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Dairy and Food Sanitation

A Publication for Sanitarians and Fieldmen

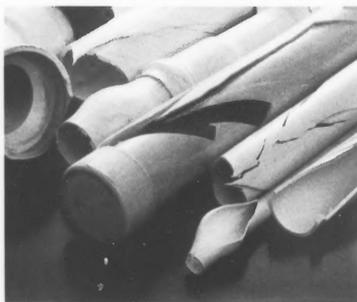
- Quality Assurance in Inflight Food Service Operations
- Regulation: Looking to the Future
- The Dairy Industry's Greatest Asset — Quality
- The Sanitarian's Role in Application of Research and Development Findings to Economical Food Production



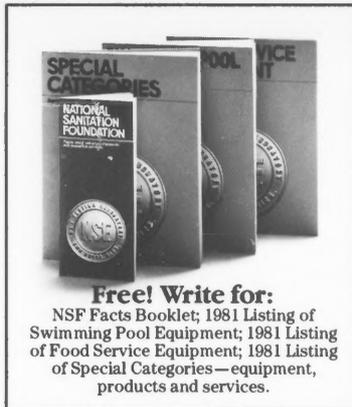
*A Publication of the International
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The National Sanitation Foundation, known as NSF, is an independent, nonprofit organization of scientists, engineers, technicians, educators and analysts. We serve as a trusted neutral agency for government, industry and consumers, helping these groups to resolve differences and achieve solutions to problems of public health and the environment. Our professional staff is involved in projects related to water treatment, air quality and improved disposal of solid and liquid wastes, including hazardous waste processing. We develop standards and criteria in selected public health and environmental areas and engage in research and testing.



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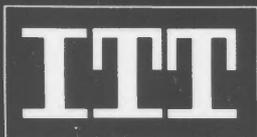
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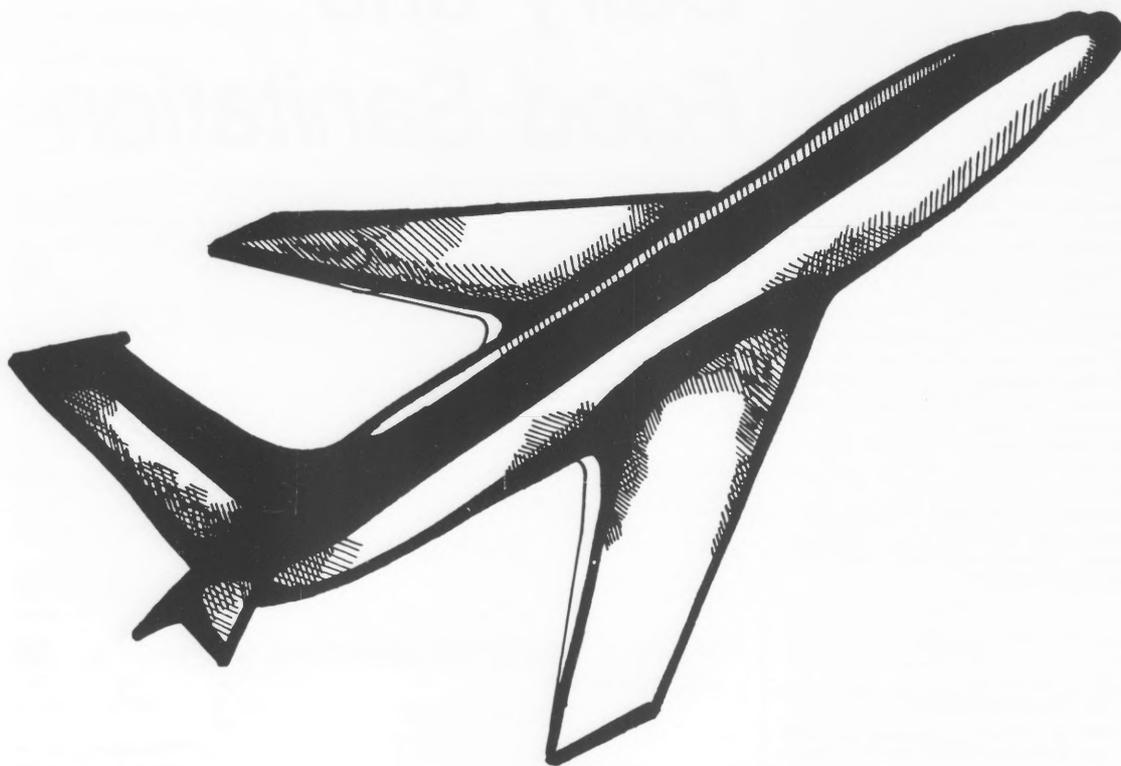
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QUALITY ASSURANCE IN

INFLIGHT FOOD SERVICE OPERATIONS

ULFERT H. ESEN

*United Airlines Food Service
La Guardia Airport
Flushing, NY 11371*

Frequently when someone talks about the food on airplanes, those around him look with raised eyebrows and say, "Boy, that was the best hockey puck I ever had!" or, "How did this meal ever get past the metal detector?" A few movies produced recently do not help much to extol the quality of inflight meals. However, if there are concerns about the quality of airline meals, hopefully they will be alleviated by reading further.

As a Food Service Representative for United Air Lines, the author's responsibilities are primarily quality control of food and sanitation in the airline's food processing facilities.

United Air Lines (UAL) Food Services operates 19 flight kitchens in major metropolitan areas of the country, including Kennedy, Newark, Cleveland, Philadelphia, Detroit, Denver, Los Angeles, San Francisco, Honolulu, and others. At United's busiest airport, Chicago's O'Hare, the two flight kitchens handle an enormous volume. The narrow body kitchen caters 727, 737 and DC-8 aircraft, serving roughly 12,500 meals per day, or 175 flights a day. The wide body kitchen caters DC-10 and 747 aircraft, amounting to roughly 6500 meals on 40 flights per day. Consider that this represents 40 separate dining rooms.

In addition, our pastry kitchens produce nearly 50% of United's rolls, desserts and danish pastry. The volume produced per eight hour shift is approximately 4400 dozen rolls, 2600 dozen danish and 32,000 portions of dessert.

The 19 flight kitchens produce over 65% of the 35 million meals United serves yearly. United also contracts catering for 22 other airlines, with an additional meal volume of 7 million meals.

Where UAL does not operate its own flight kitchen, it purchases contract catering from local airport caterers. This is the case in 58 locations, including Hartford, Kansas City, Pittsburg, San Diego and LaGuardia.

To assure that quality is consistent with that of its own flight kitchens, United Air Lines assigns Food Service Reps, such as the author, at these locations.

Through the day-to-day management of its own flight kitchens and by supervision of outside catering locations, UAL can determine and control the quality of the meals it serves, as well as the sanitation of its equipment.

There is a special category of meals that UAL serves, amounting to roughly 55% of the total volume, or 18,000,000 meals per year, where the airline relies on other food processing plants who supply precooked and prepared frozen foods which became a necessity for most airlines in the early seventies. As a result of rising passenger volumes, ever-escalating labor costs, less available real estate at airports, increased construction costs and numerous other economic conditions, airlines had to turn to this special category of convenience foods. The provisioning and production of these precooked frozen foods is not a simple or single one-shot procedure. It requires expert technical direction at each step of the manufacturing process, as well as rigid control over post-freezing handling. While the quality should be of general concern to every employee in processing of food products, the responsibility for quality control is delegated to one individual to insure that uniform satisfactory products are packed at minimum cost. These objectives have yielded fewer rejects, positive passenger acceptability and a higher quality product for the airline. Here is how it is done:

- Executive chefs write specifications for entrees.
- The menu is written in a small quantity recipe.
- From 10 to 22 entrees, with complete specifications, are sent as a bid package to six different manufacturers.

The bid package may include beef entrees, seafood entrees, pasta entrees, and poultry entrees.

Product requirements for the vendor are:

- Meat - It must be fresh, not frozen. This results in a higher yield, gives a better quality product, requires less handling and, therefore, becomes a more economical item.
- Vegetables - They must also be fresh or blanched to supplier specification. UAL does not want a frozen vegetable for further processing.

In order to qualify as a UAL supplier:

- The plant must be FDA inspected and in good standing.
- The plant, by FDA requirement, must conduct bacteriological tests on products, by an outside lab or in an in-house lab, and these lab results must be made available to UAL.
- The plant must have culinary expertise and an in-house chef must be a member of the management team.
- The plant must have a history of producing custom foods.
- United Air Lines must have unrestricted access to the plant.
- A United Air Lines quality control expert must be present during the start-up operation of any new production run.

The six suppliers or bidders at this stage are required to produce test samples within eight weeks. At this point, United Air Lines selects a panel of ten individuals. Eight of these ten are UAL executives who blind-taste the submitted samples from the various vendors.

The top three meals in any of the categories are chosen by means of a product evaluation score card.

The criteria are:

Meat: portion size, appearance, tenderness, taste. Possible ratings are: excellent, good, minor modification necessary, and not acceptable.

Sauces: color, taste, viscosity. Again, ratings are: excellent, good, minor modification, and not acceptable.

Finally, an overall taste impression is solicited. The award or selection of the successful vendor is based on the quality and cost of the item. Any vendor can produce a loaded sample, or, in other words, an item that cannot be duplicated in a normal production run. Therefore, United does not normally award a new vendor a sizeable contract. Vendor selection is greatly dependent on past reliability for product quality. This is the essential factor in the vendor selection process.

Once vendor selection has been made, A United Air Line quality assurance specialist will supervise the formulation of the test sample into a small production run at the vendor location. This may constitute a batch of anywhere from 500-1000 meals. This run undergoes another product evaluation and the quality control specialist reserves the option of rejecting the product at this point. Although this does not happen very frequently, such an option was exercised several times.

The vendor is then required to supply the government an ingredient statement for label approval, and the label must appear on all shipping cases. For example: products manufactured are stamped with the date of manufacture, as well as an alphabetical letter to indicate period of the day.

After it has been determined that the production run is of equal quality to the submitted test sample, the vendor is given the go-ahead to start predetermined production quantities. These, depending on menu items may range in quantities of 2500 to 20,000 units per day. It can be appreciated what disastrous results might occur if the quality of one batch was bad. Thousands upon thousands of portions can end up at a location with no kitchen capacity to provide a substitute.

It must again be emphasized that three watch dogs are at work:

- UAL contracts only with FDA approved facilities.
- The airline has its own quality assurance specialist at the vendor location during start-up operations.
- UAL contracts with reputable vendors who have demonstrated they can produce quality products.

Quality assurance does not end here. Prior to any cycle change, each boarding location must pull several random samples from stock; the meals must be reconstituted, and the kitchen manager, his chef, sous chef and buyer must repeat the entire production evaluation score card on each frozen meal sample.

United Air Lines cycle changes occur every three weeks, and since all east-west menus are identical, the same procedures would be conducted simultaneously in all east and west coast airports. Product test evaluations are phoned to headquarters for analysis and trending.

One further step in the quality assurance program is that all locations are asked to route random samples to the test kitchen in Chicago for spot evaluations.

Any business carries with it certain responsibilities and obligations. Managing its own flight kitchen requires numerous economic, legal and ethical responsibilities -- but more than these it requires one clear cut objective from the UAL management team and that is protecting the customer from foodborne illness.

The entire inflight industry in the USA has made a conscientious effort to prevent outbreaks of foodborne illness. Of all published cases of food poisoning in civil aviation between 1967 and 1978, only one case originated in the US. That particular one happened in 1970, on a flight between Atlanta and Europe.

Statistics of the 15 published cases of food poisoning between 1967 and 1978 should be quickly reviewed.

