies of bacteria closely associated with an inert surface attached by a matrix of complex polysaccharide material. Other debris, nutrients and microbes may be trapped in the matrix. Research on the formation of biofilms on stainless steel food contact surfaces was initiated in my laboratory 10 years ago. The majority of the effort has been directed at the mechanism of attachment of *Pseudomonas fragi* ATCC 4973 to stainless steel. It appears that this organism attaches to stainless steel by means of a complex polysaccharide material. Disruption of attachment may or may not be accomplished with commonly used cleaning and sanitizing methods. We have also shown that *Listeria monocytogenes* and *Yersinia enterocolitica* are able to attach to stainless steel under varying cultural conditions. Research has shown that two or more organisms grown together in contact with stainless steel form what appears to be a more complex biofilm.

MICROBIAL ECOLOGY OF LISTERIAE-CONTAINING BIOFILMS

Joseph F. Frank, Department of Food Science & Technology, University of Georgia, Athens, GA 30602

Listeria spp. grow in the food processing environment within multispecies biofilms. Microbial interactions may occur within these biofilms resulting in consistent relationships between groups of microorganisms. Competition for attachment sites and nutrients, oxygen limitations, and production of growth stimulants and inhibitors act to provide predictable microbial relationships within biofilms. Survey data has identified associations between listeriae and microbial groups such as staphylococci, aerobes, salt tolerant aerobes and fungi in dairy processing environments. Survey results indicate that staphylococci and salt tolerant aerobes have a high degree of association with listeriae. A predictive model was developed which allows a risk assessment for listeriae contamination of a surface based on the number of staphylococci. Research on the ecology of listeriae-containing biofilms could provide a foundation for developing efficient sanitation practices within the food industry.

ANALYSIS OF BIOFILM FORMATION: CONFOCAL LASER MICROSCOPY AND COMPUTER IMAGE ANALYSIS

Douglas E. Caldwell, Department of Applied Microbiology & Food Science, University of Saskatchewan, Saskatoon, Saskatchewan S7N 0W0, Canada

Computer assisted light microscopy and confocal laser microscopy were used to study the colonization of glass and other surfaces in continuous-flow slide culture. Analog video recordings and on-line video signals were digitized in real time and analyzed using a Kontron, IBAS 2000 image processor. A Biorad MRC-500 confocal laser system with argon laser (488 and 514 nm emission peaks) was used for laser microscopy. Fluorescein was used as a negative fluorescent stain to image non-fluorescent cells. Several other fluorescent probes, including resazurin, carboxyfluorescein, and FITC conjugated dextrans, were used to image the physicochemical characteristics of cells, cell aggregates, and biofilms. These techniques provided detailed quantitative information concerning the growth kinetics and behavioral adaptations of bacteria colonizing surface microenvironments. This included growth rates, attachment rates, detachment rates, directions and rates of motility, analysis of cell distribution and orientation, distribution of exopolymers, cell viability, cell metabolism, predation rates, biofilm architecture, and response to salinity, light, antibiotics, hypochlorite, as well as other antimicrobial agents and environmental stresses. Pseudocolor maps of pH, Eh, and molecular sieving were also produced for surface microcolonies and for microbial biofilms. From these analyses it is apparent that the behavioral response of a bacterium to a surface is specific and highly dependent upon grazing pressures as well as ambient environmental conditions. This behavioral specificity is possible through genetically controlled adaptive strategies involving the type, timing, and rate of exopolymer production, morphogenesis, attachment, detachment, flagellation, and growth.

A MICROBIAL PROCESS ANALYSIS APPROACH TO MEASURING AND EVALUATING BIOFILMS IN FOOD PROCESSING SYSTEMS

R. Cahoon, National Engineering Research Center, Montanta State University, Bozeman, MT 59717

Microbial cells attach to surfaces and combine with extracellular organic and inorganic materials to form a deposit termed a "biofilm." Biofilms can be defined in terms of microbial and chemical composition, and as the cumulative result of several interactive processes.

The existence of biofilms on product-contact surfaces of food process systems has significant health and product quality implications. This is due to the documented evidence for tightly adherent attachment of pathogenic microbial cells (e.g. *Listeria, Salmonella*), persistence of sessile populations despite sanitization procedures (e.g. *Thermodurix* in HTST systems), and the numerous sites and materials within food process systems that present potential sites for biofilm formation.

Process analysis provides a conceptual framework for understanding biofilms as well as a means to quantitatively describe them in terms of transport, attachment, detachment, growth, chemical transformation, sloughing, and death processes and the net of these processes which results in surface accumulation. Spatial distribution, population dynamics, and microhabitats (e.g. dissolved 0_2 gradient in films) must also be considered.

The key to understanding biofilm processes is measurement of these processes. Discrete and on-line measurement of fluids and surface deposits at critical locations is the basis for effective biofilm monitoring; and it is monitoring that is esscntial for control of biofilms and the problems that they cause. Process analysis provides the tool to integrate the data obtained via monitoring into meaningful information.

Further understanding of biofilms in food systems is necessary, and this requires research approaches that simulate the open-system nature of real systems, and emphasize quantification of rate and extent of constitutent processes and elucidation of chemical and microbial composition.

USE OF BIOCIDES TO CONTROL BIOFILMS

Melvin H. Czechowski, Diversey Corporation - International Biocide Laboratory, 1532 Biddle Avenue, Wyandotte, MI 48192

Biocides (hypochlorite, iodophor, mixed halogen and acid anionic) at ClP use-concentrations were evaluated against pathogenic bacteria *(Yersinia enterocolitica* and *Salmonella typhimurium)* attached to surfaces (Buna-n, Teflon and stainless steel). Bacteria on stainless steel survived biocide treatment better than those either on Teflon or Buna-n. Surface-attached *Salmonella typhimurium* was more difficult to kill than attached *Yersinia enterocolitica.* With either bacteria, as biocide concentration or treatment time increased, more bacteria were killed. At the lowest in-use concentration and shortest time interval, the mixed halogen (iodine and chlorine) was the most effective biocide. These results show that not all surface-attached

bacteria are killed by commonly used biocides. Thus, bacteria on inadequately cleaned surfaces may not be killed by biocides, and the survivors could potentially contaminate foods.

CONSEQUENCES OF BIOFILMS AND BIOCIDE EFFICACY

J. Russell Bishop, Department of Food Science & Technology, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061

The significance, development, ecology, analysis, evaluation, and biocidal efficacy of biofilms are much-researched. We have learned a great deal concerning biofilms, but are still uncertain as to their ultimate consequence in food processing situations. They exist, "shed" cells, are difficult to remove, and encompass known environmental pathogens. When considering biocidal efficacy, what should the "kill" parameters be — 3-log in 30 seconds, 5-log in 1 min., etc? What level of kill is achievable and what level of kill is needed? Can we afford less than a 100% kill of *Listeria monocytogenes* or *Yersinia enterocolitica* or *Salmonella typhimurium*? When we have continuous high counts in finished product, we thoroughly clean and sanitize the system and change the gaskets, and counts go back down. Were the gaskets a harborage for biofilming? For the food industry to meet the future challenges of a more discerning consuming public, we must fully understand the consequences of a potential source of contamination.

LISTERIA

TEMPERATURE SHIFT EFFECTS ON INJURY AND DEATH IN *LISTERIA MONOCYTOGENES*

James L. Smith*, USDA and Benne S. Marmer, USDA, Eastern Regional Research Center, USDA, ARS, 600 E. Mermaid Lane, Philadelphia, PA 19118

The extent of death and injury in *Listeria monocytogenes* (Scott A strain) is dependent on growth temperature, i.e., the cells become increasingly less heat resistant as the growth temperature decreases. When *L. monocytogenes* is grown at 37°C, heating cells at 52°C for one h is only slightly lethal whereas cells grown at 28, 19 or 10°C are more heat sensitive. Shifting cells grown at lower temperatures to 37°C for 2.5 to 5 h led to cells that had increased heat resistance, i.e., the cells grown at lower temperatures behaved more like 37°C grown cells. Addition of 50 to 100 µ g/ml chloramphenicol prevented the shift-up effect whereas 50 to 100 µ g/ml ampicillin had little effect. The antibiotics results suggest that protein synthesis may be necessary for the shift-up increase in heat resistance. However, cells grown for 12 h at 37°C and then shifted to 19°C for 12 h did not show decreased heat resistance. The results indicate that *L. monocytogenes* present in foods at low temperatures (and growing) will become more heat resistant if the food is temperature abused.

EFFECTIVE CONTROL OF *LISTERIA MONOCYTOGENES* IN A DAIRY PROCESSING AND PACKAGING PLANT BY ISOTHIAZOLONE MICROBICIDE

J. Charles Hsu, Rohm and Haas Co., Research Division, 727 Norristown Road, Springhouse, PA 19477

The incidence of contamination with *Listeria monocytogenes* in food, especially dairy and beer products, has caused public health concerns. A microbicide, 2-Methyl/5-Chloro-2-Methyl Isothiazolones (MCI), was evaluated for the control of *L. monocytogenes* on the conveyors in a dairy processing and packaging plant. This conveyor lubrication system used about 3,200 gallons of a 1:125 dilution of the lubricant per day. The pH of the use-dilution lubricant was 11. Microbial slimes and *L. monocytogenes* were present on the conveyors at the start of the trials. The MCI microbicide provided complete control of *L. monocytogenes* when it was incorporated in the use dilution of a conveyor lubricant at a continuous dosing rate of 10 ppm active ingredient. At this use rate, the overall microbial population on the conveyors was also greatly reduced. The same treatment regimen is recommended for most conveyor lubricants to control Listeria on the conveyors.

VIRULENCE OF *LISTERIA MONOCYTOGENES* IN A PREGNANT ANIMAL MODEL

A.M. Lammerding*, K.A. Glass, A. Gendron-Fitzpatrick, and M.P. Doyle, Food Research Institute, 1925 Willow Drive, University of Wisconsin, Madison, WI 53706

A pregnant mouse assay has been developed to assess the potential ability of different strains of *Listeria monocytogenes* to infect fetal tissues after oral administration. BALB/c mice, at 10 to 12 days gestation, were inoculated with a human clinical strain, *L. monocytogenes* Scott A, serotype 4b, at a dose of 10^9 cells. The test animals were sacrificed over a 5-day period and samples analyzed by microbiologic and histopathologic examination. The organism proliferated in the gastrointestinal tract and within 24 h had spread to the liver and spleen. By day 3, the placental tissues of some, but not all, of the pregnant mice were infected. Infection of fetal tissues did not occur until days 4 and 5 postinoculation. By contrast, a rough isogenic mutant of *L. monocytogenes* Scott A failed to consistently infect the fetal tissues, although the rough strain exhibited the same LD_{50} as the parent strain when administered intraperitoneally to nonpregnant mice. This model will be used to differentiate between phenotypically similar strains of *L. monocytogenes* isolated from various sources.