The total number of passengers subjected to contaminated food were approximately 10,000, although an exact number cannot be determined. Some 1800 passengers, (20%) had to be treated for various food poisoning symptoms. In those cases where causes could be established, the predominant causes were:

- failure to properly refrigerate foods
- infected kitchen personnel
- improper personal hygiene

These are the very same causes that the Center for Disease Control list high in publications identifying foodborne disease hazards in food service establishments.

The aim of the entire inflight catering industry is to be in a position to eliminate foodborne disease problems so that outbreaks such as some persons suffered a few years ago on a jumbo jet flight between Alaska and Copenhagen will not occur again. But before all food service operations will achieve this goal, they must have training programs in operation to make all employees, supervisors and managers aware of the factors that contribute to foodborne disease outbreaks. Employees must be motivated to practice appropriate preventative measures as routine practices in all operations that they perform and supervise. Formal training and in-house training will assist all employees, including supervisors and managers to gain such an awareness and motivation.

As Gail G. Holland wrote, "Education of management and employees is the key to solving sanitation problems." United Air Lines is in the process of developing an in-house sanitation program. The certification and formal training of food service managers in proper sanitation procedures is fast becoming a reality for many of this country's restateurs and food service operations as they voluntarily develop their own internal certification program. In order to have a uniform understanding and interpretation, and to be in concert with FDA sanitation requirements, UAL is structuring this program along the following lines:

The program will consist of 12 audio-visual slide modules covering the following topics:

- General provisions of the food service sanitation code.
- Food care-covering supplies, storage, preparation and display of food.
- Personnel-employee health.
- Concept of sanitation-causes of foodborne illness and harmful agents.
- Basic bacteriology.
- The design and fabrication of equipment and utensils.
- The cleaning, sanitation and storage of equipment and utensils.
- A module on the sanitary facility and control.
- Construction and maintenance of the physical facility.
- Compliance procedures-inspections and self-inspections.

In order for the program to be successful, the following objectives have been set:

The program must be:

- Accurate. In other words, it must convey information that is factual, up-to-date, and complete.
- The program must be appropriate for the purpose of training the employee.
- It must be attractive, meaning that it must gain and retain the attention of the trainee.
- It must be authenticated by an authority in the field.

While an in-house, on-going program will not necessarily prevent an outbreak from happening, a program such as this could significantly reduce the possible risks associated with an outbreak of foodborne illness. These, of course, include but are not limited to, loss of customers, loss of sales, loss of prestige, reputation and embarrassment.

It is anticipated that this discussion has provided insight into the problems and concerns of the inflight food service industry. They are, of course, similar to the concerns of other food service operations and yet, a highly specialized segment of the industry.

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Cynthia Good is not your everyday riding enthusiast.

Cynthia Good was paralyzed in 1961. She is now able to walk with the use of a cane.

She graduated Magna Cum Laude in Business Management and received her M.P.A. in Health Administration. Today, she's logistics manager for the nursing department of the Institute of Rehabilitation Medicine of New York University.

Cynthia takes part in national and international riding competitions and is on the board of directors of two riding foundations, the Winslow and North American. She says, "Developing skills in riding produces an unparalleled sense of accomplishment and independent participation—an environment that allows people to deal with people."

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Regulation: Looking To The Future

RICHARD M. COOPER

What broad factors are going to influence regulation in the remaining decades of this century and beyond? Richard M. Cooper describes some of these influences and how he expects they will affect FDA and its sister agencies. The author, former general counsel of FDA, is an attorney with the Washington, D.C. law firm of Williams and Connolly.

If you can look into the seeds of time, And say which grain will grow, and which will not, Speak then to me. . . .

—Banquo to the Three Witches
Macbeth, I, iii.

An awesome request and, as Macbeth and Cassandra learned to their sorrow, one not likely to profit the asker or the asked. But political prophecy being a popular national pastime, *FDA Consumer* may be forgiven for having asked and I may be forgiven for responding as best I can.

Start with the economy, the machinery that produces goods and services. The market is primary. Without it, there would be no regulation and no need for it; it is the object on which regulation acts. It is also primary in that it provides the things people most want—food, clothing, housing, medical care, transportation, and so on. Regulation cannot provide these things—though it can bring about the provision of other, “secondary” things (some also highly desired), such as a greater degree of workplace safety, a more honest securities market, a cleaner environment and greater purity in foods and drugs.

The regulatory process as a whole applies a variety of standards to the economic processes by which goods and services are produced and distributed. Thereby, it affects not only the processes, but also the mix of goods and services offered in the marketplace. As a result of regulation, some goods and services are not offered at all, some are offered at higher prices (and thus are available to fewer people), a few are offered at lower prices (and

thus are available to more people), and some are offered that otherwise wouldn't be.

“For a number of reasons having little to do with regulation, we live in a time of unacceptably high inflation, which is likely to continue for the rest of the century. Inflation means that consumers find it more expensive to buy desired goods and services. The result is a general dissatisfaction with the limits of what money will buy.”

For a number of reasons having little to do with regulation, we live in a time of unacceptably high inflation, which is likely to continue for the rest of the century. Inflation means that consumers find it more expensive to buy desired goods and services. The result is a general dissatisfaction with the limits of what money will buy. That dissatisfaction has political consequences, one of which is a search for ways to improve the power of consumers to buy the primary goods and services offered by the economy. Popular discontent with prices puts pressure on politicians to make trade-offs between primary goods and services and the secondary ones brought about by regulation. The purpose of these efforts is to make primary goods and services easier to buy by reducing the regulatory demand that productive resources be diverted toward secondary objectives.

I think it fair to interpret the Presidential and Congressional elections of 1980, together with the emergence of an intellectually respectable set of antiregulatory public policy recommendations, as warranting some loosening of regulatory controls on the

economy. This is a democracy in which voters and responsible ideas have their chance. If they call for more primary goods and less regulation, then the political process will and should respond. Moreover, distrust of regulation is not a monopoly of conservatives. It was William O. Douglas who said, "(A)s I read the Constitution, one of its essential purposes was to take the government off the backs of people and keep it off."

I suggest one set of exceptions to this general view. Certain fundamental rights, mainly those protected by the Constitution, but a few others as well, are so important—essential to even a rudimentary notion of justice—that reasonable regulations to assure them ought to be removed from the vicissitudes of politics. I refer here principally to regulation of State electoral laws to assure the right to vote, the core regulations that seek to assure equal employment opportunity, regulations to assure equal access to the benefits of government programs, and regulations to require some degree of fairness in broadcasting concerning politics and public issues. There is room for debate about the merits and public acceptability of regulations providing for affirmative action, busing, bi-lingual education or inclusion of women in military programs, but I see no mandate for changing our society's commitment to implement nondiscrimination.

"The efforts to reduce regulation will be pursued in two general ways—across-the-board and sector-by-sector."

The efforts to reduce regulation will be pursued in two general ways—across-the-board and sector-by-sector. The across-the-board efforts, commonly known as "regulatory reform," are attempts to change the mix of primary and secondary goods and services without facing up to the detailed consequences of such a change. The mechanisms proposed in such efforts—amendments to the Administrative Procedures Act, requirements for impact statements of various sorts, sunset, legislative veto, regulatory budget—are intended to stem the flow of new regulations by making it harder to regulate or by forcing reconsideration of the need for regulatory programs. These efforts may have some marginal effect, but—as the lack of passionate public controversy about them reflects—they don't get to the heart of the matter;

they will not bring about a substantial shift of resources back from secondary goods and services to primary; and some, such as moratoria on regulation, may even hinder efforts to reduce regulation (and delay innovation where new product approvals must take the form of regulations—for example, food additives and antibiotics). The recent experience with the delayed extension of FDA's provisional list for color additives is instructive.

"Substantial shifts will occur only when the substance of regulatory standards (whether legislatively or administratively imposed) is addressed sector by sector, statute by statute. Then the tough political fights will be fought, the interests of different segments of society will clash, and we will see how the political process responds to the contending forces."

Substantial shifts will occur only when the substance of regulatory standards (whether legislatively or administratively imposed) is addressed sector by sector, statute by statute. Then the tough political fights will be fought, the interests of different segments of society will clash, and we will see how the political process responds to the contending forces.

The overall political interest in reducing inflation will clash on many fronts with other social goals. Sometimes one interest will prevail, sometimes another; most often, the result will be *ad hoc* compromises.

The biggest blow to the anti-inflation forces will come in the field of energy. Decontrol of oil prices means the inflation numbers will be significantly worse. The overriding interests here are national security and the need to cushion the economy against interruptions of foreign oil supply by stimulating increased domestic energy production and raising the cost of energy consumption to induce conservation.

Other types of economic regulation have for many years served little purpose other than protection of inefficiency or prevention of competition. Such regula-

tion of airlines (excluding airline safety) is already on its way out. Substantial deregulation of banking, communications, and trucking has taken place, and more should come. Further deregulation of surface transportation is in order.

In the fields of health and safety regulation, a variety of discrete battles will be fought. The heavy hitters in the inflation field are the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA), and they are likely to receive the brunt of the anti-inflation attack.

As the proportion of unionized workers in the labor force declines, and as the political power of the unions declines with it (particularly relative to the power of corporations acting through their political action committees), OSHA is likely to see its authority cut by the Congress. In administering the Occupational Safety and Health Act, the new administration probably will be more willing to be satisfied with individual protective equipment (as an alternative to engineering controls) than was the Carter OSHA. Moreover, the Supreme Court's decision in the benzene case last July probably marks the beginning of an era of stricter judicial review of health and safety regulation. The strictness will be focused initially and most intensively on OSHA, but will spread to other agencies as well. If President Reagan makes an appointment or two to the Supreme Court, this trend is likely to be imposed even more forcefully.

The future of EPA is more difficult to predict. Certainly major industrial interests will press hard for a softening of environmental standards through both administrative and legislative action. And some relaxation will occur to facilitate a production-oriented approach to the energy problem (particularly with respect to mining and burning coal and production of synthetic fuels), and to help the beleaguered auto industry. And as real food prices soar in coming years, pesticides are likely to be regulated more leniently.

There are powerful countervailing forces, however. Concern for the environment is a product of the affluence of the upper middle class, a politically influential and growing segment of society. Much of the likely environmental degradation as a result of energy development (and the MX missile system) will occur in the West, the heartland of the rejuvenated Republican Party. Whether the West will peacefully acquiesce in such degradation on a large scale remains to be seen. In general, we can expect to see hand-to-hand combat over standards for air, water, pesticides, and chemicals

generally, waste disposal, and so on: and the probable outcome is some softening of existing standards and a slow-down in the rate at which new standards are imposed.

"In the field of food and drug regulation, major change is unlikely. Congress may relax the requirement that the effectiveness of new drugs be proven with scientific vigor."

In the field of food and drug regulation, major change is unlikely. Congress may relax the requirement that the effectiveness of new drugs be proven with scientific vigor. The Carter Administration (with the support of Senator Kennedy) proposed some relaxation for "breakthrough" drugs. So the issue is now drawn as one of degree rather than principle. In the new political climate created by the 1980 elections, the relaxation is likely to be greater. Some "proof" of effectiveness will continue to be required, however, because even the Pharmaceutical Manufacturers Association doesn't want to legalize laetrile.

Food safety is a minefield for legislators. The Delaney Clause is a popular whipping boy, but its repeal would have little effect if the general safety clause were left intact. Will Congressmen vote to repeal the provisions that food and color additives be shown to be safe? In practice, the issue may be defused if FDA makes aggressive use of the discretion given it by the D.C. Circuit in the acrylonitrile case in 1979. The decision (whose general approach was subsequently fortified by the Supreme Court's benzene decision) allows FDA to disregard *de minimis* migration of carcinogenic food packaging materials into food. The principle is obviously extendable.

Some critics of current food safety regulation will be dissatisfied even with that degree of loosening up and will press for broad risk-benefit standards. Indeed, pressures for risk-benefit decisionmaking are building across the field of health and safety regulation. The idea has undoubted intuitive appeal: the costs of regulation are too high, and it is only rational for regulators to take costs into account and to impose a regulation only when its benefits (in reducing risk) outweigh its costs.

What are seriously underestimated in most discussions of risk-benefit decisionmaking, however, are the costs of the technique itself—the vesting of broad and virtually unreviewable discretion in regulatory officials, the imposition of large transaction costs in connection with each risk-benefit decision, and the great unpredictability of risk-benefit decisions in view of the uncertainties in the analysis of individual risks and benefits and the additional uncertainty as to how the various quantifiable and nonquantifiable factors will be valued. In some settings, risk-benefit decisionmaking is the only sensible approach, but enthusiasts ought to review closely the history of the technique as applied to pesticides. My own view is that over the next few years new requirements for risk-benefit analysis will be enacted by Congress and imposed by the courts in a variety of areas of health and safety regulation, but over the longer term disenchantment with the application of the technique will grow; and, perhaps under the stimulus of the doctrine of unconstitutional delegation, we will eventually see a movement back toward more detailed congressional specification of regulatory decisionmaking rules.

In the field of health and safety regulation, such specification has commonly taken the form of a risk-based standard (for example, that food additives be shown to be safe). Thus far efforts to define standards like "safe" or "reasonable risk" in quantitative terms have not succeeded. After several years of trying, FDA still has not adopted a sensitivity-of-the-method regulation. But progress is being made, and we can expect to see over the next couple of decades increased analytical sophistication and increased ability to design studies to yield the kind of data needed for quantitative estimations of risk. The difficulty is that the actual generation of the data is prohibitively expensive. A breakthrough in the science of toxicology (particularly cancer testing) through increased reliability of short-term assays, for example, could open the way for greatly expanded use of quantitative risk estimation, and thus for more tightly drawn statutory standards for regulation.

Labeling strategies are also a currently popular approach to dealing with health and safety risks. In some circumstances, they are the optimal approach, but in others they are likely to be ineffective; and they almost always raise questions of social justice (as to the people who can't use them effectively). We can expect to see increased use of labeling as an alternative to other regulatory techniques (bans, stricter standards); the test will come when, in the case of some labeling approaches,

it is determined after several years of experience that the labels have not significantly reduced the health of safety problem that created the need for regulatory action in the first place.

A fair test of the Reagan Administration's philosophical commitment to labeling strategies will be its handling of FDA's patient package insert (PPI) program. Perhaps FDA has not yet found the optimal way to provide information to consumers of prescription drugs. But an administration committed to shifting decisionmaking from the Government to the people cannot jettison or pare down the PPI program without inviting the comment that it has no consistent philosophy at all. Similarly, an administration committed to reducing inflation and assisting State governments ought to maintain the informational activities grouped under FDA's therapeutic equivalence program.

The regulatory reform discussions during the Carter Administration led to a broad consensus supporting a number of "innovative" regulatory techniques. These have achieved the status of "simply good government," and their use is likely to expand. The techniques include: use of performance standards rather than detailed specification of means of compliance, use of economic incentives rather than "command and control" regulation, modifying general requirements to suit the circumstances of different groups within the regulated sector (for example, less onerous requirements for small businesses), and increased opportunities for effective public participation in the development of regulations. In gross, these techniques may not do much to reduce inflation, but at the margin they should make regulation more intelligent, more responsive to the complexities of the world, and somewhat less irritating to those regulated.

One type of regulatory innovation that may yield significant economic savings is the substitution of economic incentives for traditional regulatory requirements. EPA has pioneered in this area by developing the "bubble concept," under which the various emissions from a plant are subject to a single overall limit, but the firm operating the plant decides how to allocate the permitted quantity of pollution among the various sources of emissions. This flexibility should enable firms to minimize the costs of compliance. Last October EPA again broke new ground by proposing that certain uses of chlorofluorocarbons be regulated through the sale of permits, which could be resold in the open market. EPA's assumption is that the permits would end up

allowing the economically most valuable uses, and that as their prices rose firms would seek alternatives to chlorofluorocarbons. In these ways, the approach may be more efficient than a system of bans-with-exceptions.

Coordination of regulatory activities carried out by agencies was begun during the Carter years. The Regulatory Analysis Review Group (RARG) in the Executive Office of the President tried to harmonize major regulations with overall economic policy. The Regulatory Council was a creature of the agencies themselves, designed to provide a measure of voluntary coordination to stave off further intervention by the White House. Other interagency cooperative efforts also sprang up (for example, the Interagency Regulatory Liaison Group, consisting of EPA, OSHA, FDA, the Consumer Product Safety Commission, and the Department of Agriculture's Food Safety and Quality Service (FSQS); *ad hoc* cooperative efforts among FDA, FSQS, and the Federal Trade Commission. On the whole, these efforts had some impact, did some good. But it cannot be said that the regulatory activities of Executive Branch agencies (let alone the independent commissions) are coordinated to any substantial extent.

Sooner or later some President will undertake to bring about substantial coordination. And he (or she) will find that the way to do it will be to vest the responsibility not in a staff office like RARG or in the Regulatory Council, but in a line institution: the Office of Management and Budget (OMB). Then we should see regulatory coordination (and control) assume an importance within OMB akin to its responsibilities for the budget, general management, and legislative coordination. Regulatory coordination would become an everyday part of the workings of the Government and a channel for Presidential power. This is the direction the current administration is taking, but it remains to be seen whether the impetus will extend beyond the review of a small number of highly visible regulations.

Finally, I foresee private and quasi-private institutions playing increasingly important roles in the regulatory process. The National Academy of Sciences continues to provide a forum for scientists in the private sector to articulate the state of scientific knowledge and advise on issues of public policy. Advisory committees to agencies—consisting of private individuals serving temporarily as special government employees—play a similar role. Some industries are establishing more or less independent organizations to develop data for use in the regulatory process.

Perhaps the most interesting recent venture to enter the regulatory field is the Health Effects Institute, an independent, nonprofit corporation created and funded jointly by EPA and the manufacturers of automobiles and truck engines. The purpose of the institute is to conduct (through contracts and grants) scientific research on the health effects of motor vehicle emissions. The institute will have its own scientific committees which with the concurrence of a board of directors will set research priorities, design protocols, and conduct peer review. The institute will simply produce research, with the expectation that the research will become the agreed-upon basis for debates about regulatory policy. EPA, the industry, public interest groups, and other interested parties will, of course, remain free to criticize the research, to argue about the significance of the results, and to debate about what should be done. But, if all goes well, the quality of discussion will be greatly improved by the generation of the basic data under the nonadversarial auspices of an independent institution able to draw on the best available scientific knowledge and talent.

The Health Effects Institute may become a model for similar government-industry cooperative efforts in other regulated areas. If so, the result is likely to be better and more broadly accepted regulations.

I have dealt here only with what has traditionally been regarded as "regulation"—commands and controls issuing from "regulatory" agencies. Many other kinds of governmental action, however, effectively regulate behavior, even though they are not cast as "regulations"—tax provisions, grants and subsidies, tariffs and trigger prices, procurement policies, and so on. In terms of economic impact and the "hassle factor," these areas offer far more significant opportunities for reducing costs to taxpayers and consumers and for reform generally than does traditional regulation.

Finally, any prediction about the future of regulation must allow for the unpredictable—the surprises in store for us in the toxicology and analytical chemistry labs, in the conduct of hazard-producing activities, in the experience of people as they encounter toxic substances and hazardous conditions in their daily lives. The capacity of fortuitous events to alter the agenda for governmental action is astonishing—as history from Elixir Sulfanilamide to thalidomide to Three Mile Island and the 1979 infant formula recall testifies.

THE DAIRY INDUSTRY'S GREATEST ASSET - QUALITY

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Endless numbers of laboratory analyses do not measure the true "eating quality" of a dairy product. The "true" measure of milk quality, as far as the consumer is concerned, is flavor.

Five steps to effective cleaning of dairy equipment and methods for detecting flavor/odor problems are described.

The dairyman is most important in the chain of events involved with delivery of high quality milk from farms to consumers. The importance of sanitation, mastitis control, and temperature control cannot be taken for granted.

Is mediocrity of milk flavor at all responsible for decreased per capita consumption of fluid milk and cream in the U.S.?

"The dairy industry, if it is to reach and maintain its proper goal in the present economy, must direct every effort towards the marketing of quality products," noted James R. Welch, Farm Program Manager for Klenzade in a 1974 issue of *Professional Fieldman*.

We all should readily realize that the responsibility for quality lies not only with the dairy equipment manufacturer, the milk handler, the milk hauler, regulatory agencies at local, state and federal levels, but also with the dairy farmer.

Today consumers demand their money's worth in the products they purchase, whether it be automobiles, furniture, shoes or food. This is the era of consumerism. Those of us in

the dairy industry are entitled to ask, "How might we best be 'on guard' against the wary, aggressive buyer of our products?"

Rather than being "on guard" or "plotting a defense" for the production and marketing of milk products, a properly designed program of quality assurance is needed.

Fortunately most consumers have a strong feeling of confidence in the quality of most dairy products in the U.S. For decades the dairy industry has been the world leader in maintaining high standards for sanitation, nutrient content and product quality.

This consumer confidence is related to the overall wholesomeness, cleanliness, palatability and nutritional dimensions of all dairy products. The U.S. has the best, safest and largest choice of food ever offered to mankind. However, those of us associated with the dairy industry know that it is a constant challenge to maintain that record.

What is meant by the term "quality"? The expression "good", or "high quality", conveys the relative degree of excellence we observe in a product.

Does your milk supply qualify? Quality is more than mere conformance to specification, grade, or standard. The concept of good quality refers to the sum total of performance which is reflected in the

end product. The consumer measures the degree of quality daily, by consumption of food products.

Don't forget, flavor is the voice of milk! The flavor of milk and other dairy products is the key to consumer acceptance. Endless numbers of laboratory analyses do not measure the true "eating quality" of a dairy product.

For the dairy industry, the most important requirement of a thorough quality assurance program is careful flavor evaluation, screening and, if necessary, rejection of certain milk and cream supplies. Dairy products are only as good as the raw materials from which they are made.

The art of competent detection of off-flavors and odors in raw milk supplies and finished dairy products is an invaluable quality assurance tool. The correct diagnosis of a flavor-quality problem is absolutely necessary before remedial measures can be taken.

Generally, three methods of tracing the cause of flavor/odor problems are available; sensory evaluation, chemical tests, and microbiological tests.

The most efficient approach to quality assessment is the sensory method. A person trained in flavor evaluation has a distinct advantage over the dairy industry employee competent only in the other methods.

“Rather than being ‘on guard’ or ‘plotting a defense’ for the production and marketing of milk products, a properly designed program of quality assurance is needed.”

Bear in mind that one cannot effectively evaluate milk samples for flavor quality, taste or odor, when the samples are tested at temperatures below 50°F. Any potential off-odor or off-taste in a milk sample is more readily detected after tempering to 60-70°F.

A more effective technique is to temper the samples to 80-90°F. The higher temperatures serve to more completely volatilize any potential off-odors and to emphasize unwanted odor notes.

In a recent case a milk hauler unfortunately misjudged an off-flavor as a “peculiar, caramel-like feed” flavor. Since it was “just feed,” the sample was ruled acceptable and the milk in question was pumped into the big silo. The sampling was done at cold temperatures. Before the “crying over spilled milk” faded into the night, this incorrect sample ruling had a price tag of \$30,000.

There are many of us involved with the technology phases of the dairy industry who sincerely believe that the industry’s greatest potential danger lies in the failure to obtain high quality milk from the dairy farm in its raw state. In order to secure the top quality raw milk, the following factors must be considered:

Sanitation

“97% clean is still at least 3% dirty” in any language.