VIRULENCE OF *LISTERIA MONOCYTOGENES* HEMOLYSINS

P.I. Peterkin*, E.S. Idziak and A.N. Sharpe, Bureau of Microbial Hazards, Health Protection Branch, Health and Welfare Canada, Tunney's Pasture, Ottawa, Ontario, Canada K1A 0L2

Clones of a *Listeria monocytogenes* gene bank in *Escherichia coli* expressing ß-hemolytic activity were shown to be lethal to mice. Non-hemolytic clones and a weakly-hemolytic clone were not virulent. Evidence based on insert size suggested that an additional or alternate gene product may not be required for mouse virulence, and that the presence of hemolysin was a sufficient cause of the virulence of these recombinant clones. Studies on the insert DNA of the clones including restriction mapping and probing of Southern blots, indicated the possible presence of a determinant for a second hemolysin.

BEHAVIOR OF *LISTERIA MONOCYTOGENES* IN THE PRESENCE OF LACTIC ACID BACTERIA IN A MEDIUM WITH INTERNAL pH CONTROL REQUIRING AGITATION (IPCM-2)

J.M. Wenzel*, and E.H. Marth, Department of Food Science, University of Wisconsin-Madison, 1605 Linden Drive, Madison, WI 53706

A medium with internal pH control (IPCM-2) was inoculated with *Listeria monocytogenes* (strain V7, Scott A or California) to contain ca. 10^3 cfu/ml plus 0.25 or 1.0% lactic acid bacteria (*Streptococcus cremoris* or *S. lactis*) and placed in a shaking waterbath at 30°C for 30 h. Populations of *Listeria* and lactic acid bacteria and pH were determined at appropriate intervals. This medium is ready for use when a pH of 5.4 or less is reached, which occurred at 12 and 15 h of incubation in samples containing 1.0 and 0.25% *S. cremoris*, respectively. Then *Listeria* populations, in all instances, were ca. 10^4-10^5 cfu/ml. A pH of 5.4 was not reached until 18 and 24 h of incubation in samples containing 1.0 and 0.25% *S. lactis*, respectively. At this pH all strains of *Listeria* behaved similarly and had grown to ca. 10^5 cfu/ml regardless of percentage of *S. lactis*. Although, when compared to controls, inhibition of *Listeria* occurred in samples containing the pathogen plus the lactic culture, substantial numbers of the pathogen were present when the medium was ready for use.

FACTORS CONTRIBUTING TO GROWTH INHIBITION OF *LISTERIA MONOCYTOGENES* IN RAW EGG ALBUMEN

Chi Wang* and Leora A. Shelef, Department of Nutrition & Food Science, Wayne State University, Detroit, MI 48202.

The presence of *Listeria monocytogenes* (LM) in poultry and on the eggshell is well documented, leading to potential contamination of the raw egg. In the course of work on survival and growth of LM in raw eggs, we

observed cell proliferation in the egg yolk, growth suppression in the whole raw egg, and listeriocidal effects in the egg albumen. The present study was undertaken to investigate sensitivity of the organism to several factors in the raw albumen, which may contribute to the observed effects. Inhibition of growth depended upon the amount of egg albumen added to trypticase soy broth (TSB). A concentration of ca. 15% was listeriostatic to 10^5 cells/g after 24 h at 35°C, and listeriocidal effects showed at higher albumen concentrations. Egg albumen lysozyme added to TSB inhibited growth at a concentration of 3 mg/ml. Rapid heating of the albumen to temperatures between 50° and 80°C prior to inoculation showed progressive loss of the antibacterial effects, and heating to 80° resulted in growth of $7x10^8$ cells/g after 24 h at 35°C. Addition of ferric ammonium citrate to egg albumen enhanced LM survival.

GROWTH SUPPRESSION OF *LISTERIA MONOCYTOGENES* BY SODIUM OR POTASSIUM LACTATE IN COOKED CHICKEN OR BEEF

Leora A. Shelef* and Qian Yang, Department of Nutrition & Food Science, Wayne State University, Detroit, MI 48202

Na or K lactate is available commercially as a neutral water solution (60%), approved for use as a flavoring agent in meat and poultry products. While it is recommended for extending the shelf life of fresh and cooked meats, little work on the antimicrobial effects in meat or other foods has been published, and none in relation to *Listeria monocytogenes*. We report here experiments in sterile minced chicken or beef samples containing 0 and 3% Na or K lactate, inoculated with *L. monocytogenes* strain Scott A and incubated at 5, 20, and 35°C for 21, 5, and 3 days, respectively. Suppressed growth was observed in lactate-containing chicken or beef, with one exception (chicken, after 3 days at 35°C). Ultimate difference in cell numbers between treated and untreated samples increased with decrease in incubation temperature in chicken, and was ca. 1.5 log cycle in beef, irrespective of incubation temperature. No difference was observed between the inhibitory effect of the Na or K salts, inferring that the lactate is responsible for the delay in listerial growth.

SURVIVAL OF *LISTERIA MONOCYTOGENES* IN SYNTHETIC EGG WASHWATER

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Three strains (Scott A, 78-34, and 81-861) of *Listeria monocytogenes* were subjected to various combinations of temperature (27, 33, and 42°C) and pH (6.5-10.5) in synthetic egg washwater containing 1% egg solids. All three strains were able to survive normal washwater conditions (i.e. pH 10.5/42°C) for at least 1 hour; significant numbers of Scott A remained viable after 4 hours. Survival of all strains was greater in the higher pH washwater than for washwater near neutrality. The effect was reversed when egg solids were omitted from the synthetic washwater preparation. The results suggest that, given the ubiquitous nature of *L. monocytogenes*, washwater can serve as a source of contamination of washed eggs with this bacterium.

USE OF A BACTERIOCIN PRODUCED BY *PEDIOCOCCUS ACIDILACTICI* TO INHIBIT *LISTERIA MONOCYTOGENES* ASSOCIATED WITH FRESH MEAT

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A bacteriocin produced by *Pediococcus acidilactici* had an inhibitory and bactericidal effect on *Listeria monocytogenes* associated with fresh meat. Minimum inhibitory concentrations were significantly lower than minimum killing concentrations. When meat was inoculated with *L. monocytogenes*, the bacteriocin reduced the number of attached bacteria in two minutes by 0.5 to 2.2 log cycles depending upon bacteriocin concentration and inoculum size. Meat treated initially with the bacteriocin resulted in attachment of from 1.0 to 2.2 log cycles fewer bacteria compared to the control. The bacteriocin, after 28 days of refrigerated storage on meat surfaces, was stable and exhibited an inhibitory effect on *L. monocytogenes*. Use of the bacteriocin in conjunction with traditional sanitary procedures could be an effective method of controlling *L. monocytogenes* contamination.

PERSISTENCE AND CONTROL OF *LISTERIA MONOCYTOGENES* IN NON-FOOD CONTACT AREAS IN A FOOD PROCESSING PLANT

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A model system consisting of a free-standing sewer trap was developed and used to evaluate the growth and persistence of *L. monocytogenes* under simulated conditions that might occur in sewer traps in a food processing plant. Nutrients added to one trap included tryptic soy broth with yeast extract. Milk solids were added to a second trap. *L. monocytogenes* was added to each and growth monitored for up to 16 weeks. The traps were maintained at room temperature (25°C).

Population levels in excess of 10^8 were observed in 7 days. The pH of the material in the sewer trap containing TSBYE was adjusted to 8.5 for several days and then to 5.5 for several days. This change did not affect the numbers of Listeria as they continued to persist for the remaining test period. In the trap containing milk solids, a nisin-producing culture of streptococci was added and allowed to grow. After 4 weeks Listeria were not recovered. Addition of nisin-producing streptococci may be a method to control Listeria in sewer traps in a food processing plant.

INHIBITION OF *LISTERIA* SPECIES BY *BACILLUS* IN RAW MILK

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The growth of *Listeria* has been found to be inhibited by an unknown species of *Bacillus*. During routine laboratory testing for Listeria in raw milk, it was observed that the growth of Listeria was hindered by the interference of other microorganisms. An organism was isolated which completely inhibited Listeria growth and was identified as *Bacillus*.

Further testing will be done to identify this *Bacillus* to species. This particular species is able to produce a large zone of hemolysis on a blood agar stab. It appeared that the *Bacillus* inhibited Listeria on Listeria-selective media. The potential exists to use this organism as a biological agent to control *Listeria monocytogenes* in food samples.

THE POTENTIAL FOR USE OF DIACETYL AS A BACTERIOSTATIC AGENT IN FOOD SYSTEMS

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The effect of diacetyl on the growth and survival of *Listeria monocytogenes* was examined. Minimum inhibitory concentrations (MIC) were determined for the four strains of *Listeria monocytogenes* in trypticase soy broth with yeast extract (TSB-YE) at pH 5.5 and pH 7.0. Cultures were heat-shocked for 5 minutes at 55°C in TSB-YE with 0-1,000 ppm diacetyl at pH 6.5 and pH 5.5. Treated cells were plated on trypticase soy agar with yeast extract (TSA-YE) and Oxford agar and incubated at 35°C. Heating in TSB-YE with 1,000 ppm diacetyl resulted in a larger decline in population at pH 6.5 than at pH 5.5. A comparison between recovery on TSA-YE and Oxford agar indicated more cells were injured at pH 5.5. These results suggest that diacetyl, in conjunction with heat, can cause microbial injury and death.

BIOTECHNOLOGY AND THE DAIRY FOOD INDUSTRY

BOVINE SOMATOTROPIN - EFFECTS ON MILK AND MILK COMPOSITION

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Bovine somatotropin (bST) is a protein hormone produced by the pituitary gland of the dairy cow. Bovine somatotropin is normally present at very low levels in milk. Administration of bST to lactating dairy cows increases the efficiency of milk production but does not change the level of bST in milk. Through advances in biotechnology it is commercially feasible

to produce bST by fermentation. A full lactation study of the chemical composition of milk produced by cows supplemented with bST (n=39 control and n=40 supplemented) concluded that the flavor, composition, processing and quality characteristics of milk produced by bST supplemented cows were within the normal range of biological variation observed for unsupplemented cows. Many other investigators have reported similar results. The FDA has concluded that milk from bST supplemented cows is safe because: 1) bSt is not active in humans even if injected, 2) bST is normally present in milk and its level is not changed by this technology, and 3) bST is a protein and is digested like any other protein when consumed.

DAIRY

BACTERIAL QUALITY OF VANILLA ICE CREAMS PURCHASED AT STORES IN PENNSYLVANIA

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Samples of vanilla ice cream have been purchased at stores in Pennsylvania for a number of years. Evaluations of flavor, body and texture have been made. Weight, total solids and milkfat content have been determined, also. Those criteria used by consumers have greatly improved. Most samples have met composition and weight requirements. Starting in 1989, bacterial analysis of these samples was made prior to any other tests or evaluations being done. A high percentage of these samples met the bacterial limits set by most states of less than 10 coliforms and less than 50,000 Standard Plate Count per gram. In fact, the majority of samples contained less than one coliform and less than 1,000 Standard Plate Count per gram. This would indicate that ice cream manufacturers were following recommended sanitation practices which resulted in a product of good bacterial quality.