If equipment such as milking machines, pipelines, pumps, receivers, and bulk tanks are not clean -

both visibly and microbiologically - then bacteria counts go up, and quality goes down. Stay off the “see-saw,” stay clean!

Practice (faithfully) the 5 classic steps of effective dairy equipment cleaning:

1. Rinse with warm water (pre-rinse).
2. Circulate (or brush with) hot alkaline cleaner.
3. Rinse with warm or cold water.
4. Apply acid rinse (post-rinse).
5. Allow to drain and air dry.

The cleaning task refers to the complete removal of residual soil following each equipment use with minimum physical effort in the shortest time and at the lowest possible cost.

It is generally recognized that effective cleaning depends on correct application of the following: time, temperature, detergent concentration and proper physical action.

1. *Time* - generally ranges from 10-20 minutes. Long cleaning cycles lead to decreased solution temperatures and failure to remove milk bacteria residues.

2. *Temperature* - at least 135°F on the end of the pipeline or tank outlet is required for cleaning solutions.

3. *Detergent concentration* - Follow the exact recommendations of the manufacturer, which is frequently about 1% by weight.

4. *Proper physical action* - (1) manually - via brush action and “elbow grease”, or (2) clean-in-place (CIP) - via turbulence and velocity of cleaning solution provided by proper pumps.

Don’t take your cleaning program

for granted. Scrutinize your CIP system, your detergent, and the sales representative who calls on you. The service person and associated cleaning products must measure up to the high-performance demands of dairy sanitation. In essence, “be good, or be gone”, to avoid product quality problems.

Equipment surfaces must be thoroughly clean before chlorine or iodine-based sanitizers are effective. Carefully measure the required amounts of chlorine or iodine into known quantities of water to provide 200 ppm of chlorine or 25 ppm of iodine. Allow for good drainage of the sanitizer solution from all equipment surfaces.

Mastitis Control

The primary cause of abnormal milk (not typical composition) is mastitis. Certainly, abnormal milk is outside the realm of good quality. Uncontrolled mastitis is a major economic factor (lost milk production) working against successful dairying. It is necessary for each dairyman to practice effective milking techniques, teat-dipping after milking and/or dry cow treatment to help control the various bacterial organisms that trigger mastitis. Don’t overlook the important role that properly installed and operating milk equipment plays in mastitis control.

Housekeeping

How is the image of your farm in the eyes of prospective milk con-

“The true measure of milk quality, as far as the consumer is concerned, is flavor.”

sumers? Not good, or could be better? If you have a “Dairy of Merit” plaque hanging from a post at your roadside, skip ahead to the next section.

Housekeeping or general appearance of a dairy farm is always the first thing to catch the eyes of the public as they pass by or visit the farm. For the overall good of the dairy industry it is most important that we “create a favorable image” upon consumers and prospective consumers.

If the state of appearance and housekeeping of a dairy farm is bad, it is simply human nature to conclude that the milk product being produced is inferior. Remember, eye appeal has been a key promotion tool for selling products for decades. Cue words are: “attractive,” “neat,” “organized,” and “clean”. How many apply to the appearance of your farm?

Temperature Control

“Life begins at 40°F.” That is, the growth of certain types of spoilage bacteria starts at this point. These bacteria are the psychrotrophs; microorganisms that have the ability to reproduce at refrigeration temperatures, and in doing so, serve to deteriorate milk quality. Some of the psychrotrophs from the raw milk supply are able to survive pasteurization (heat resistant sporeformers). The primary concern about psychrotrophs in milk, raw or pasteurized, is the major impact they have on restricting milk shelf-life and causing

objectionable off-flavors, (fruity, unclean, putrid, rancid, and/or bitter).

Most state regulations require that Grade A milk be cooled to 50°F or less within one hour after completion of milking, and to 45°F or less within two hours. Preferably, for quality maintenance reasons, the above temperatures should be 5°F less, i.e., 40°F or less. How do you prove that your cooling rate of milk meets this? Easy, with a recording thermometer. This recorder device is a “tattle-tale” if milk cools at a slower rate than indicated above, or it does not maintain milk contents of the farm tank below 50°F at all times. The recorder device can provide a warning signal (light or bell alarm) when 50°F is exceeded, and show evidence of CIP cleaning of the tank, and certain other short-comings. The recording thermometer is like a “24 hour fieldman”, it is a remarkable quality assurance tool.

Please don't develop the attitude, “If God had meant milk to be refrigerated, cows would have been made cold-blooded.” Those dairy industry people who take proper temperature control of milk for granted seem to blame many of the temperature induced quality problems on God's “lack of foresight”. Keep the “quality up by keeping your temperatures down. Flavor is, the voice of milk.”

The true measure of milk quality, as far as the consumer is concerned, is flavor. The quality measures used by most regulatory agencies and milk handlers are bacteria counts and sediment tests. While milk of low bacteria count and low sediment content may be of good flavor, this is

not necessarily always true. For example, milk can be rancid, oxidized, or feedy even though it is relatively free of bacteria and sediments. In other words, sanitary quality and milk flavor need not be related.

For a given dairyman's milk supply, the flavor quality and the potential for extended shelf-life are most pertinent in helping to determine consumer acceptance of milk. The extent of product acceptance determines per capita consumption of fluid milk and cream, hence, the proportion of Grade A milk utilized in Class 1 sales. The larger the percentage of milk used for Class 1 sales, the higher the blend price and the greater the producer's return. The flavor quality and shelf-life of milk and milk products affects you, the dairyman, right in your pocket-book! Several factors help determine per capita milk consumption: (1) price/unit, (2) season of year, (3) promotional activities, and (4) ethnic and cultural patterns of people. But there is no denying the fact that satisfactory flavor characteristics and reasonable shelf-life are critical prerequisites for consumer acceptance of fluid milk and cream products. The dairyman is the most important component in the chain of production, processing, and marketing activities necessary for the flow of high quality milk from farms to consumers.

The Space Age doesn't have room for unacceptable milk off-flavors; nor does the dairy industry, faced with declining per capita consumption of fluid milk.

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THE SANITARIAN'S ROLE IN APPLICATION OF RESEARCH AND DEVELOPMENT FINDINGS TO ECONOMICAL FOOD PRODUCTION

"A variety of both agricultural and industrial manufacturing industries investigated in the 1960's revealed, without exception, that an industry's or a firm's rate of productivity increase was directly related and development carried out by supply industries lowers the production costs of the industry so supplied."

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The rate of return on investment in agricultural research and development in the United States has been more than 90% and 130% in the Southeast. Fieldmen and sanitarians have played a vital role in the application of research and development findings to industry. These developments include: (a) bulk handling of milk, (b) automation in milk production and processing, (c) in-place-cleaning, (d) maintenance of quality milk in the marketing channels. Fieldmen and sanitarians will continue to supply the means for application of further research and development findings to the economical production of food.

If the current retail cost of fluid milk were based upon production and processing methods in use 20 or 30 years ago, the cost of milk to the consumer would be several times the current price. But the current price situation is largely due to research and development, and its application. A variety of both agricultural and industrial manufacturing industries investigated in the 1960's revealed, without exception, that an industry's or a firm's rate of productivity increase was directly related to the amount spent on research and development (3). Even the research and development carried out by supply industries lowers the production costs of the industry so supplied.

If the output per hour of labor can be increased at the same rate as cost per hour of labor, the total costs per unit of output will remain constant. No increase in prices will occur. Inflation, however, tends to push up the cost of production, and only with consistent effort to increase output per hour of labor can prices remain relatively stable.

The increase in productivity of the American farmer is a marvelous success story of the free enterprise system (1). In 1790, 90% of the people were producers of food; in 1972 one farmer produced food for 52 people. The labor productivity on American farms has increased materially in the past 20 years (Fig. 1), as has the land productivity (Fig. 2). The total farm productivity in 1950 was about 70% of that of 1967, and by 1978, was about 115% of the 1967 level. Prime reasons for this are greater mechanization and more fertilizer use. The milk production per cow per year in 1950 was about 5,500 pounds, but in 1978 it was over 11,000 pounds. The average dairy cow in the United States in 1978 produced twice as much milk as did the average cow in 1950. The labor used for milk cows in 1977 was less than half of that used in 1967 (9). The application of research and development findings and the use of better production methods on the dairy farm has made this possible.

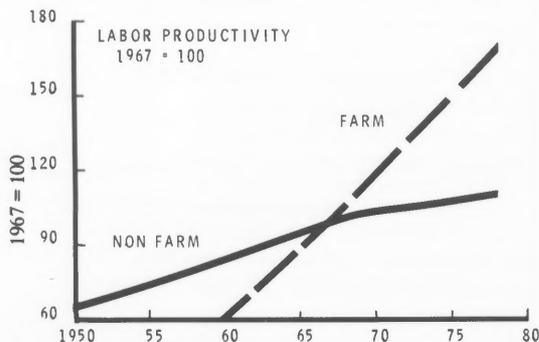


Figure 1. Labor productivity in the United States from 1950 to 1980. Evenson et al. (1).

The use of research and development advances in milk processing has enabled the handler to perform his function at less cost than in previous years (5,6). The profit

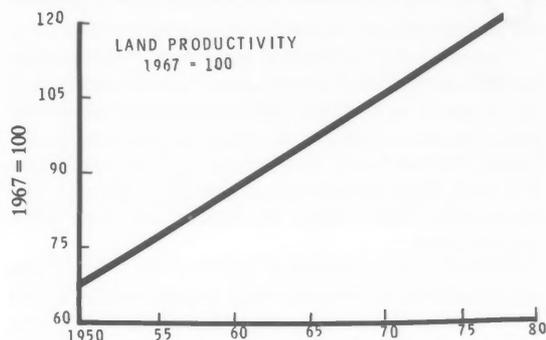


Figure 2. Land productivity in the United States from 1950 to 1980. Evenson et al. (1).

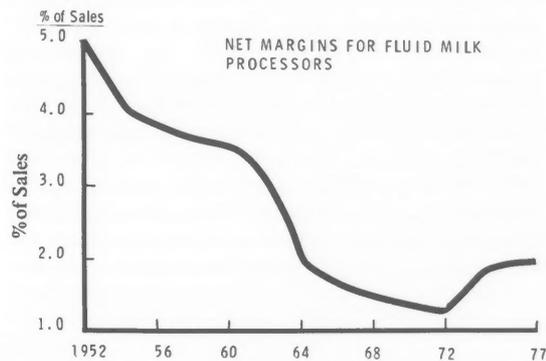


Figure 3. Net margins for fluid milk processors in the United States, 1952-1977. Lasley et al. (2).

margin for milk processors as a percent of sales, is shown in Fig. 3 (2). Because of processor efficiency, more money is available to pay to the producer, or to pass on to the consumer in the form of lower costs for milk products. Fig. 4 shows the actual minutes of factory labor necessary to earn the purchase price of a half-gallon of milk in the years 1950 to 1979 (4, 8). By expressing the cost of milk in this manner the inflation factor is negated. An average factory worker needed to work only half as long in 1978 to purchase his milk as did the worker in 1950. The actual price of fluid milk (Fig. 5) has increased less in 1977-1980 than all food in general (10, 11).

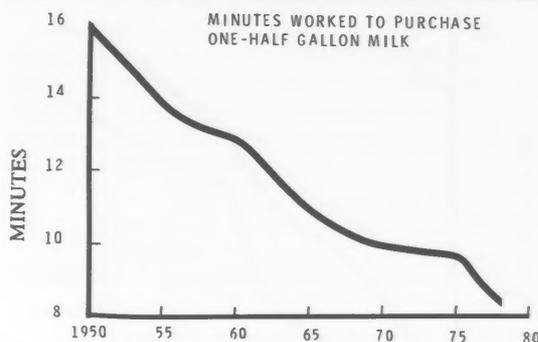


Figure 4. Minutes of factory labor equivalent to the purchase price of one-half gallon of milk in the United States for the years 1950 to 1979. MIF (4) and USDA (8).