A SURVEY OF FLUID MILK PROCESSING PLANTS FOR AIRBORNE CONTAMINATION USING VARIOUS SAMPLING METHODS

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Air in four commercial fluid milk plants was sampled for physical and microbiological particles over a period of 5 d at each plant. Sampling methods utilized Andersen 2-stage and Ross-Microban sieve samplers, a Biotest RCS sampler, and a MET-one laser particle counter. Locations, including raw milk storage, processing, and filling areas, were sampled 2 to 3 times per day. Log mean viable particle counts per 100 l air obtained with the Andersen sampler were 2.03 ± 0.41, 2.26 ± 0.57 and 2.41 ± 0.70 in raw milk storage, processing and filling areas, respectively. These levels were significantly ($p < 0.01$) greater than those obtained using the RCS and Ross-Microban samplers. Overall correlations of the Ross-Microban and RCS samplers with the Andersen sampler were $R^2 = 0.71$ and 0.62, respectively. Correlations between Andersen sampler results and number of physical particles greater than 0.5µ were R^2 0.36 in raw milk storage, 0.15 in the processing area, and 0.18 in the filling area. This study indicates that substantial airborne contamination exists in commercial fluid milk plants and that it can be readily monitored using simple instrumentation.

POTENTIAL FOR COLD-PASTEURIZATION OF MILK USING MICROFILTRATION

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Microfiltration (MF) is a new membrane separation technique finding increasing application in the dairy industry. The membranes are purported to allow permeating of all components while rejecting passage of bacteria. Interest lay in determining whether MF could be used as a cold-filtration/sterilization process for dairy fluids.

There were two aspects to the study. The first was whether MF can remove native and inoculated spoilage and pathogenic microbes from dairy fluids. The second aspect was to determine if the separation was a membrane effect or a decline due to operational temperatures.

Raw milk, reconstituted skim milk (RSM), skim milk, and whey were microfiltered or inoculated and microfiltered using various membranes and microfiltration units from several manufacturers. Operational temperatures were 30°C and 53°C. Both permeate and retentate streams were monitored. The physical analyses consisted of temperature, pH, per cent total solids, and component balance. The microbiological analyses consisted of plate counts on appropriate media.

Native, spoilage, and pathogenic microbes were observed to pass through the membranes. Results were a function of the dairy fluid filtered, operational parameters, membrane characteristics, and microbial species.

DEVELOPMENT OF A NISIN-PRODUCING STARTER CULTURE SUITABLE FOR CHEDDAR CHEESE MANUFACTURE

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Use of nisin producing starters for production of rennet-type cheese has been hampered by their slow acid development. Initial attempts to increase acid development in mixed cultures of nisin-producing and non-nisin-producing co-cultures by electroporating pFG010 ($Nis^r Em^r$) into *L. lactis* subsp. *lactis* C2 were successful. However, nisin assays revealed that the mechanism of nisin resistance resulted in elimination of nisin from the system. Screening of known nisin producers for proteinase activity by monitoring growth in milk and subsequently for acid production during Pearce activity tests resulted in a starter culture employing *L. lactis* subsp. *lactis* NCDO 1404 and *L. lactis* subsp. *cremoris* JS102. Cheddar cheese manufactured using this starter exhibited a normal manufacturing profile, was of acceptable flavor and contained about 100 IU nisin/gram as determined by agar diffusion assay. Nisin producing starters may be useful in controlling certain gram positive pathogens during manufacture and storage of rennet-type cheese.

MODE OF ANTIMICROBIAL ACTIVITY OF LACTOBACILLI AND YOGURT

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Yogurt was prepared from selected strains of *S. thermophilus*, *L. delbrueckii* ssp. *bulgaricus* and *L. acidophilus* having maximum antimicrobial activity (AA) towards *Yersinia*. Acidophilus yogurt and typical yogurt were contaminated with *Yersinia enterocolitica* at two levels and the survival of the pathogen was monitored during storage at 4°C for 48 hours to study the inhibitory mechanism. *Yersinia* counts were determined on Yersinia Selective Agar. Only lactobacilli appeared to cause antibiosis, and *S. thermophilus* showed little or no antibiosis. The AA was not a function of the *Yersinia* load.

The reduction of *Yersinia* was due to the fermentation products. Hydrogen peroxide was not significantly responsible for the antibiosis as delineated by the addition of catalase. Neutralization of yogurt resulted in annihilation of AA. Weak acids such as lactic and propionic acids were more detrimental to *Yersinia* than nitric or hydrocholoric acid. The AA of yogurt appeared to be due to the undissociated moiety of lactic acid.

DAIRY INDUSTRY EDUCATIONAL PROGRAMS IN PENNSYLVANIA

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Dairy industry employees are interested in learning how and why they should carry out their responsibilities. Producers have had access to programs to help them do a better job for many years. Meetings or conferences have been conducted for milk haulers, regulatory sanitarians, industry field staff, and laboratory technicians. Now efforts have been made to conduct programs for processing plant workers. These dairy industry employees are the final link in providing consumers with high quality milk and dairy products. Educational institutions have conducted a variety of specific programs for these processing

plant employees. Evaluation has indicated great interest and participation of those programs conducted by Penn State University. These include processor meetings at six locations, a food sanitation conference, a pasteurizer operator's workshop, a dairy laboratory workshop, and an ice cream short course.

DAIRY DRUG RESIDUES

PHILOSOPHY OF ANTIBIOTIC RESIDUE TESTING

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The testing of antibiotic residues in foods, especially milk, is an ever-changing challenge made more difficult by the number of antibiotics and drugs being used, and the questions of level of concern and level of detection. Methodology development involves scientific theory, laboratory techniques, regulatory policy, and overall industry philosophy. This "philosophy" may not always be based on sound scientific information but may result from lack of adequate risk-benefit analysis, media hype, or a false sense of imminent danger. In order for the food industry and regulatory agencies to put this issue in proper perspective, the approach must be a well-established protocol based on knowledge rather than a knee-jerk reaction to quell whatever is the pressing item at that time. The impact of industry, regulatory, academic, and consumer "philosophies" will be discussed in greater detail.

A DRUG MANUFACTURER'S PERSPECTIVE ON DRUG RESIDUES IN MILK

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It is in the best interest of all parties, dairymen, veterinarians, consumers, milk processors, the pharmaceutical industry, and others, that violative drug residues in milk and other edible commodities be held to a minimum. Critical issues addressed herein are 1) definition and interpretation of "violative" residues and 2) definition and understanding of "minimum."

The US Food and Drug Administration has responsibility within the USA 1) for establishing tolerances for drugs in milk of treated animals, and 2) for establishing screening and confirmatory residue detection methods consistent with the tolerances. Tolerances are established on the basis of extensive drug toxicology data from multiple animal species and from metabolism data obtained from both laboratory animal species and the target animal to assure that laboratory animals are auto-exposed to the same drug(s) as would humans when consuming edible tissues (milk) from treated animals. These procedures and bases for establishing tolerances are public documents and have been arrived at based on inputs from all interested persons.

Milk discard intervals are established on the basis of the tolerance and a statistical tolerance limit procedure which provides assurance that, when products are used at maximum label provisions, the milk will not contain drug residues in excess of the established tolerance.

The "minimum" factor is determined by the statistical procedure including applied confidence limits. One procedure used by FDA provides for a milk discard time within which lies the 99th percentile of the target population. The upper 95 percent confidence interval on the discard time provides the "minimum" definition to this procedure.

Drug concentrations that exceed the tolerance are, by definition, deemed unsafe or "volatile." Drug concentrations, even though measurable, that are less than the tolerances are, again by definition, deemed safe. Application of residue detection methods that measure drug concentrations below the established tolerance lead to confusion and, therefore, problems for all of us. Application of methods that are nonspecific also add to the confusion. It is proposed that tolerances and residue detection methods approved by FDA be universally applied for residue determinations.

DAIRY FARM

THE BST (BGH) DILEMMA: IMPLICATIONS FOR INDUSTRY

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An editorial in the May 1, 1990 issue of the New York Times stated, "The dairy industry and consumers everywhere will be losers if the obscurantist (opposition to the increase and spread of knowledge) fight against new technology should prevail." A review of the situation in Wisconsin where facts concerning BST became secondary and political motivation became the primary driving force is a cause for great concern. While BST was the issue, many feel that it was only the tip of the iceberg and offers potential problems for the future of biotechnology statewide as well as nationally.

APPLICATION AND USE OF VETERINARY PRESCRIPTION DRUGS

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Drugs are either over-the-counter (OTC) or prescription (Rx). Certain criteria must be adhered to if either are used in an extra-label fashion. A veterinary-client-patient relationship must be maintained for extra-label usage. All veterinary drugs must be correctly labeled including an adequate withdrawal time. Some drugs are not allowed in dairy cattle under any circumstances. Knowing that drug residues are not acceptable in milk, veterinarians are concerned with the moving definition of zero caused by changes in detection technology.

MEMBRANE FRACTIONATION ON THE FARM: POTENTIALS AND PITFALLS

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Membrane fractionation of on-farm milk research in Europe and the United States is reviewed, including the year-long California study involving 12 million pounds of milk. This milk was thermalized and concentrated up to 2X at the farm and delivered to various cheese plants for processing. Results show feasibility of UF at the farm and that the concentrate can be handled and processed in cheese plants designed for single-strength milk. Cheese produced was equal to or better than that produced conventionally.

Advantages and disadvantages of application are discussed. Future application needs equitable pricing, acceptance of component pricing and a sharing of the processor's savings with the producer.

Approval by IMS, FDA and FMMA will be the biggest hurdle.

CONTAGIOUS MASTITIS

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The common contagious mastitis organisms are *Streptococcus agalactiae* and *Staphylococcus aureus* with *Mycoplasma* also being prevalent in certain areas. Although some of these organisms can exist in the environment, the chief reservoir is the milk in an infected udder. These organisms are well adapted to survival in the udder and are usually associated with chronic high somatic cell counts and milk subclinical infections of long duration. Transmission from infected to uninfected quarters and cows occurs mainly at milking time.

The key to controlling contagious mastitis relies on a continuous monitoring system. Tools to evaluate this, such as DHI-SCC, individual cow cultures, and bulk tank milk cultures will be discussed.

Controlling contagious mastitis hinges on prevention of new infections. The roles of proper milking procedures and milking equipment and their relationship to efficient milking and mastitis will be discussed.

The other facet to controlling contagious mastitis is decreasing the duration of existing infections. The role and economics of antibiotic and treatment, both lactating and dry, as well as other supportive therapy will be discussed.

ESSENTIALS OF A QUALITY MILK PROGRAM

D. Berg, Land O'Lakes, P.O. Box 116, Minneapolis, MN 55440-0116.

Quality milk is an attitude — a commitment — and a team effort. Quality is more than a marketing ploy to the dairy industry. It is our way of life.

First of all, we should take pride in our many accomplishments and

communicate our success to consumers on a continuing basis. Our accomplishments far outweigh our problems.

The primary challenge we face is the fact that as milk moves through the production/processing/marketing system, quality is never improved, but rather continually challenged. This fact creates a situation where the quality of dairy products is established at the production level and all other segments must have a "caretaking" attitude that will minimize the deterioration of the initial quality to the point of consumption.

The old saying that cows don't market milk, people do, adds perhaps the most important aspect of our business — we are in the people business. This means attitudes toward quality are affected by motivation, recognition, and success. Quality cannot be a demand or a dictated element, but rather a committed attitude that is understood and supported by people throughout the production, processing, and marketing segments.