The economic laws of competition and economy of scale affect the dairy industry as they do all industries. In 1954 there were 6,689 fluid milk processing plants in the United States; in 1977 there were 1,923 (4).

Among the developments which have been applied are:

Bulk handling of milk. This has tended to keep the hauling costs from rising. The hauling costs in a representative market in the Southeast in 1955 while milk was being transported in 10-gallon cans was 30 cents per hundred pounds and the price of the milk was about \$5.00 per hundred pounds. Thus the hauling costs were 6% of the price of the milk. During the transition period from cans to bulk handling in 1955 to 1958 the hauling cost was 5% of the price of the milk. In 1980 when the price of milk was \$13.36 per hundred pounds in some areas, for example, the hauling costs averaged 45 cents, 3.4% of the price of the milk. Cooperation of many segments of the dairy industry was necessary for this method of hauling to come about, but fieldmen and sanitarians were the key persons in this cost-reducing development. This change in handling technique also reduced the receiving costs at the processing plant.

Automation in dairy plants. The push-button operation in use in a modern plant has reduced the number of workers needed to operate a processing facility. The number of workers in the production section of fluid

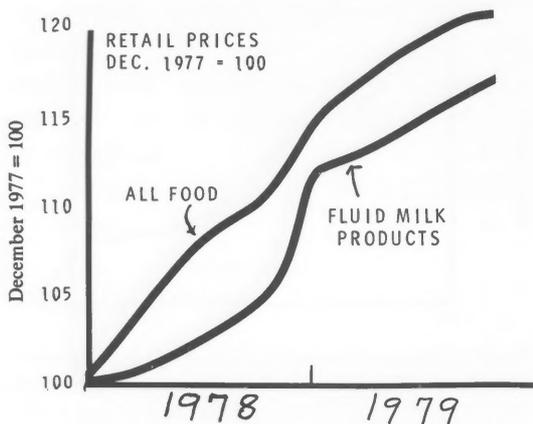


Figure 5. The retail price of fluid milk products and all food for 1978 and 1979. USDA; ESCS (10, 11).

milk processing plants in 1954 was 89,000 and in 1977, was 41,000 (4). In these same years the fluid milk sales were 47.7 billion pounds (7) and 55.9 billion pounds (4). Each worker in 1954 processed about 536,000 pounds of milk per year and in 1977, 1.4 million pounds. In selected plants in the southeastern United States, each production worker processed, in 1979, over 3 million pounds of milk. The application of research and development results has enabled the fluid milk processor to make much better use of his employees' time than in past years.

In place cleaning. The use of the technique of passing the cleaning solution over the equipment without disassembling the equipment, has reduced the number of employees required for this necessary operation.

Changes in marketing. The greater proportion of milk sold in stores has decreased the delivery costs, resulting in savings which can be passed on to the consumer.

Evenson and his co-workers (1) have evaluated the economic benefits derived from research in agriculture. In the 1948 to 1971 period, over 1,100 observations were made in 48 states on the annual rate of return for technological research in agriculture. These researches yielded a return of more than 90%. In the South the annual return rate was 130%. These studies clearly point

out that agricultural research is grossly undervalued.

Figures 1 - 5 illustrate that agriculture, and the dairy industry in particular, is operating more efficiently than the economy as a whole. The accomplishments of the past give encouragement for what can be done in the future. Research and development and its application has made these improvements possible. Research and development can supply information for even more improvement.

Fieldmen and sanitarians play a vital role in the production of an adequate food supply. Research and development efforts mean little without the application of quality assurance supplied by fieldmen and sanitarians, the people who make sure that the research and development findings are applied correctly, the people of whom the consumer asks, "Is this a good product?" Fieldmen and sanitarians supply the conventional wisdom vitally necessary for the application of research findings, and thus play essential roles in food production. Upon their shoulders rest the awesome responsibility of deciding certain research findings should be pursued and used for more efficient production and/or quality assurance. Continued effective work in this area will help to combat inflation and put more dairy products and other high quality foods on American tables.

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News and Events

IAMFES Secretary-Treasurer Nominations Due

Nominations are open for the IAMFES Secretary-Treasurer. This year an industry representative will be elected.

Send a biographical sketch and photograph of your nominee to the Nominating Committee as soon as possible, but not later than November 1, 1981. Send this information to: Paul Pace, Chairman, Nominating Committee, IAMFES, Milwaukee Health Dept., 841 N. Broadway, Milwaukee, WI 63205.

Book Review Section to Expand

The book review section of *Dairy and Food Sanitation* is expanding, and we need additional book reviewers. If you're interested in helping, send your name and address and the subject matter you'd like to cover to: Jan Richards, Editor, *Dairy and Food Sanitation*, PO Box 701, Ames, IA 50010.

Energy Conservation workshop Scheduled

A three day workshop presenting the latest technical information on energy measurement, data analysis, and approaches to energy conservation in the food processing industry will be presented this fall by the University of California Davis Extension. The workshop is designed for energy managers, plant engineers, and process engineers.

"Energy Conservation in Food Processing" is scheduled Monday through Wednesday, November 30-December 2, and will use lectures and case studies to emphasize the use of energy measuring instruments, organization of data collection procedures, and the analysis of data from the energy and economic stand-points. Case studies will emphasize examples from the food industry of significant energy savings. In addition to lectures and discussion, a demonstration of use of computers in energy measurements will be presented.

The workshop is taught by Paul Singh, professor, agricultural engineering department, UCD; and Dennis Heldman, professor, food science and human nutrition department, Michigan State University, East Lansing, MI.

For more information, contact University Extension, University of California, Davis, CA 95616; 916-752-0880.

Awards Candidate Nominations Also Open

Awards nominations are now due for 1982 IAMFES awards. The success of the IAMFES Awards Program depends on organizations which generously and regularly fund the program, but also on you, for nominating persons you know who are worthy of the awards.

Contact William Kempa, Chairman, IAMFES Recognition and Awards Committee, Public Health Inspection Dept., Ryerson Polytechnic Institute, 50 Gould St., Toronto, Ont., with information on your nominees. Present Executive Board members are not eligible for the 1982 awards.

con't. p. 437

Wildasin Honored with Hood Award

Dr. Harry L. Wildasin, who holds the position of Director of Regulatory Affairs and Quality Assurance for H. P. Hood, Inc., Boston, MA., was awarded the organization's Distinguished Service Award for 1980-1981.

Dr. Wildasin has been a very active member of the Association of New England Milk Dealers, Inc. and Chairman of the organization's Legislative Committee since 1974.

His experience with the regulatory people throughout the country and his knowledge of the Federal orders has given the New England Milk Dealers the opportunity to use his expertise at local and regional affairs.

Dr. Wildasin was presented with a plaque and mantle clock at the Annual Convention in June by Harold E. Mikoleit, Executive Director of the Association.

NSF Wastewater Conference Proceedings Available

Proceedings of the Seventh National Conference on Individual Onsite Wastewater Systems are available from NSF.

Theme of the Seventh Conference was "Development Beyond the Sewer--The Appropriate Utilization of Onsite Wastewater Systems." The 32 papers included in the 355 page volume summarize the successes and failures in application, describe technologies, techniques and approaches which have been successful. The price of volume VII is \$30. Copies of previous volumes, I-VI are also \$30 and are available from NSF.

USDA Proposes Wider Phosphate Use in Meats

A USDA proposal would allow processors to use a wider range of phosphates to improve meat and poultry products, according to Donald L. Houston, administrator of USDA's Food Safety and Inspection Service.

"These phosphates help keep in juices during processing and cooking, and they also help prevent flavor loss in uncured beef that has been cooked, refrigerated and reheated," Houston said. "The Food and Drug Administration has either recognized these substances as safe or has proposed to affirm or reaffirm their safety."

"The proposal covers several sodium and potassium phosphates, as well as sodium hydroxide," Houston said, "and, because these substances have been shown to be safe and functional, we believe it is appropriate to allow or extend their use in meat and poultry products."

Under the proposal, a potassium phosphate could be used wherever the corresponding sodium phosphate is now allowed. For example, dipotassium phosphate could be used in a meat or poultry product if disodium phosphate is now allowed.

The sodium and potassium phosphates covered by the proposal could also be used in all meat food products, unless specifically prohibited by regulation. Sodium hydroxide, which aids the moisture-retaining action of phosphates by maintaining acidity or alkalinity, could also be used with phosphates in these same products.

The sodium phosphates covered include disodium phosphates, monosodium phosphates, sodium hexametaphosphates, sodium tripolyphosphates, sodium pyrophosphate and sodium acid pyrophosphate.

Guidelines Offered to Eliminate Mycoplasma Mastitis

Treatment for mycoplasma mastitis is not usually effective, says Don Thomas, Utah State University animal health specialist. Therefore, according to Thomas, control must be accomplished by segregation and/or culling of infected cows because the major method of spreading seems to be from infected cows to clean cows during milking.

Here are some guidelines for the elimination of mycoplasma mastitis:

Culture all cows, or all cows in infected strings, using composite samples (one sample includes milk from all four quarters). Appropriate samples of bulk tank milk may help to classify strings as infected or not infected.

Remove all cows with positive mycoplasma milk cultures from the main milking string of the herd. Then the following alternatives may be considered:

1. Market infected cows for slaughter. This is the best recommendation for most severe clinical infections or for herds with only a few infected cows.

2. Segregate infected cows. Those that recover can be milked, but should not be returned to herd strings until two or more negative tests have been obtained.

3. Cows without obvious mastitis and yielding only a small number of organisms should be removed from the main milking string until two consecutive re-examinations show them to be negative. Dairywomen should not mingle these cows with clinical cows or with negative strings.

4. Dry infected cows and resample at least twice after freshening. At that time remove cows that are positive.

Monitor the herd weekly by sampling the tank milk after each string is milked once each week until four negative tests have been obtained. Collect cow samples from all strings associated with positive tank samples. Remove positive cows from the milking string and handle as pointed out above.

After four consecutive weekly samplings are negative, test on a monthly basis for several months.

Test each clinical mastitis quarter for mycoplasma and bacteria.

Test each fresh cow before admission to the milking string.

Keep mastitis cows separate from fresh cows at all times.

Dairywomen should always milk any known mycoplasma infected cows last or in a separate milking set-up. Milkers should never milk clean cows after milking infected cows without changing clothes and sanitizing hands.

Teat dipping with an approved teat dip should be rigorously followed.

Where possible, dairywomen should disinfect teat cup clusters in a clean disinfectant solution in herds suspected of having mycoplasma infection.

Reprinted from July-August, 1981 "Professional Fieldman," a Klenzade publication.

Issue of Health Screening of Food Handlers Discussed

The Infectious Disease Section of the California Department of Health Services is frequently consulted on the issue of health screening of asymptomatic food handlers, especially the testing of fecal specimens for bacterial pathogens and ova and parasites.

Much of the concern about transmission of disease from foodhandlers is based on the fact that food establishments employ immigrants, legal and otherwise, recently arrived refugees, and persons with unconventional life-styles. The assumption is that these individuals pose a greater than average public health risk because they are often infected with intestinal pathogens and may be more likely to have poor personal hygiene habits.

These concerns should be examined from several points of view and recommendations made on the basis of clinical, public health, and cost considerations. California's Infectious Disease Section takes the position that enteric studies of foodhandlers and routine examination for tuberculosis or venereal disease are not cost-effective and should not be undertaken except when disease investigations suggest possible transmission by food.