The challenges of the future include the adoption of new technology, continued pressure on cost savings, and increased challenges to quality caused by an intensified and varied distribution system coupled with a continuing expectation of "perfection" by our consuming public. In addition, the dairy industry will continue to receive challenge from new product innovation, creating new processing and marketing approaches as well as "substitute" products that stand ready to pick up market share whenever dairy products fail to meet consumer expectations.

FOOD SANITATION

SANITATION FROM ANOTHER PERSPECTIVE

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A sanitarian devotes his life to anticipating and preventing sanitation problems. On the other hand, an industry lawyer frequently doesn't hear about a sanitation problem until after the event. It must have been an industry lawyer who first said, "An ounce of prevention is worth a pound of cure."

The author will discuss specific post facto examples of sanitation problems, including food warehouses, grain elevators, wholesale distributors and rail cars.

The moral of the whole speech is "An ounce of prevention, etc. . . ."

GROWTH OF *AEROMONAS HYDROPHILA* AND *PLESIOMONAS SHIGELLOIDES* ON COOKED CRAYFISH TAILS STORED UNDER MODIFIED ATMOSPHERE, VACUUM AND AIR

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Growth of *A. hydrophila* and *P. shigelloides* on sterile cooked crayfish tails was monitored for 6d storage under an 80% CO_2/0% O_2 modified atmosphere (MA), vacuum, and air. Storage temperatures were 2 and 8°C for *A. hydrophila*, and 8, 11, and 14°C for *P. shigelloides*. MA was strongly inhibitory to *A. hydrophila* at 2°C and less inhibitory at 8°C.

A. hydrophila grew slowly under vacuum at 2°C, and at 8°C grew at a rate similar to that under MA at 8°C. At 2 and 8°C, growth of *A. hydrophila* was least inhibited under air. *P. shigelloides* did not grow under any storage treatment at 8°C.

MA effectively prevented *P. shigelloides* growth at 11°C, and slowed growth slightly at 14°C. Vacuum storage was less inhibitory than MA at 11°C and did not deter growth at 14°C. Growth of *P. shigelloides* was most rapid at 11 and 14°C under air.

THE EFFECT OF SANITARY PRACTICES ON THE MICROBIAL ECOLOGY OF A MEAT PROCESSING PLANT

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From the raw materials to the finished product, processed meats are highly susceptible to food spoilage organisms and to contamination by human pathogens. Optimal sanitation practices can limit the potential for both spoilage and disease. Attention to HACCP should be a prime target for operation of meat processing. Samples were taken of the raw and finished product areas from equipment and air for spoilage bacteria and fungi. In addition, spot samples were taken for several emerging pathogens in areas of potential contamination. Sanitized areas show significant reduction not only on surfaces but in air contamination levels.

SURVIVAL OF *CAMPYLOBACTER JEJUNI* UNDER MODIFIED ATMOSPHERES AND AFTER FREEZING IN PROCESSED POULTRY

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Campylobacter jejuni, a common intestinal inhabitant of poultry, is frequently implicated as the cause of acute human gastroenteritis. The objectives of this study were to (1) investigate the survival of *C. jejuni* during storage of chicken nuggets under freezing, refrigeration, and abuse conditions, and (2) evaluate the effect of various modified packaging atmospheres on the survival of *C. jejuni* in processed turkey roll. Two commercial brands of breaded, fully cooked, frozen chicken nuggets were inoculated with *C. jejuni*. Campylobacters decreased by $\log_{10}$ 3.0 CFU/g at -18°C over 6 wk of storage. A decrease of $\log_{10}$ 1.5 CFU/g was noted at 4°C after 6 d. At 21°C, *C. jejuni* numbers declined by $\log_{10}$ 4.0 CFU/g over 24 h. Sliced turkey roll inoculated with *C. jejuni* was stored under seven gas packaging mixtures at 4 and 21°C. Atmospheres containing oxygen (≥5%) were the most lethal to *C. jejuni*. Increasing carbon dioxide concentration resulted in an increase in *C. jejuni* survival, accompanied by greater inhibition of aerobic and psychrotrophic spoilage bacteria.

CONTROL OF *SALMONELLA ENTERITIDIS* IN POULTRY

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Antimicrobial compounds were screened *in vitro* in trypticase soy broth for activity against a virulent strain of *Salmonella enteritidis*. Of several compounds tested, polymyxins B and E showed the strongest inhibition. The minimum inhibitory concentration of polymyxin B SO_4 was 1-2ppm. Butylparaben (10 ppm) and EDTA (1mM) were also inhibitory *in vitro* to *S. enteritidis*. Polymyxin E (colistin methane sulfonate) was ineffective alone at 10 ppm but had inhibitory activity when combined with 10 ppm butylparaben. Inhibition of *S. enteritidis* was also tested *in vivo* using 24 hour chicks as a model system. The effectiveness of the antimicrobial systems were evaluated by their ability to prevent infections and to remove existing infections. Polymyxin was effective *in vivo* in preventing infection but was relatively ineffective in removing existing infections. Unexpectedly it was found that trimethoprim, which was not active *in vivo*, gave excellent activity in preventing and removing infections when combined with polymyxin B SO_4. Selenite-Cystine and Tetrathionate Broth enrichments showed that chicks that were given a combination of polymyxin B SO_4 and trimethoprim 24 h prior to oral inoculation with 10^8-10^9 CFU were *S. enteritidis* negative in seven days. Existing infections (10^5-10^6CFU/g feces) were eliminated with the polymyxin/trimethoprim system in 13 days. This antimicrobial system may be useful in preventing colonization or eliminating *S. enteritidis* from infected flocks.

THE SURVIVAL OF *SALMONELLA* IN TURKEY HAM HELD AT 4°C UNDER VACUUM AND AEROBIC ATMOSPHERES

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The survival of *Salmonella blockley*, *S. typhimurium* and *S. infantis* in vacuum and aerobically packaged turkey hams formulated with nitrite (156 ppm) and selected levels of NaCl (0.5-3.0%), sodium tripolyphosphate (STPP) (0 and 0.5%) and erythorbate (0 and 550 ppm) and stored at 4°C for 15 days was studied. Viable *Salmonella* in turkey hams in this study persisted for 15 days at 4°C in vacuum and aerobic atmospheres. Vacuum and aerobic packaging were not significantly different ($p>0.05$) in inhibiting the survival of *Salmonella* in turkey ham. *Salmonella* levels declined rapidly in vacuum packaged hams containing 2.5-3.0% NaCl and in aerobically packaged hams

containing 0.5% NaCl in combination , with erythorbate and STPP. Salt levels of 2.5-3.0% were also more effective than 0.5-2.0% in inhibiting the survival of psychrotrophs, lactobacilli, and aerobes in turkey hams held under vacuum packaging at 4°C.

COMBINED EFFECT OF MODIFIED ATMOSPHERE PACKAGING AND LOW DOSE IRRADIATION ON TOXIN PRODUCTION BY *CLOSTRIDIUM BOTULINUM* IN PORK

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The effects of three initial levels of oxygen (0, 10 and 20%), irradiation dose (0,0.5 and 1 kGy) and storage temperature (5, 15 and 25°C) on toxin production by *Clostridum botulinum* in modified atmosphere packaged pork inoculated with a mixture of proteolytic strains to approx. 10^3 spores/g were investigated using factorial design experiments. Toxin was detected after only 2 days in all treatments stored at 25°C. No toxin was detected in any sample stored at 5°C, even after 44 days. At 15°C, irradiated and non-irradiated treatments packaged with 10 or 20% headspace oxygen were toxic after 14 days. For product packaged with 0% oxygen and an oxygen absorbant, toxin was found after 21 days in non-irradiated samples compared to 43 days for product treated with 1 kGy. Headspace oxygen in product initially packaged with 20% oxygen decreased to 0.1% after 14 days at either 15 or 25°C, with concomitant increase in CO_2 to 25-40%. For product packaged with 0% oxygen and an oxygen absorbant, oxygen remained at <1.0% throughout the storage trial, while CO_2 increased to an average of 8.4%. Therefore, the initial packaging of product with oxygen appeared to enhance toxin production by *C. botulinum* in product stored at 15°C, probably due to increased levels of CO_2.

EXOPOLYSACCHARIDE PRODUCTION BY ENTEROHEMORRHAGIC *ESCHERICHIA COLI*

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Enterohemorrhagic *Escherichia coli* (EHEC) 0157:H7, a causative agent of hemorrhagic colitis and hemolytic uremic syndrome, has caused several outbreaks and cases linked to consumption of meat and dairy products. We have found that EHEC strains are capable of producing an exopolysaccharide (EPS). EPS was quantified by colorimetric determination of uronic acid content relative to protein content of whole cell suspensions. EPS is most strongly produced at temperatures below 30°C under aerobic conditions. Under similar conditions EHEC strains will attach to glass slides. While EPS production does appear to be influenced by peptones in the medium, no added carbohydrate is necessary for EPS synthesis. EHEC strains that have been cured of a 60-MDal plasmid produce EPS much more strongly aerobically at 25°C than do parental strains, but parental strains appear to produce more EPS than cured strains anaerobically at 37°C. EPS may be important in colonization of the intestinal tract, but the strong expression at low temperature suggests possible importance in biofilm formation in the environment.

GROWTH OF *YERSINIA ENTEROCOLITICA* IN TURKEY ROLL AT 4°C

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Turkey roll was formulated to contain 0.5, 1.0, 1.5, 2.0, or 2.5% NaCl with and without sodium tripolyphosphate. Turkey roll was sliced, inoculated with 10 cells of *Yersinia enterocolitica* per gram and stored under aerobic or vacuum atmosphere at 4°C. Enumeration of *Y. enterocolitica*, aerobic mesophilic and psychrotrophic bacteria and lactic acid bacteria was performed. Vacuum packaging of rolls extended shelf-life by reducing spoilage microflora; however, *Y. enterocolitica* increased from log 1.0/g to log 5.5 during the 15 day storage period at 4°C in rolls containing 1% NaCl + STPP. *Y. enterocolitica* decreased to non-detectable levels between 3 and 9 days (depending upon strain) under aerobic storage in the same product. At NaCl levels above 2.5%, counts of *Y. enterocolitica* increased approximately one log/g after 15 days at 4°C.

RELATIONSHIP BETWEEN AFLATOXIN PRODUCTION AND MOLD GROWTH AS MEASURED BY ERGOSTEROL AND PLATE COUNT

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Samples of rice were inoculated with different inoculum levels of *Aspergillus flavus* subsp. *parasiticus* spores and incubated at 25°C. Ergosterol was determined using a method that consisted of methanol-hexane extraction, saponification and quantitation using HPLC with UV detection. The recovery of ergosterol from rice was high (up to 94%). Ergosterol level, aflatoxin production and mold count were determined each day up to ten days. At low inoculum levels (10^1 to 10^3 spores), ergosterol content remained at a low level (3 to 4 ppm), whereas aflatoxin B1 production then increased and reached a maximum after 5 to 6 days of incubation, and then decreased. At 10^6 spores inoculum level, ergosterol content reached a maximum of 12 ppm. Aflatoxin B1 production followed the same trend as ergosterol, but there was no clear pattern between aflatoxin G1 production and ergosterol content. Mold counts increased during the first two days and reached maxima of 10^4 - 10^6 spores/g and stayed at the stationary phase during the rest of the incubation period. Highest levels of aflatoxin were produced during the stationary phase of growth, which was characterized by decreasing rates of ergosterol formation.

THE EFFECT OF STARCH DEGRADING ENZYMES ON FOOD GRADE, CORN STARCH CONTAINING POLYETHYLENE FILM

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Corn starch has been added to plastic polymers to make biodegradable plastic bags. The effect of starch degrading enzymes on food grade polyethylene (PE) film that contained 6% corn starch (CSPE) was examined. Control PE film with no added starch, CSPE and laboratory grade soluble starch were placed in solutions that contained an excess of alpha-amylase (AA) or amyloglucocidase (AG). The pH and temperature of the solutions were optimized for each enzyme. Samples were removed periodically and were subjected to the Nelson-Somogyi method for the determination of reducing sugar content. Treatment with AA released 20% of the soluble starch as glucose, while only 1% of the starch in CSPE was released. AG activity released up to 50% of the soluble starch as reducing sugar. However, less than 4% of the CSPE starch was liberated. Microscopic examination of films stained in Lugol's Iodine solution showed that enzymatic treatment did not remove surface starch granules. These results indicated that breakdown of CSPE by starch degrading enzymes was limited.

CAPTAN INDUCTION OF GASTRIC MUCOSAL CELL PROLIFERATION: ROLE OF TYROSINE KINASES AND EPIDERMAL GROWTH FACTOR

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The fungicide Captan (1,2,3,6-Tetrahydro-N-Trichloromethyl-thiophthalimide) is used extensively on agricultural products and has been shown to induce carcinoma in the gastrointestinal tract of rodents. Recent evidence suggests that tyrosine kinases (Tyr-K), which catalyze tyrosine phosphorylation of proteins, play an important role in cell proliferation. Moreover, induction of epidermal growth factor receptor (EGF-R) has been shown to occur in a number of carcinogenic processes. In an evaluation of early biochemical changes in the Captan induction of neoplasia we observed that 2 wk Captan administration to rats (100mg/kg, b.w.) stimulated thymidine kinase activity by 98% and increased the rate of DNA synthesis *in vitro* by 331% over controls. The increased proliferative activity was accompanied by a 199% rise in Tyr-K activity, which was associated with tyrosine-specific phosphorylation of certain membrane proteins with Mr of 55 and 53. Western

blots of EGF-R showed a time dependent rise following Captan administration. These early biochemical changes are proposed as indicators to predict risks of other pesticides.

THE HAZARD COMMUNICATION STANDARD - IMPLICATIONS FOR THE FOOD SERVICE INDUSTRY

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The Hazard Communication Standard implemented by the Occupational Safety and Health Administration (OSHA) in 1983 was initially focused on large scale industrial producers and users of hazardous chemicals. On 17 March 1989 OSHA expanded this standard to include the foodservice industry. The Hazard Communication Standard requires workers to be provided with hazard communication (HAZCOM) training on the use of chemical substances used in the workplace. Sanitarians in the foodservice industry and state and local health departments may be called upon to assist foodservice managers in developing HAZCOM programs. Requirements for HAZCOM training in the foodservice industry and resources that sanitarians can use in program implementation are identified.

COMPOSITION AND SENSORY CHARACTERISTICS OF WHITE PICKLED CHEESE

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Sixteen samplings of cheese representing eight different factories over two seasons were stored at 4°C and tested on the 60th day of ripening. The objective measurements of quality were % moisture, % fat, % salt, pH, % lactic acid, total protein (TP), water soluble protein (WSP), volatile fatty acids and penetration values. The samples were also submitted to a sensory panel for flavor, texture, color and for overall quality assessment.

The correlation coefficients between quality attributes and chemical physical parameters were presented, as well as multiple regression equations, to predict overall quality scores with a given set of objective measurements. A statistical model was developed to determine sequentially the most important quality attributes of white pickled cheese as well as objective parameters effecting these quality factors.

FOOD MICROBIOLOGY

CURRENT STUDIES ON *LISTERIA MONOCYTOGENES*

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Our presentation will summarize our research on the (a) role of *L. monocytogenes* in the dairy cows and (b) characterization of monocytogenes by restriction enzyme analysis.

Epidemics of *L. monocytogenes* have been linked to the consumption of contaminated dairy products. We wished to examine the effect of dexamethasone, a synthetic glucocorticoid, which mimics the immunosuppression associated with stress, on milk titers of *L. monocytogenes*. Lactating dairy cows were experimentally infected with *L. monocytogenes* and chronic infections established. Following dexamethasone treatment, the number of pathogens shed in the milk increased nearly 100-fold. This suggests that stress of adverse weather, lactation and pregnancy may increase titers of *L. monocytogenes* in the milk and thus pose a significant health problem.

Because each of the 4 major food-borne listeriosis epidemics in North American epidemics involved the 4b serovar, we evaluated alternative methods of differentiating isolates. In this study, restriction enzyme analysis with the enzyme Hha I was used to characterize isolates recovered from the 1981 Canadian (n=29), the 1983 Massachusetts (n=9) and the 1985 Southern California (n=54) outbreaks. Isolates from each of the epidemics exhibited a distinguishing pattern. Thus, the ease with which REA can be applied to all serotypes of *L. monocytogenes* argues for its use as a powerful epidemiological tool in evaluating listeriosis outbreaks or suspect cases of cross-infection.

BEHAVIOR AND SEROLOGICAL IDENTIFICATION OF STAPHYLOCOCCAL ENTEROTOXIN A IN CANNED MUSHROOMS

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Foods preserved by thermal processing are sometimes time-temperature abused by food manufacturers before canning. Improper microbiological monitoring of the product and the lack of adherence to good manufacturing practices, particularly for thermally processed foods, may place the consumer at risk of contracting foodborne disease caused by heat-stable (250°F, 30 min.), biologically active enterotoxins produced by some strains of *Staphylococcus aureus*. Initially, the etiology of several foodborne illnesses recently caused by canned mushrooms was difficult to determine because of structural changes in the toxin caused by the thermal process. Although the preformed toxin (serotype A) in the thermally processed product was rendered serologically inactive, biological activity persisted, thus producing illness. The heat-altered toxin required serological reactivation with urea to reveal the masked serological sites before it could be identified by a double antibody "sandwich" ELISA and direct precipitation. Heat-altered and urea-exposed toxin generally showed various degrees of serological degradation during storage (5°C). In some cases serological reactivation of heated toxin was spontaneous.

SALMONELLA ENTERITIDIS AND EGGS: A SMALL ISSUE FOR HUMAN HEALTH; A LARGE ISSUE FOR AMERICAN AGRICULTURE

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Salmonella serotype enteritidis (SE) has consistently been one of the three most common serotypes causing Salmonellosis in humans in the United States for over 20 years. In 1988, eggs or egg-containing foods were linked to the disproportionate increases of human illness due to SE within northeastern states. This finding raised new concerns within the agricultural community about the longstanding issue of *Salmonella* in foods of animal origin. Field research by University poultry scientists confirmed that egg production flocks traced to from human outbreaks can be affected by SE and that eggs from such flocks can be internally contaminated by the organism. Since that time the issue of control of SE in humans by control of SE at the egg farm has escalated from voluntary industry attempts to a nation-wide mandatory program. The results to date of the field research and the methods utilized by the national program will be presented.

UPDATE ON RESEARCH EFFORTS TO CONTROL HUMAN BACTERIAL ENTEROPATHOGENS IN POULTRY

N.A. Cox*, J.S. Baily, S.E. Craven, L.C. Blankenship, N.J. Stern and R.J. Meinersmann, USDA, ARS, Russell Research Center, P.O. Box 5677, Athens, GA 30613

Breaking the chain of salmonellae passage from one generation of chickens to the next has been the goal of poultry researchers for many years. At the Russell Research Center, innovative means for intervention, such as introduction of competitive exclusion mixtures *in ovo*, are being explored. Research is being concentrated on the hatchery and young birds because: 1) young chicks are very susceptible to colonization, 2) the hatchery is an existing reservoir of salmonellae, and 3) several routes of salmonellae entry into the young chick exist (oral, cloacal, naval, nasal). Other ongoing projects include: 1) chemical treatment of hatching eggs, 2) attempts to produce vaccines by defining colonization and/or attachment factors of *Salmonella* and *Campylobacter*, and 3) determining incidence of *Listeria* in chickens and developing methods to intervene in colonization.

IMPLICATIONS OF MICROBIAL INFECTIONS IN IMMUNOCOMPROMISED POPULATIONS

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Recent studies show that stimulation of the immune system by viral or bacterial infections, by lipopolysaccharides (endotoxins) or by other factors which increase production of endogenous interferons, results in an interferon-induced increase in activity of indoleamine diosygenase, an enzyme which degrades the essential amino acid L-tryptophan. Thus, in conditions in which indogenous interferon levels are induced (AIDS virus infection, or in autoimmune diseases such as rheumatoid arthritis, scleroderma or lupus erythematosus), or in patients treated with exogenous interferons, tryptophan degradation is markedly induced as indicated by low serum tryptophan levels and elevated tryptophan metabolite levels. Since tryptophan is an essential amino acid not only for protein synthesis, but as a precursor for biosynthesis of serotonin (a neurotransmitter and immunomodulator) and the niacin-containing coenzymes NAD and NADP, this loss of tryptophan may have far-reaching metabolic and clinical significance in a wide range of diseases. Further, it has been shown that the antiproliferative effects of interferon-gamma against several microbial pathogens and against several human tumor cell lines *in vitro* is due to interferon-mediated tryptophan depletion: restoration of tryptophan levels in the culture medium negates the antiproliferative effects of interferon-gamma in these systems. The implications of interferon-induced tryptophan catabolism in cancer, autoimmune diseases, microbial infections and AIDS will be discussed.

CHALLENGE OF THE 90'S

ROLE OF THE FOOD PROTECTION PROFESSIONAL IN MEETING THE CHALLENGES OF THE 90'S

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Many of the food safety issues facing us in the 90's are the same problems public health professionals were faced with in the 40's. One can't image how we failed in the past half century to address these concerns. Tomorrow's food safety professional will need to be more of a change agent as opposed to an inspector. In the past 50 years we have been more concerned with auditing than what to do with the information we are gathering. Consumers will have to re-assess their risks on whether future controls, pesticides, preservatives, etc., are worth sacrificing for the return to daily grocery shopping.

GLOBAL ASPECTS OF FOODBORNE DISEASE SURVEILLANCE

INTRODUCTION AND CANADIAN FOODBORNE DISEASE SURVEILLANCE

Ewen C.D. Todd, Bureau of Microbial Hazards, Health Protection Branch, Sir Frederick G. Banting Research Centre, Ottawa, ON K1A 0L2

Foodborne disease is a world-wide phenomenon, although more is known about the types and causes of infections and intoxications from countries such as the United Kingdom, Japan, the United States and Canada because of long established surveillance programs. However, recently many European, Asian and South and Central American countries have been attempting to accumulate similar data. Are these countries experiencing problems like those in North America or are the agents and conditions unique to their regions? The conclusions drawn are only as good as the investigations that are made, and these depend on sufficiently trained staff to carry out the epidemiological investigations, collect the implicated food, inspect food premises, and analyze specimens submitted. In addition, the political will to encourage investigations is essential; many administrations wish to ignore foodborne illness as a problem because of unnecessary embarrassment and possible loss of tourist revenue through adverse publicity. Canadian data have been collected and published since 1973.