This position was reached by considering the following: 1) Infectious diseases such as tuberculosis and syphilis are rarely, if ever, transmitted through food contaminated by foodhandlers. 2) Laboratory studies for enteric pathogens provide information only on the particular day the specimen is obtained. They cannot be relied on to identify infection where shedding is intermittent. 3) Negative laboratory results (which are sometimes falsely negative) can give a false sense of

Proper Milking Procedures Stressed

Along with good dairy sanitation, dairy producers must use proper milking practices to insure quality milk and herd health.

One danger of incorrect or careless milking procedures is that air may enter the milking machine and increase the risk of mastitic infections in cattle, says William Crist, University of Kentucky dairy specialist.

If air is allowed to enter the milker, small milk droplets may be propelled at high speed toward the end of the teat, says Crist. These droplets may contain mastitic organisms that can enter the udder upon impact with the teat.

Near the end of the milking process, there is greater risk of introducing infection because with reduced milk flow bacteria are less likely to be flushed out of the teat or udder.

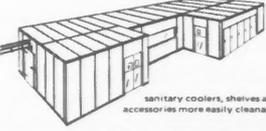
security and lead to relaxation of hygienic practices. 4) The annual turnover of foodhandlers is estimated to be about 300%. This would make any routine examinations, particularly laboratory work, and monitoring for compliance extremely costly. 5) Health education of foodhandlers, with emphasis on sanitary foodhandling practices and good personal hygiene (handwashing), is more efficient and cost-effective than health screening.

In California there are no state requirements for workers in the food industry to obtain physical or laboratory examinations. Any such requirements are based on local ordinances or employer policies. According to California health authorities, education in food handling and hygiene, along with a structural program of sanitary inspection of food establishments, will prevent far more foodborne diseases than any program involving routine screening of foodhandlers for communicable diseases.

Source: California Department of Health Services. Routine screening of foodhandlers for enteric diseases: stop it. Calif. Morbidity Weekly Rep 1980;47:9.

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Milking Practices, *con't. from p. 429*

"For this reason," says Crist "the vacuum to the claw should be shut off before the teat cups are removed, as the last quarter milks out."

To deal with the possibility of one quarter milking out ahead of the others, Crist suggests the dairymen follow this general rule of thumb: "If the teat cup will hold fast without slipping, it should be left on the teat. But if it is apparent that the liner will slip, shut off the vacuum to that teat cup and remove the cup."

Slight overmilking with properly operating equipment will not affect udder health, but carelessly removing a teat cup may permit air to enter the milker, explains Crist.

In addition to air entering the milker, careless or excessive machine stripping also may increase the risk of mastitis infection. Crist recommends that dairymen eliminate machine stripping at the end of milking.

At least half of each teat should be dipped in a germicide, according to Crist. "This is a highly effective

mastitis control practice and should be followed routinely in all herds."

As for pre-milking procedures, Crist says that teats and the lower part of the udder should be washed with clean water containing a sanitizer. Using a hand-held hose and the bare hand is the easiest way, says Crist. This practice not only removes dirt and contamination, but stimulates the cow for proper milk letdown as well.

Before teat cups are attached, the teats and udder should be dried with single service paper towels to eliminate water, which may contaminate the milk.

About a minute after dairymen start to prepare the cow, milk letdown should occur. The milking machine should be attached to the udder as soon as possible, says Crist, because complete milk harvest may be impossible if attachment is delayed beyond 3 minutes.

Reprinted from July-August, 1981 "Professional Fieldman," a Klenszade publication.

Study Completed on Whey Use in Brewing Industry

While many of today's major industries are marked by constant change and innovation, there still are industries in which companies and manufacturers follow processes and methods that have remained essentially unchanged. A prime example is the brewing industry, where technology has contributed primarily to more consistent quality of the final product rather than having an effect on the time-honored process of brewing beer.

The Whey Products Institute (WPI), in cooperation with Dairy Research, Inc. (DRINC), recently completed joint sponsorship of a research project involving the use of whey in brewing beer. Results of this effort have shown that whey can be used as a replacement for secondary grains currently used by the brewing industry, while yielding a brew with comparable flavor and character.

The primary grain used in brewing beer is malt, which makes up at least 60% of the grains employed. Malt contributes carbohydrates, proteins, acids and enzymes, as well as influencing color, taste and aroma. While not replacing malt, whey is a viable and economical alternative to the use of secondary grains, such as corn or rice, that make up the remaining percentage of grains.

Research by WPI and DRINC have provided solutions to some of the problems in whey processing. The protein in whey caused a cloudiness in cold beer. By utilizing a process known as ultrafiltration, protein can be removed from whey before brewing. This removed protein can be sold by the whey processor as "whey protein concentrate," a valuable protein product used as an ingredient in many foods, eliminating product waste.

Arrangements were made with a small midwestern brewery to utilize whey in the production of a commercial brew as part of the WPI/DRINC research project. The brewery prepared a half-sized brew from corn and malt, following all normal procedures except that 10% of the corn was omitted and replaced with the whey ingredient. A little over 100 cases of 12 oz. bottles were filled, pasteurized and held for examination. Results of the experiment showed essentially no difference between the beer produced using the whey ingredient and that made with traditional ingredients. The flavor of the experimental brew compared favorably with that of "normal" beer, and samples presented to brewers and dairymen proved quite acceptable (and were sampled with enthusiasm!). Five months after bottling, tests of the experimental beer demonstrated that shelf life was not impaired by using the whey ingredient. Testing showed that flavor stability was excellent and foam character remained consistent.

In view of these results, it is reasonable to assume that a whey ingredient easily could make up 10% of the extract material used in the brewing process; a requirement equivalent to nearly 50 pounds of whey per barrel of beer. At that rate, a small brewery with an annual production of 500,000 barrels of beer would require 25,000,000 pounds of this whey ingredient per year. The report concludes that if 25% of the brewing industry were to utilize whey at a 10% replacement level, over 2 billion pounds would be needed annually -- based on current U.S. beer production figures.

Antibiotic Use Guidelines Offered

Antibiotics and other drugs have a specific purpose in livestock operation: To cure disease and maintain an adequate level of herd health.

The responsibility for the proper use of these drugs is shared among:

- The manufacturer, who establishes efficacy, safety and withdrawal data.
- The salesman, who supplies the drug to the dairyman and gives verbal instructions.
- The veterinarian, who has broader powers of drug usage and establishes treatment regimen.
- The dairyman and his employees, who use the drugs and are responsible for proper withholding of products.
- The processor, who handles and sells the product into the food chain.
- The regulatory personnel who maintain industry performance and are charged with enforcement.

Although in the area of drug residues emphasis in the dairy industry is placed on penicillin in milk, our true concern should concentrate on all drugs and the resulting residues in meat as well as milk.

Antibiotics and other antimicrobial compounds can be classified as to their availability and labeled use:

- Drugs available over-the-counter to the dairyman, with labeled use for food animals, listing dosage and withdrawal requirements (penicillin, terramycin).
- Drugs once available for food animals that have been withdrawn because of adverse claims, but are still found on dairy farms.
- Drugs for food animals available only through licensed veterinarians on a prescription basis, but often available directly to the dairyman from other sources.
- Drugs available to a veterinarian for use in other species, such as horses or small animals, but not labeled for food animals. These can be used legally or prescribed by a veterinarian if he assumes the responsibility of establishing dosages and withdrawal times.

Any or all of these types of compounds can be found in a dairyman's drug arsenal.

Further confusing the issue of tissue residues is the dosage and route of administration of the antibiotic used. A properly labeled drug for food animals can produce residues outside the withdrawal period if excessive dosages or abnormal routes are used.

At this point, one may ask: "Why the need for so much confusion over types of drugs and the added risk of misusing chemotherapeutic agents in food-producing animals? Why not provide for drugs which are effective

against given diseases, label them accordingly and establish withdrawal times which effectively prevent residues in milk and meat?"

One reason lies in the expense of doing business in the field of drug development and marketing. Government requirements have forced 80 percent of the research dollar to be expended in defensive type of research.

Before a claim for a product's use and dosage can be placed on a label, it must be thoroughly researched and documented. Many companies are hesitant to spend the funds to determine every possible predicted use of a compound. Thus a drug which can be very effective against calf scours may be approved only for use in horses.

Some drugs are sold under restricted dosage forms, such as 100,000 units of penicillin in mastitis treatment tubes which may be found to be ineffective against certain infections. By using higher levels of penicillin, the disease frequently can be treated successfully. The solution is to use several tubes of the marketed mastitis tube or to resort to "self-mixed" products to gain higher dosage levels.

For some conditions, few or none of the marketed products are available. Self-mixed products then become the only choice available.

When we start using unlabeled products, increased dosages and alternate routes of administration, the question of residues becomes a big one. However, there are practical data available in most cases for guidance to safe use of these products, but the information may not be available to the man who ultimately treats the cows.

Transmitting information accurately to those doing the treating may be difficult because special labels must be attached to products and language becomes a barrier when the person doing the treating neither speaks nor reads English.

It is important that the veterinarian properly identify the cows he has treated, the product used and the withholding times for both milk and meat. In the absence of a herdsman or owner, the veterinarian must be certain this information is left with the cows he selected to treat. The same requirements should be written on all drugs left for the herdsman to use.

It then becomes important that the dairyman maintain a written record of treatment with the same information about drugs, dosages and withdrawal times recommended for the veterinarian to use.

Ice Cream Association Offers Marketing Plan

The International Association of Ice Cream Manufacturers (IAICM) has unveiled plans for a comprehensive, industrywide program to gather marketing information for ice cream and related frozen dessert companies. The project is an outgrowth of the association's recent marketing report, "Marketing Information on Ice Cream and Related Products," released last February. The earlier study found that, despite the relatively high market penetration of ice cream and related products, only a limited number of firms were following well-developed marketing plans and strategies. The study reported that a general lack of consumer targeting and effective market segmentation were partially responsible for stagnant sales recently.

To help remedy these weaknesses, the Ice Cream Marketing Advisory Council, established last year, recommended implementation of a three-phase research project, under the auspices of the Dairy Training and Merchandising Institute.

The study's only purpose is to make available to ice cream companies contemporary marketing tools which can be used in their own individual promotional efforts.

Industry advertising on a non-brand basis is not a part of the project nor is it being contemplated.

The first phase will involve Phase I analysis of historical user trends as well as the current situation on ice cream and frozen dessert consumption. It will include the identification of market segments and the demographic characteristics of consumers, including such factors as age, occupation, income and education--- as well as when and how the products are used. Phase I results should be available to members in early 1982.

The second phase will include contracting with a market research firm to obtain in-depth consumer attitudinal information based on the various market segments identified in Phase I. Basically, this analysis should answer "Why consumers are or are not buying ice cream." Phase III is expected to involve an ongoing monitor of the industry and consumer developments to provide information on current data, as well as any new developments and trends.

The Ice Cream Marketing Council is composed of IAICM members will provide guidance and recommendations during the course of the project.

Antibiotics, *con't. from p. 431*

Here are some good guidelines for your dairy patrons to follow:

- A minimum number of drugs should be kept for animals treated.
- All of the drugs should bear some label for use, dosage, method of application and withholding times for milk and meat.
- Maintain drugs in a central location; preferably not in the milking parlor.
- Limit access to drugs to only competent people. Ideally, one person should handle all cow treatments.
- Treated animals should bear a physical mark to indicate they have been treated and their milk withheld.
- Keep a written record reflecting treatment of each animal.
- Milk treated animals separately and do not randomly mix and milk them with milking strings.
- Seek advice from knowledgeable veterinarians on proper drug usage. Beware of products not bearing a label with directions for administration to cattle.
- Apply a simple test system to monitor residues where possible.

Undertreatment and low-level antibiotics are also hazards to therapeutic regimens as they allow development of strains of organisms resistant to other forms of chemotherapy. There is also the possibility of the transfer of the R (resistance) factor to other environmental organisms.

Dairymen should be encouraged to control antibiotic residues and excessive drug use through the use of alternate methods of disease control.