Microorganisms are the most important etiological agents, with *Salmonella* responsible for most cases, followed by *Clostridium perfringens* and *Staphylococcus aureus*. *Campylobacter*, *Listeria monocytogenes* and *Escherichia coli* 0157:H7 have emerged as significant foodborne pathogens since the early 1980s. Most problems occur because of mishandling in foodservice establishments or homes. Attempts are now starting to be made to obtain more current statistics through sharing of information at the provincial level through computerized programs, but it will take some time before such a system will work efficiently.

SURVEILLANCE SYSTEMS IN NEW YORK STATE AND MALAYSIA

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Diarrhea is the most common disease in Malaysia, as it is in most developing countries. Foodborne etiologies, which include waterborne, are believed to be the major cause of this morbidity and mortality. The epidemiology unit in the Ministry of Health is responsible for establishing and maintaining a program for the investigation of foodborne disease outbreaks. Health inspectors conduct outbreak investigations. Malaysia is currently improving its investigation program through training of ground level and supervisory staff, developing procedures and expanding laboratory capabilities. New York State's foodborne disease surveillance program began in 1980. In its first ten years, 1,261 outbreaks involving 26,174 cases of illness were reported. The New York State Department of Health coordinates the surveillance network which is carried out in the field by 37 county and city health departments and ten state health district offices. The program laid the basis for the Hazard Analysis Critical Control Point approach followed in the foodservice establishment regulatory program as well as helped identify many regional and national food contamination problems.

FOODBORNE DISEASE SURVEILLANCE IN EUROPE

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The European WHO Programme for surveillance of foodborne diseases was launched in 1980. The Berlin Institute of Veterinary Medicine (Robert von Ostertag-Institute) was given the task of acting as managerial centre for the Programme. By now (1990) 31 countries have joined the Programme and more are expected to take part in the near future. The information given here is based on data provided by national Contact Points to the Programme. The national sources of this information is: 1) statutory notification (cases reporting); 2) reporting of epidemiologically investigated outbreaks; 3) laboratory report; 4) special surveys. National reporting systems vary in a wide range. These variations of the sources and of the kind of information cause difficulties when trying to prepare a picture for the whole Europe. However, when the data are looked at in a critical manner useful information can be obtained. The examples chosen from various countries may illustrate the situation of foodborne diseases in Europe. The presented picture is, of course, incomplete. It shows some trends in Europe and indicates differences which may be particular for certain countries.

FOODBORNE DISEASE SURVEILLANCE FROM WHO PERSPECTIVE: THE SITUATION IN SELECTED DEVELOPING COUNTRIES

Fernando Quevedo, Food Safety Unit, Division of Environmental Health, World Health Organization, 1211 Geneva 27, Switzerland

Foodborne diseases are one of the most widespread health problems in the world, and an important cause of reduced economic productivity. However, the nature and magnitude of these diseases differ in various parts of the world. Surveillance of foodborne diseases helps to identify the kind of intervention needed to improve the health problems related to contaminated food. Therefore, WHO considers surveillance of foodborne diseases of utmost importance. The paper reviews the type of information received by WHO on foodborne diseases, and presents the ongoing and planned programmes and strategies in this regard.

Recent data on foodborne diseases in selected developing countries are presented.

SHELF LIFE AND SAFETY OF MINIMALLY PROCESSED REFRIGERATED FOODS

SOUS VIDE AND MINIMALLY PROCESSED REFRIGERATED FOODS: LOOKING BACK AND MOVING FORWARD

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Sous Vide and other types of minimally processed refrigerated foods belong to the pasteurized foods category (foods needing refrigeration to maintain quality and safety). Such foods must be handled in such a way that safety and "fresh like" quality of the food is maintained. Sous vide has been established in Europe for some time and minimally processed refrigerated foods are rapidly emerging in the United States, Japan and Canada. However, consumer understanding and a solid distribution system for minimally processed refrigerated foods have developed much more rapidly in Europe and Japan, than in the United States and Canada. Geography, customs and marketplace impact the safety and distribution of these food products. By 1995, the minimally processed refrigerated foods market is estimated to exceed $1 billion and will change the way food is prepared and served in retail establishments, supermarkets and the home.

FDA'S POSITION ON RETAIL VACUUM PACKAGING

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"Fraught with danger" has been the FDA Retail Food Protection Branch's position on retail vacuum packaging for over two years. FDA is concerned about optimizing conditions for *Clostridium botulinum* growth and toxin production, as well as the potential for growth of psychrophilic pathogens. The introduction of this processing technology without appropriate controls and facilities in retail establishments were also related to FDA's cautious position.

FDA's allowance for controlled processing of certain products in retail establishments and the proposed Model Code Interpretation on refrigerated food in reduced oxygen packages will also be addressed.

MICROBIOLOGICAL CRITERIA AND REGULATORY ASPECTS OF MINIMALLY PROCESSED REFRIGERATED FOODS

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The role of microbiological criteria for foods has been the subject of a National Academy of Sciences report and a National Advisory Committee established by USDA. Refrigerated ready-to-eat foods containing cooked meat, poultry or seafoods that are packaged for extended shelf life can pose a potential risk of food poisoning. Recommendations made by the Committee include; use of HACCP programs, guidelines for *Listeria monocytogenes* thermal inactivation studies and inoculated pack protocols for *Clostridium botulinum* in products containing meat, and uniform mandatory requirement for pasteurization of crab meat. Criteria for cooked ready-to-eat shrimp and crab meat have been proposed to include sampling plans and test methods. Recommended criteria are for salmonellae, *L. monocytogenes*, *Staphylococcus aureus* and thermal tolerant coliforms.

APPLICATION OF EXISTING TECHNOLOGY TO IMPROVE SAFETY OF RAW AND MINIMALLY PROCESSED FOODS STORED UNDER MODIFIED ATMOSPHERES

James L. Smith*, Robert L. Buchanan, Laura L. Zaika and Samuel A. Palumbo, USDA, Eastern Regional Research Lab, 600 E. Mermaid Lane, Philadelphia, PA 19118.

The effects and interactions of temperature, pH, sodium chloride content (a_w), sodium nitrite concentration, and atmosphere on the growth kinetics of *Listeria monocytogenes*, *Staphylococcus aureus*, *Aeromonas hydrophila*, and *Shigella flexneri* were determined using microbiological media. Individual growth curves were modeled using the Gompertz function, a mathematical relationship that describes a non-symetrical sigmodial curve. These data were then analyzed using response surface modeling techniques to develop mathematical expressions that describe the impact of the various variables.

These models, along with one for *Salmonella* provided by researchers at England's AFRC Institute of Food Research laboratories, have been used to produce "user friendly" software that allows one to rapidly estimate how the pathogens are likely to behave in foods.

THE SOLID WASTE CRISIS

THE TRASHING OF AMERICA? AN OVERVIEW OF THE SOLID WASTE PROBLEM - A PANEL DISCUSSION

Harvey Alter, U.S. Chamber of Commerce, 1615 H Street, NW, Washington, DC 20062.

Conventional wisdom is that we are drowning in our solid waste. Data show that the per capita generation of municipal solid waste (MSW) was statistically constant from about 1970-1984, that population increased only about 1% per year, that packaging has been decreasing as a fraction of the MSW, and that certain forms of packaging are decreasing. Packaging helps reduce the amount of MSW as shown by regression relations between the fraction of food residues and the fractions of packaging residues in MSW.

The problem is a shortage of disposal capacity caused by several factors, including NIMBY (Not in My Backyard). Choosing a few components of MSW for restrictions or bans, or setting unrealistic recycling goals, will not compensate for the shortage of capacity.

These factors and others will be reviewed as an introduction to how MSW can be managed.

METHODOLOGY

RAPID *SALMONELLA* DETECTION BY A NEW CONDUCTANCE METHOD

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Conventional methods for detecting *Salmonella* are either labor-intensive, time-consuming, or both. There is a need for improved methods to rapidly screen foods for this pathogen.

A new method of *Salmonella* detection utilizing the measurement of electrical conductance changes in a selective medium was studied. 1441 samples of a wide range of foods were tested for presence of *Salmonella* by both the standard agar plating method and the conductance method. Results showed that the conductance method was at least as sensitive, and for meat products, significantly more sensitive than the standard method. This study clearly indicates that the conductance method can accurately detect *Salmonella* in foods in a manner less labor-intensive and quicker (48 hours or less for positive samples), than the standard agar plating method.

TACTICS FOR COMBINING THE COLIFORM AND INDOLE TESTS: SIMPLE MEDIA FOR BOTH TOTAL COLIFORMS AND *ESCHERICHIA COLI*

George W. Chang* and Rosalind Lum, Department of Nutritional Sciences, University of California, Berkeley, CA 94720

Lactose metabolism and indole production are two most useful traits for enumerating *Escherichia coli*. However, these traits cannot be tested simultaneously because lactose metabolism represses indole production.

This repression is avoided by use of chromogenic or fluorogenic ß-D-galactosides as surrogates for lactose metabolism.

Media containing tryptophan and a suitable galactoside indicate coliforms by color or fluorescence and *E. coli* by positive indole tests.

Use of tryptophan as sole nitrogen source gives an even simpler and more specific *E. coli* medium. However, the specific medium will not detect all coliforms.

A ONE-STEP DEVICE FOR EVALUATION OF SURFACE MICROBIAL CONTAMINATION

James M. Buzonik* and Katalin Rossmoore, Biosan Laboratories, Inc., 10657 Galaxie, Ferndale, MI 48220-2133.

A one-step surfaee sanitation monitoring device was compared to RODAC, calcium alginate swabs, and the Millipore method. This deviee eonsists of a plastic strip to whieh is attaehed a filter paper pad. The paper contains dehydrated culture media and a growth indieator whieh beeome aetive upon hydration. Laboratory experiments measuring reeovery of baeteria from surfaees were conducted. Results showed a 95% correlation between RODAC and the one-step method. Post-sanitation field studies eomparing the various methods in both food processing and foodserviee establishments were also eonducted. Correlation between RODAC and the one-step method was again shown. In both studies, swabbing (ealcium alginate and Millipore) gave similar results compared to the one-step method, but ease of use and interpretation made the latter elearly the method of choiee.

A RAPID NEW 24-HOUR METHOD FOR DETECTION AND CONFIRMATION OF TOTAL COLIFORMS AND *E. COLI* IN FOODS

Gil Diehter*, Steve Mongillo, Lori Gaidish, Stephen Edberg and Stephen Wardlaw, Aeeess Analytical Systems, Inc., 21 Business Park Drive, Branford, CT 06405

Total eoliform and *E. coli*. densities were determined in 11 different foods within 24 hours using Colilert, a new defined substrate test. Colilert incorporates ONPG and MUG as speeifie primary nutrient indieators to simultaneously deteet and eonfirm total eoliforms and *E. coli* in a food sample. Development of yellow eolor eonfirms total eoliforms, yellow plus blue fluoreseenee eonfirms *E. coli*. Approximately 80% of the food samples were naturally eontaminated, the remainder were seeded with either K. *pneumoniae* or *E. coli*. Colilert MPN results were compared to AOAC/BAM referenee methods. (Multiple Tube Fermentation for total eoliforms, E.C. broth for fecals at 44.5°C).

Results of this preliminary feasibility study indieate exeellent agreement between Colilert and referenee methods for total eoliforms and *E. coli*. Indices of agreement generated by eomparing Colilert to presumptive LTB and eonfirmed BGLB results were 0.958 and 0.875 respeetively. Index of agreement between Colilert *E. coli* and E.C. fecal eoliform was 0.977.

Colilert was easy to perform and read, requiring no subeulturing or eonfirmation steps, with results available within 24 hours of inoeulation, redueing eosts and turn around time associated with the comparative methods.

FLUORESCENCE SCREENING TEST FOR PYRUVATE KINASE ACTIVITY IN CANNED CURED HAM

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USDA-APHIS requires imported eanned eured ham to reaeh 156°F/68.9°C. USDA-FSIS uses aeid phosphatase aetivity as a eonfirming laboratory test for attained eooked temperature. A rapid method has been developed to sereen imported eanned eured ham for end-point temperature based on a visual fluorescence test for musele pyruvate kinase (PK) activity. Pressed meat juiee (10 l) is added to 100 l PK substrate and ineubated at 37°C for 40 min. When musele PK activity is present, NADH is oxidized eausing fluoreseenee loss. The reaetion mix (10 l) is spotted on filter paper, dried and viewed under UV (320-420nm) light. Commereial-style eanned ham was eooked to target temperatures of 152°F/66.7°C, 154°F/67.8°C, and 158°F/70°C for 0, 15, and 30 min. PK aetivity was measured aeross a meat eore by visual fluoreseenee. PK aetivity deereased as temperature and holding time inereased. PK activity in a time/temperature eore showed thermal gradients from the can surfaee to the eore thermocouple point. This procedure requires about 1 hour, ineluding sampling and ineubation, with eommon laboratory equipment and readily available enzyme substrate.

PERFORMANCE OF A COLORIMETRIC DNA HYBRIDIZATION METHOD IN THE DETECTION OF *SALMONELLA* IN DRIED PASTEURIZED EGG PRODUCTS

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A rapid DNA hybridization method employing a eolorimetrie deteetion system was evaluated for use in identifieation of *Salmonella* eontamination of dried pasteurized egg products. A parallel comparative analysis was eonduete by the eonventional eulture proeedure of the Agricultural Marketing Serviee of the U.S. Department of Agrieulture (USDA-AMS). A total of 220 samples were analyzed, eomprised of multiple samples of ten different dried pasteurized egg product types inoculated with *Salmonella* and/or non-*Salmonella* eompetitor baeteria. Results indieated false-negative rates for the DNA hybridization method and the USDA-AMS culture proeedure of 0% and 3.9%, respeetively. It is eoneluded that the colorimetrie DNA hybridization method is an effeetive proeedure for the deteetion of *Salmonella* in dried pasteurized egg produets and offers a more rapid analytieal alternative to eonventional microbiologieal methods.

RAPID IDENTIFICATION OF ANTIBIOTIC RESIDUES BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY COUPLED WITH THE MICROBIAL RECEPTOR ASSAYS - HPLC RECEPTORGRAMS

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A simple, rapid confirmation procedure has been established to identify and quantitate antibiotic residues in milk, meat, urine, serum and eggs. Samples that were found positive by screening methods, using the Receptor Assay and/or Microbial Inhibition assay, were confirmed, and drug species were identified by the HPLC-Receptorgram method. The procedure involves a fast high yield extraction of antibiotics from the tissue followed by a single step purification using Sep-Pac C-18 hydrophobic columns. These preparation steps take less than 30 minutes. The eluate is concentrated using rotavaporator, re-dissolved in HPLC buffer, then analyzed by HPLC equipped with a fraction collector. Using an isocratic system and Lichrsorb RP-8 column, a single buffer can separate sulfonamides, beta-lactams, and chloramphenicol species into individual fractions in less than 30 minutes. The HPLC fractions with retention time (RT) similar to antibiotic standards are tested and quantitated using the Microbial Receptor assay. Other buffers are used to separate and identify tetracyclines, aminoglycosides, spectinomycin, and macrolides. If multi-group analysis is required a gradient system is needed; however, using the receptor assay for screening eliminates this need. Recovery levels are calculated using radioactive tracers. Limit of detection with the HPLC-Receptorgram for: beta-lactams — 2-20 ppb, sulfonamides — 1-10 ppb, tetracyclines — 50-200 ppb, chlormphenicol — 50 ppb, aminoglycosides — 20-100 ppb and macrolides — 20-50 ppb. The HPLC-Receptorgram has been found to be superior to UV or Fluorescent monitoring because of its group biospecificity, which eliminates interreferences.

DETECTION OF *BRUCELLA SPP* IN MEXICAN WHITE SOFT CHEESE PROCEEDING FROM Cd. OBREGON, MEXICO

M. Diaz de Aguayo* and E. Acedo F., Centro de Investigacion en Alimentacion y Desarrollo, A.C. Apartado Postal 1735, Hermosillo, Sonora. Mexico

The incidence of Brucellosis has been increasing at southern Sonora. 73 samples of Mexican white soft cheese were analyzed to determine if this product is a carrier as well as its frequency. To isolate the bacteria 10 g were analized in 90 ml of saline solution 0.85% with 2% of tween 80 and serial dilutions. Afterwards they were inoculated in Brucella broth with 2% of glicerol and 3% of dextrose plus 6 antimicrobial agents. Every 48 hours the enriched Brucella agar was stroken and incubated at 37°C in both aerobiosis and CO_2 during 21 days. Seven *Brucella* spp. were isolated from the 73 samples (9.72%), which is indicative that this cheese is a Brucellosis carrier.

BAKERY SANITATION

WASTE REDUCTION IN FOOD PROCESSING: A PEOPLE MANAGEMENT ISSUE

Stephanie S. Richardson, North Carolina Pollution Prevention Program, P.O. Box 27687, Raleigh, NC 27611

With increasingly stringent effluent limits, the pending passage of the air toxics regulations and shrinking landfill volumes, the traditional approach to waste management is no longer adequate. End-of-pipe approaches and landfilling are not only inadequate, they are expensive. Effluent characteristics are directly proportional to product loss where solid waste is an exact measure of product loss.

Through proven practices of dry cleanup, inventory control and employee training, waste on all fronts can be significantly reduced. Low tech, people management approaches can be used to eliminate some waste and reduce other waste, thereby reducing the size of treatment or pretreatment facilities and resulting in a more profitable facility.

An outline of a training program and case histories were presented.

IN-PLANT SANITATION EDUCATION: RESOURCES AVAILABLE AND SUGGESTIONS FOR DESIGNING YOUR OWN

Jerry W. Heaps, R.P.E. and Field Sanitarian, American Institute of Baking, Manhattan, KS 66502

The focus of this presentation will be to identify resources available to plant personnel when the decision is made to design an in-plant sanitation program.

Many are available that provide written educational materials, slide sets, video presentations and, if practical, provide on-site consultation. This information allows the facility to design a specific program that will custom fit their needs.

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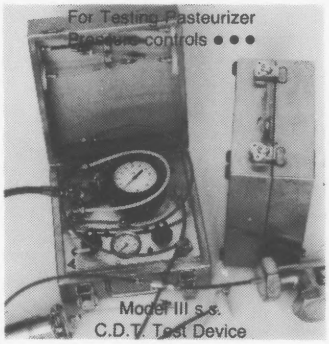

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Coming Events

1990

November

•**1, Sanitation Workshop for the Food Industry**, Anaheim Plaza Resort Hotel, Anaheim, CA. For more information contact Joan Byers, Department of Food Science & Technology, University of California, Davis, CA 95616-8598, (916)752-3835.

•**4-7, National Fisheries Institute** will hold its 45th annual convention at the new Marriott Marquis, San Francisco, CA. For more information contact Pat McCoy, convention coordinator (703)524-8881.

•**5-8, UCD-FDA Better Process Control School** for low-acid food canners, Country Side Inn, Costa Mesa, CA. Contact Sharon Munowitch, University Extension, University of California, Davis, CA 95616-8727, (916)757-8899.

•**6-8, International Cheese Technology Exposition** will be held in Milwaukee, Wisconsin. For further information contact: USCMA/WEMA, P.O. Box 2133, Madison, WI 53701 (608)255-2027.

•**12-14, 1990 Food Industry Environmental Conference**, sponsored by the Environmental Sciences and Technology Division, Georgia Tech Research Institute will be held at the Hyatt Regency, Downtown, Atlanta, GA. The Conference is being conducted by the Education Extension Services, Georgia Institute of Technology. For more information contact Edd Valentine or Chuck Ross, Environmental Sciences and Technology Division, Georgia Tech Research Institute, Room 040 O'Keefe Building, Atlanta, GA 30334 (404)894-3412 FAX (404)894-8281.

•**12-15, Better Process Control School**. For more information contact Justin Morris, Ph.D., University of Arkansas, Department of Food Science, Route 11, Fayetteville, AR 72703-8197, (501)575-4607.

•**14, 46th Annual University of Maryland Dairy Technology Conference**. For more information contact Dr. James T. Marshall, Department of Animal Sciences, University of Maryland, College Park, MD 20742 (301)454-7843.

•**14-15, Alabama Dairy & Food Conference** to be held at the Howard Johnson Motor Lodge in Birmingham. For more information contact Tom McCaskey at (205)844-1518.

•**27-29, Biotech USA '90 presents PharmBiotech, AgBiotech, BioLab and BioBusiness** at the Ramada Renaissance Techworld, Washington, DC.

•**27-30, Better Process Control School**. For more information contact Terry Titus, Ph.D., Clemson University, Food Science Department, 224 P& AS Bldg., Clemson, SC 29634-0371, (803)656-3399.

•**28, Ontario Food Protection Association Annual Meeting**, will be held at the Airport Hilton Hotel, Toronto, Ontario. The title of the all-day symposium is "FOOD PROTECTION: HOT TOPICS FOR THE '90's". For more information, please contact program convenors: Garth Sundeen (416)239-8411 or FAX (416)239-2416 or Patrick Kwan (416)671-5080 or FAX (416)671-5176.

December

•**3, Pesticide Applicator Certification Seminar**, Okumura Biological Institute, Clarion Hotel, Sacramento, CA. For more information contact George Okumura, 6669 14th Street, Sacramento, CA 95831 (916)421-8963.

•**3-5, Introduction to Food Processing Systems**, UC Davis, Davis, CA. For more information contact Sharon Munowitch, University Extension, University of California, Davis, CA 95616-8727, (916)757-8899.

•**4-5, Pests Associated with Food Industry and Environmental Sanitation Seminar**, Okumura Biological Institute, Clarion Hotel Sacramento, CA. For more information contact George Okumura, 6669 14th Street, Sacramento, CA 95831 (916)421-8963.