Drugs are not an acceptable substitute for good management. Disease prevention based on good sanitation at all levels, vaccination for common diseases and segregation of cows that are infected carriers are all effective procedures which will prevent disease spread among animals and reduce the need for antibiotics.

If we recognize that the responsibility for milk and meat free of antibiotics and other drugs is shared by all of us working in the dairy industry, we can truly help the dairyman to achieve this goal - Robert Bushnell, extension veterinarian, University of California-Davis.

Reprinted from Professional Fieldman, published by Klenzade Products.

Food Service Sanitation Notes



Food Service Sanitation Notes is written by the National Sanitation Foundation. Write to the NSF with your questions on food service sanitation, problems for which you need answers, or issues you feel should be aired. They'll be included in a future issue of Dairy and Food Sanitation.

Q. In reviewing the NSF "Manual on Sanitation Aspects of Installation of Food Service Equipment" in the chapter on installation of hot water generating equipment, under the section relating to recirculation, mention is made of including a proper heat trap. We have searched our referenced, plumbing codes, etc., but locate no specific information on heat traps. What can you offer?

-John Haines, R.S. Supervisor
Food & Institutional Sanitation
State of Utah Health Department

A. Heat traps are common with electric storage type hot water generating units. The purpose is to keep the water hot until drawn and serve as an energy conservation measure.

Heat traps are of two basic types. The internal type is located within the heater tank (Figure 1), and the external type is normally located within the insulation of the heater (Figure 2).

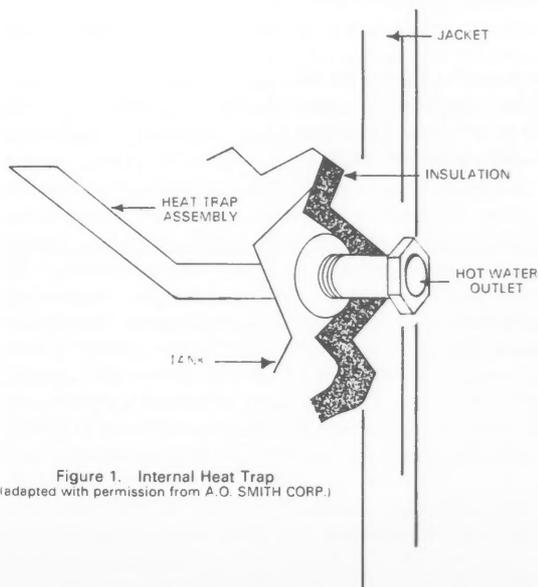


Figure 1. Internal Heat Trap
(adapted with permission from A.O. SMITH CORP.)

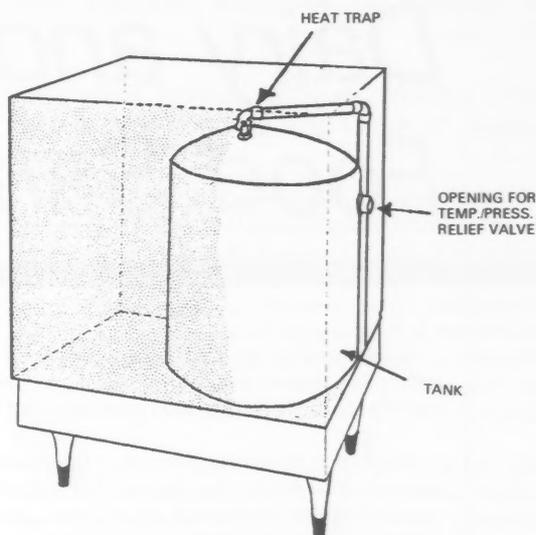


Figure 2. External Heat Trap
(adapted with permission from HATCO CORP.)

Q. Section 2-302(a) of the 1976 edition of the Food and Drug Administration "Food Service Sanitation Manual" requires that each refrigerator be provided with an indicating thermometer accurate to $\pm 3^{\circ}\text{F}$, be located to measure the air temperature in the warmest part of the facility and located to be easily readable.

This has been a requirement in most food service codes for 30 or more years and yet is still found in violation in probably 50% of all establishment inspections. It would seem by this time regulatory agencies and equipment manufacturers would realize a free hanging thermometer will either be missing, inaccurate or not easily readable and take the initiative to require thermometers to be built into the facilities. With our modern technology it would seem a durable, readily replaceable thermometer could be designed and included with all NSF approved refrigerators. Perhaps NSF should take the lead and make this a part of Standard No. 7.

-James W. Tader, Chief Sanitarian
Washtenaw County Health Department
Ann Arbor, Michigan

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Book Reviews

Foodborne and Waterborne Diseases: Their Epidemiologic Characteristics. I. Jackson Tarteckow and John H. Vorperian. AVI Publishing Company, Inc., Westport, CT. 1981. 300 pages.

The stated purpose of the book is to make the reader aware of various characteristics of major foodborne and waterborne diseases that are presently found in our environment. The authors emphasize that this is a knowledge that is necessary for the prevention and control of these foodborne and waterborne diseases. Each chapter describes a particular disease or group of diseases including a description of the causative agent, characteristics of the disease, sources of infection, prevention, diagnosis, treatment and control. Many diseases include a brief history of the investigation of an outbreak, including characteristics of the cases involved, incubation time of outbreak, number of cases and distribution, possible factors of causation, mode of contamination, laboratory findings and a summary of the outbreak with the investigators conclusion. Unfortunately, only those outbreaks of diseases which the authors have encountered in Nassau County, New York are examined and described in detail.

The book includes twenty-six chapters. The first part includes discussions of various infectious and toxic agents including bacteria, viruses, protozoans, parasites, fungi, plants and chemicals. The following disease causing agents and/or diseases are included in this section: salmonellosis, typhoid fever, staphylococcosis, botulism, shigellosis, *Streptococcus*, cholera, *Clostridium perfringens*, enteropathogenic *Escherichia coli*, brucellosis, tularemia, leptospirosis, *Bacillus cereus*, *Vibrio parahaemolyticus*, melioidosis, diphtheria, yersiniosis, infectious hepatitis, amebiasis, giardiasis, balantidiasis, trichinosis, ascariasis, trichuriasis, enterodiasis, angiostrongyliasis, visceral larva migrans, intestinal capillaries, hepatic capillaris, taeniasis, cysticercosis, hydatidosis, diphyllbothriasis, hymenolepiasis, fasciolopsiasis, clonorchiasis, paragonimiasis, mushrooms, molds, yeasts, chemicals, plants and natural food poisons. The second part of the book includes methods for preventing foodborne and waterborne outbreaks, the control of possible outbreaks by monitoring commercial food processing and food service establishments and "how to" conduct and report an investigation of a foodborne and/or waterborne disease outbreak. Outbreaks aboard cruise ships and airplanes are another topic of one chapter.

All the chapters are followed by a number of recent

references and an extensive glossary of scientific and medical terminology is included at the end of the book.

Tarteckow and Vorperian suggest that the book should be intended to serve students of schools of public health, administrative science, food sciences and hotel management. This book should also be instructive to

con't. p. 437

Microbial Ecology of Foods. Volume One: Factors Affecting Life and Death of Microorganisms. ICMSF.

The International Commission on Microbiological Specifications for Foods has produced a definitive text in its two volume *Microbial Ecology of Foods*. This review will be limited to volume one: *Factors Affecting Life and Death of Microorganisms*. Volume one is a comprehensive review of environmental factors affecting the survival of microorganisms in foods. It is not merely a collection of reviewed literature by different authors but an integrated text in which each chapter fits into an overall scheme.

Subject areas covered by *Factors Affecting Life and Death of Microorganisms* include: temperature, irradiation, water activity, pH, oxidation-reduction potential, organic acids, curing salts, antibiotics, gases, packaging and cleaning systems. Separate chapters are devoted to each of these factors and the part each plays in affecting microbial populations of food. Each chapter addresses both spoilage organisms and organisms of public health importance.

Chapter four, reduced water activity, was of special interest. This is an excellent explanation of water activity, and its influence on microorganisms. This information is critical in defining potentially hazardous food and establishing food handling procedures for potentially hazardous foods.

I found volume one indispensable both as an instructor in food sanitation science and as a practicing sanitarian. This volume is not intended as a text for students without prior knowledge and experience in food sciences. It would be suitable at the graduate level for several disciplines. *Factors Affecting Life and Death of Microorganisms* is a must for those interpreting the results of microbiological analyses of foods and personnel managing food sanitation surveillance programs.

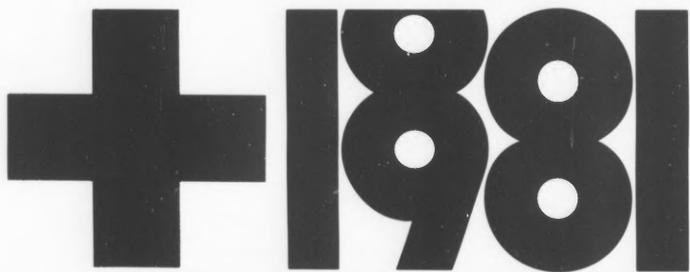
Homer C. Emery
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A large, bold, black graphic consisting of a plus sign followed by the year '1981'. The plus sign is a simple cross shape. The numbers '1981' are in a very thick, sans-serif font. The '1' is a vertical bar, the '9' has a circular cutout at the top, the '8' has two circular cutouts, and the final '1' is a vertical bar.

Calendar

Oct. 14-15---NEBRASKA DAIRY INDUSTRIES ASSOCIATION, Annual Convention. Omaha, NE. For information: T. A. Evans, 116 Filley Hall, East Campus, University of Nebraska-Lincoln, Lincoln, NE 68583.

Oct. 19-21---CANADIAN SANITATION SEMINAR. Course sponsored by American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

Oct. 19-21---CANADIAN FOOD PLANT SANITATION SEMINAR. Toronto, Ont. Contact Carol Lyon, Sanitation Education Dept., American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502, 913-537-4750.

Oct. 20-22---1981 ONSITE WASTE-WATER CONFERENCE. Chrysler Center, University of Michigan, Ann Arbor, MI. Sponsored by National Sanitation Foundation and US Environmental Protection Agency. Registration: \$150. Contact: Joe L. Evans, Supervisor, Wastewater Technology Services, NSF, PO Box 1468, Ann Arbor, MI 48106, 313-769-8010.

Oct. 21---IOWA ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, Fall Meeting. Holiday Inn, Cedar Rapids, IA. Contact: Hale Hansen, 4010 University Avenue, Des Moines, IA 50311, 515-281-4937.

Oct. 21-22---NORTH CENTRAL CHEESE INDUSTRIES, Annual Conference. Earl Brown Center, University of Minnesota, St. Paul. For information: E. A. Zottola, Secretary-Treasurer, North Central Cheese Industries Association, P.O. Box 80113, St. Paul, MN 55108.

Oct. 22-24---GUM CHEMISTRY AND TECHNOLOGY IN THE FOOD INDUSTRY, Denver, CO. Course sponsored by American Association of Cereal Chemists, 3340 Pilot Knob Road, St. Paul, MN 55121.

Food Service, *con't. from p. 433*

- A. NSF Standard 7, "Food Service Refrigerators and Storage Freezers" has also for many years had a requirement for temperature indicating devices. The root of the situation you mention comes from the fact that the manufacturers of refrigerators, whether reach-in or walk-in, have no way of knowing what location within the unit will be the warmest. Add to this the fact that the warmest area may change from time to time due to operational practices, adjacent units, room air flow, or a multiplicity of other factors. The thermometer issue is continuously under review by the NSF Joint Committee on Food Service and the Standard 7 Task Committee. The NSF listing of thermometers relates to the materials used, ease of cleaning, readability, protection, accuracy ($\pm 2^\circ\text{F}$, 1°C), and graduation within the use range (2°F increments).