•**6-7, Advanced Course on Pest Recognition and Food Industry Problems**, Okumura Biological Institute, Clarion Hotel, Sacramento, CA. For more information contact George Okumura, 666914th Street, Sacramento, CA 95831 (916)421-8963.

•**10-12, Microbiology and Engineering of Sterilization Processes** three-day course will be given at the University of Minnesota, St. Paul Minnesota campus. For more information contact Dr. William Schafter, Department of Food Science and Nutrition, 1334 Eckles Avenue, St. Paul, MN 55108 (612)624-4793.

•**11-13, Producing Top Quality Mexican Foods**, Country Side Inn, Costa Mesa, CA. For more information contact Sharon Munowitch, University Extension, University of California, Davis, CA 95616-8727, (916)757-8899.

•**12-18, American Society of Agricultural Engineers** will be sponsoring the **International Symposium on Agricultural and Food Processing Wastes**. For more information contact: Jon Hiler, American Society of Agricultural Engineers, 2950 Niles Road, St. Joseph, MO 49085 (616)429-0300.

1991

January

•**7-10, Better Process Control School.** For more information contact Ralph L. Price, Ph.D., University of Arizona, Department of Nutrition and Food Science, 308 Shantz Building, Tucson, AZ 85721, (602)621-1728.

•**7-16, 41st Annual University of Maryland Ice Cream Short Course**. For more information contact Dr. James T. Marshall, Department of Animal Sciences, University of Maryland, College Park, MD 20742, (301)454-7843.

•**22-23, Third Annual Southern California Food Industry Conference** will be held on the campus of Chapman College in Orange, California. For more information contact: Walt Clark, Chapman College, Food Science & Nutrition Department, Orange, CA 92666 (714)997-6869 FAX: (714)532-6048 or Patrick Cochran, LaLoma Foods, P.O. Box 8863, Riverside, CA 92515 (714)351-4300 FAX: (714)351-3635.
•**29-February 1, Better Process Control School**. For more information contact Mark Daeschel, Ph.D., Oregon State University, Dept. of Food Science & Technology, 100 Wiegand Hall, Corvallis, OR 97331, (503)754-3463.

February

•**13-14, Dairy and Food Industry Conference**, The Ohio State University, Department of Food Science & Technology, 2121 Fyffe Road, Columbus, OH 43210-1097. For more information contact Dr. John Lindamood (614)292-7765.
•**20-22, National Research & Development Conference on the Control of Hazardous Material**, sponsored by the Hazardous Materials Control Research Institute, to be held at the Disneyland Hotel, Anaheim, CA (301)589-0182.

March

•**4-7, Better Process Control School.** For more information contact William Schafer, Ph.D., University of Minnesota, Department of Food Science and Nutrition, 1334 Eckles Avenue, Room 265, St. Paul, MN 55108, (612)624-4793.
•**10-13, IEFP '91**, sponsored by the Food Processing Machinery & Supplies Association, to be held at the McCormick Place, Chicago, IL. For information contact FPM&SA at (703)684-1080.
•**11-14, Better Process Control School**. For more information contact Robert Price, Ph.D., University of California, Department of Food Science, 250 Cruess Hall, Davis, CA 95616, (916)752-2194.
•**18-20, Better Process Control School**. For more information contact Jack Matches, Ph.D., University of Washington, HF-10, Institute for Food Science and Technology, Seattle, WA 98195, (206)545-1941.
•**18-21, Better Process Control School**. For more information contact Jorg Augustin, Ph.D., University of Idaho, Food Research Center, Moscow, ID 83843, (208)885-6456.
•**25-28, Better Process Control School**. For more information contact Winston Bash, Ph.D., Ohio State University, Food Industries Center, 140 Howlett Hall, 2001 Fyffe Court, Columbus, OH 43210, (614)292-7004.
•**25-28, Better Process Control School**. For more information contact Walter L. Clark, Ph.D., Chapman College, Food Science & Nutrition Department, 333 North Glassell, Orange, CA 92666, (714)997-6869.
•**25-29, Better Process Control School**. For more information contact Robert C. Wiley, Ph.D., University of Maryland, Food Science Program, Holzapfel Hall, 1122A, College Park, MD 20742-5611, (301)454-2829.
•**25-29, Mid-West Workshop in Milk and Food Sanitation**, The Ohio State University, Department of Food Science & Technology, 2121 Fyffe Road, Columbus, OH 43210-1097. For more information contact Dr. David Dzurec (614)292-7723.
•**26-28, Western Dairy and Food Industry Conference** to be held at the University of California-Davis. For more information contact John Bruhn and Shirley Rexroat, Department of Food Science & Technology (916)752-2191.

April

•**2-5, Better Process Control School**. For more information contact C.E. Johnson, Ph.D., University of Wisconsin, Department of Food Science, Babcock Hall, 1605 Linden Lane, Madison, WI 53706, (608)263-2013.
•**10, 41st Annual University of Maryland Ice Cream Conference.** For more information contact Dr. James T. Marshall, Department of Animal Sciences, University of Maryland, College Park, MD 20742, (301)454-7843.
•**15-18, Better Process Control School**. For more information contact James V. Chambers, Ph.D., Purdue University, Food Science Department, Smith Hall, W. Lafayette, IN 47907, (317)494-8279.
•**29-May 2, Better Process Control School**. For more information contact Gerald D. Kuhn, Ph.D., Pennsylvania State University, Department of Food Science, 116 Borland Building, University Park, PA 16802-7501, (814)863-2965.

May

•**13-16, Better Process Control School**. For more information contact D.L. Downing, Ph.D., Cornell University-NYSAES, Department of Food Science and Technology, Geneva, NY 14456, (315)787-2273.
•**13-17, Better Process Control School**. For more information contact Aurora S. Hodgson, Ph.D., University of Hawaii at Manoa, Department of Food Science & Human Nutrition, 1920 Edmondson Road, Honolulu, HI 96822, (808)948-6564.

June

•**17-20, Better Process Control School**. For more information contact Robert M. Grodner, Ph.D., Louisiana State University, Food Science Building, Baton Rouge, LA 70803-4280, (504)388-5206.

October

•**26-30, Food & Dairy Expo 91,** sponsored by Dairy & Food Supply Association, to be held at the McCormick Place, Chicago. For more information contact DFISA, 6245 Executive Boulevard, Rockville, MD 20852-3938 (301)984-1444.

To insure that your meeting time is published, send announcements at least 90 days in advance to: IAMFES, 502 E. Lincoln Way, Ames, IA 50010-6666.

On My Mind . . .

Steven K. Halstead
IAMFES Executive Manager

What Meaning - Membership ....

I recently received two "catalogs" that got me to thinking.

The first was a Speakers Bureau catalog from the American Council on Science and Health. An impressive document, it listed speakers from across the country on a variety of topics, all under the general heading of science and health.

The speakers were multi-disciplinary. They ranged from plant scientists to economists to lawyers. Their topics were correspondingly wide ranging, from Acid Rain to Vitamins; Pros and Cons. Want to guess what topics listed the most speakers?

It was "Food Supply: Is it Safe?" Out of the fifty-five speakers, twenty-five of them list this as a topic on which they speak.

My interest picqued, I checked out the speaker's resumes. Not a one of them listed membership in IAMFES. Why, I wondered, aren't they IAMFES Members? The background and interest of many of them implied that they would be ideal candidates for membership. But how do we reach them?

We're going to try, believe me .....

The other "catalog" was from CAST - Council for Agricultural Science and Technology. It basically was a listing of publications available from CAST.

Included was a listing of its member societies. Missing from the list was IAMFES. If this omission is correct it is incorrect. We will be checking into our status relative to CAST with an eye to seeking membership status.

CAST provides scientific information on key national issues in food and agriculture to policy makers, the news media and the public. It does not advocate positions on these issues.

I feel that IAMFES has a unique presence to lend to CAST. We are one of the very few associations that brings together the regulator, the processor and the teacher/researcher. Bringing them together under one roof allows for an informational exchange that just could not take place under any other circumstances. I saw a lot of this at our annual meeting and it is a wonderful happening to witness.

Please note that in both these short discussions on the meaning of membership, nothing was said about what we could get out of this. Maybe that's because I tend to measure membership in terms of what I can give instead of what I can get.

State Fairs . . .

I spent some quality time (my term, not his) with my twelve year old son last week at the Iowa State Fair. We have made this a "guys" trip for the past several years, and we really enjoy it.

The state fair is a true agricultural celebration. One in which competition is always present but just being there is almost as important as wining for the young showmen and women.

We immediately head for the barns to view and maybe pet the variety of animals. Sheep, cattle, hogs, goats, rabbits - you name it, it's at the fair.

Along the way, we stop for corn dogs, turkey burgers, funnel cakes, and every sort of fast food. That's part of going to the fair, too. A big part for my fast food crazed son.

This year, I was particularly aware of the sanitation report. Every vendor had to have one and had to display it in a prominent place.

There must be a hundred plus vendors so these inspections represent a tremendous amount of work. I don't know how many people there are to do the inspections, but they had to be busy.

I have never heard of anyone getting a case of food poisoning at the fair, which just goes to show that the vendors are as careful about doing their job as are the sanitarians.

Another case of being an unseen hero. I salute you people.

IAMFES

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113	126	139	152	165	178	191	204	217	230	243	256	269	282	295	308	321	334	347	360

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IAMFES

International Association of Milk, Food and Environmental Sanitarians Inc.

DFES
10/90

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103	116	129	142	155	168	181	194	207	220	233	246	259	272	285	298	311	324	337	350
104	117	130	143	156	169	182	195	208	221	234	247	260	273	286	299	312	325	338	351
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107	120	133	146	159	172	185	198	211	224	237	250	263	276	289	302	315	328	341	354
108	121	134	147	160	173	186	199	212	225	238	251	264	277	290	303	316	329	342	355
109	122	135	148	161	174	187	200	213	226	239	252	265	278	291	304	317	330	343	356
110	123	136	149	162	175	188	201	214	227	240	253	266	279	292	305	318	331	344	357
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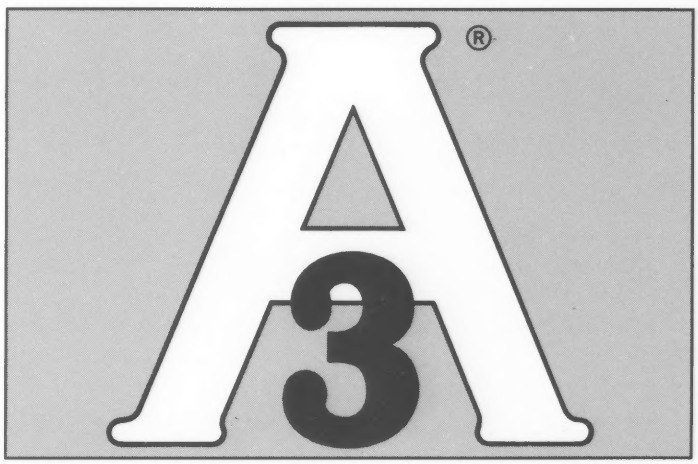

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+■◆ Amoxicillin
(Trihydrate)
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