ADDRESS any problems or questions you wish answered or clarified to:

Food Service Sanitation Notes
National Sanitation Foundation
3475 Plymouth Road
P.O. Box 1468
Ann Arbor, Michigan, USA 48106

Awards, *con't. from p. 427*

The awards are as follows:

- *Sanitarian's Award*. This year the \$1000 award will be presented to a state or federal sanitarian who has made

outstanding professional contributions during the past seven years.

- *Educator/Industry Award*. This \$1000 award will go to an industry representative in 1982. It is presented to a person who has shown outstanding service to food safety and sanitation.

- *Citation Award*. This award will be presented to an IAMFES member who has given outstanding service to the Association in helping fulfill its objectives.

- *Shogren Award*. This award will go to the affiliate organization with the best state or regional program.

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

Book Review, *con't. from p. 435*

epidemiologists, sanitary engineers, sanitarians, veterinarians, nurses, nutritionists, health educators, and social workers. The authors state that this book will "provide valuable information to alert persons engaged in the various phases of the food industry whose responsibilities include providing the public with nourishment that is wholesome and free of pollution, contamination and adulteration." This book is not written to be used as a textbook for food safety or water safety courses. However, this book is a good multidisciplinary reference book.

Richardo J. Alvarez, Ph.D.
Director of Quality Assurance
GIBCO Laboratories
2801 Industrial Drive
Madison, Wisconsin 53713

Abstracts of Papers Presented at the Sixty-Eighth Annual Meeting of IAMFES

Spokane, Washington, August 9-12, 1981

Abstracts of most papers given at the 68th Annual Meeting of IAMFES appear on this and the following pages. The complete text of many of these papers will appear in future issues of the *Journal of Food Protection* or *Dairy and Food Sanitation*.

CONTRIBUTED PAPERS

Bacteriological evaluation of alkali-extracted protein from poultry deboning residues. F. Consolacion, E. Jackson, and P. Jelen. *Department of Food Science, University of Alberta, Edmonton, Alberta, T6G 2N2, Canada.*

Our objectives were to evaluate potential microbiological hazards related to alkali extraction of poultry protein from mechanical deboning residues. The study involved bacteriological analysis of deboning residues, survival of salmonellae in model alkaline conditions and monitoring of the salmonella content of the final meat protein extract. Bacteriological characterization of the raw material included aerobic plate counts plus psychrotroph, coliform, anaerobic spore former and salmonellae determinations. Presence of a number of salmonella serotypes in the raw material was confirmed. To test the effect of alkaline conditions on survival, *Salmonella typhimurium* grown in tryptic soy broth (TSB) at 37°C for 24 h was inoculated to fresh, pH-adjusted media (7.3, 8.5 and 10.0) and exposed for 1, 5, 10 and 24 h at 20°C. Samples were taken after each exposure time, diluted in TSB and plated in tryptic soy agar (TSA) to determine immediate lethal or inhibitory effects. Potential for recovery of injured cells was tested by transfer of concomitant-diluted samples to TSB in a 5-tube MPN analysis at 37°C. Compared to pH 7.3 control, bacterial growth was not significantly retarded by pH 8.5. However, bacterial cells subjected to pH 10.0 declined in numbers and failed to recover in the 5-tube MPN even after prolonged incubation. These results suggested the efficacy of a pH 10.0 medium to cause an irreversible damage to salmonella cells

Microbiological profile of new chicken pattie products. N. A. Cox, J. S. Bailey, C. E. Lyon, J. E. Thomson, and J. P. Hudspeth. *USDA-SEA-AR, Richard B. Russell Agricultural Research Center, P.O. Box 5677, Athens, Georgia 30613.*

Chicken patties were made of broiler thigh meat (skinless), giblets, and an emulsion of broiler neck skin, soy protein concentrate, salt, seasoning and water. The basic formula of the products was 80% thigh meat and 20% emulsion.

Differences in product formulations involved replacing 10% of the thigh meat with one of the giblets (gizzards, hearts or livers). The four products thus were: (a) thigh meat plus emulsion (control), (b) control plus gizzards, (c) control plus hearts and (d) control plus livers. Total aerobic, coliform, *Escherichia coli*, *Salmonella*, coagulase positive *Staphylococcus aureus* and KF streptococcal counts were run on ingredients, and patties before and after storage at 2°C and -10°C. The log₁₀ values of the total aerobic counts of the ingredients were: thigh 7.04; heart 4.02; liver 4.44; gizzard 4.70; and emulsion 5.38. The average total aerobic counts of all patties before storage was 7.00 and the patties spoiled in 2 to 4 d at 2°C. *E. coli* and coagulase positive *S. aureus* counts were approximately 100 per gram in all ingredients and patties, while coliform counts were > 2400 per gram in most samples. *Salmonella* were isolated from all ingredients except the skinless thigh meat, from all patties before storage (except patties containing chicken livers), and from patties stored at -10°C. *E. coli* and *S. aureus* were not detected in patties after 30 d at -10°C.

Significance of the presence of beta-lactamases in milk. R. Guay, N. Brassard, and P. Lacasse. *Microbiology Department, School of Medicine, Laval University, Quebec City, Quebec, Canada G1K 7P4.*

Standardized test systems for detection of antibiotics in milk are reliable provided that the integrity of these molecules are maintained in the food samples. Among mechanisms known to affect antibiotic native structures, there is one related to conversion of an active drug to an inactive derivative by enzymes such as beta-lactamases produced by gram-positive and gram-negative resistant bacteria. In this investigation, 4,475 farm bulk tank milk samples were collected from seven rural areas. Beta-lactamase detection was performed with the use of a chromogenic cephalosporin, nitrocefin, in micro-titration plates. This yellow substrate turns red upon hydrolysis by almost all types of beta-lactamases. Positivity of the color development was estimated by visual observation. This procedure demonstrated that 98.3% of the total samples turned out positive and these results are indicative of the

contamination of milk with antibiotic-resistant bacteria. It further stresses the need of careful interpretation of numerous negative results obtained by methods based on inhibition of growth of a susceptible microorganism such as *Bacillus subtilis*. Therefore detection of enzyme end product of beta-lactamase hydrolytic activity would be a better indicator of suspected presence of beta-lactam drugs than the presence of intact antimicrobial agent.

Contribution of nitrite to the control of *Clostridium botulinum* in liver sausage. A. H. W. Hauschild and R. Hilsheimer. *Health Protection Branch, Tunney's Pasture, Ottawa, Ontario, K1A 0L2, Canada.*

The contribution of nitrite to control of *Clostridium botulinum* in liver sausage was estimated. Sausages were formulated for different water activities and nitrite input, challenged with *C. botulinum* spores at 10-fold increasing concentrations, heat-processed, incubated at 27°C and assayed for botulinum toxin after various periods of incubation. From the numbers of toxic sausages and the respective challenge doses, the probability (P) of toxigenesis from a single spore was calculated for given periods of abuse. Little effect on *C. botulinum* was obtained with 50 or 100 ppm of nitrite input; with 0, 50 or 100 ppm, P varied from 10^{-2} to $<10^{-6}$, depending on the water activity. With 150 ppm of nitrite, P was $<10^{-6}$ after one week and 10^{-3} to $<10^{-6}$ after 2 weeks. Toxic sausages were generally putrid; if not, the toxin levels were in the order of 10 mouse MLD/g or less. Consumer protection from accidental temperature abuse of nitrite-free liver sausage with a moderate salt content appears to depend mainly on organoleptic deterioration, while nitrite becomes a significant added safety factor at an input level of 150 ppm.

Influence of drying plant environment on Salmonellae contamination of dry milk products. D. L. Jarl and E. A. Arnold. *Land O'Lakes, Inc., P.O. Box 116, Minneapolis, Minnesota 55440.*

This study was done to correlate incidence of salmonellae found in the dry milk processing plant environment with finished product contamination. Three plants with various histories of environmental salmonellae incidence were chosen for the study. The daily plant samples representing one lot of production were placed in a 1500-g composite in a sterile sample container and submitted to the central analytical laboratory for analysis. Two samples of nonfat dry milk were found to contain salmonellae in eight continuous months of sampling and testing. In each instance of finished product positive, the environment had at least four positive samples recorded in the routine environmental program during the week or on the day in which the positive product was noted. Repeat tests of the positive product were negative on one lot and confirmed the positive in two of three retests of the other lot. It may be concluded from this study that controlling salmonellae in the dry milk plant environment will effectively preclude finished product contamination since dry milks are produced in essentially closed systems in a process that includes a pasteurization step.

Quantification and identification of dietary fiber components in Pinto dry beans. A. R. McCurdy, J. H. Walsh, N. Z. Hassanen, and A. L. Branen. *Department of Food Science & Technology, Washington State University, Pullman, Washington 99164.*

Although the nutritional benefits of dietary fiber have been extensively studied in recent years, most of the components in dietary fiber have not been identified. The object of this study was to isolate and identify the components in Pinto dry bean (*Phaseolus vulgaris*) dietary fiber. The soluble and insoluble dietary fiber were obtained following digestion of the bean flour with protein and starch degradation enzymes. These residues were then hydrolyzed and analyzed for individual component sugars by a GLC method. The nondigestible insoluble components represented 49.15% of the raw whole bean and 56.59% and 92.74% of the raw cotyledon and raw hull, respectively. The cooked whole bean, cotyledon and hulls contained 29.68%, 23.87% and 72.43% nondigestible insoluble residue. The soluble nondigestible dietary fiber was 16.98%, 15.8% and 6.83%, respectively, in the raw whole bean, cotyledon and hull and 11.31%, 11.32% and 11.14%, respectively, in the cooked whole bean, cotyledon and hull. The dietary fiber in dry beans contained a high proportion of arabinose and xylose with minor amounts of manosa, galactose and glucose. During this study the dietary fiber from Pinto dry beans was isolated, quantified and identified as to component sugars. Complete analysis of dietary fiber will allow more meaningful studies on the nutritional effects of dietary fiber.

Effect of potassium sorbate on growth of *Yersinia enterocolitica* in vacuum-packaged pork. Bruce R. Myers, Robert T. Marshall, Joseph E. Edmondson and Maynard E. Anderson. *Department of Food Science/Nutrition, 203 Eckles Hall, University of Missouri, Columbia, Missouri 65211.*

Yersinia enterocolitica is a facultative psychrotrophic pathogen that can be invasive and produce a heat-stable enterotoxin. It has previously been isolated from vacuum-packaged beef, lamb and pork. Pork loins, uninoculated and inoculated by dipping in 1% peptone water containing 100 cfu of *Y. enterocolitica*/ml, were treated with 0, 5 and 10% potassium sorbate by dipping or spraying and then vacuum-packaged. Packages were stored at 5°C and sampled at 1 and 21 days post-packaging for determination of psychrotrophic plate count (PPC) and three-tube MPN of *Y. enterocolitica*. Significant growth of *Yersinia* occurred on untreated loins but not on sorbate-treated samples. The PPC of sorbate-treated pork was also significantly lower than of untreated samples. Sorbate is a GRAS fatty acid currently prohibited from use on fresh meat and poultry. Sorbate treatment of fresh vacuum-packaged meats may reduce potential public health risks from *Yersinia* and increase the shelf-life of vacuum-packaged meats. However, *Klebsiella oxytoca*, another psychrotrophic pathogen, was recovered from one group of treated and untreated loins sampled 21 days post-packaging. The role of psychrotrophic *Yersinia*, *Aeromonas* and *Klebsiella* in food and in human disease warrants further investigation.

Isolation of pectinolytic *Aeromonas hydrophila* and *Yersinia enterocolitica* from vacuum-packaged pork. Bruce R. Myers, Robert T. Marshall, Joseph E. Edmondson and William C. Stringer. *Department of Food Science/Nutrition, 203 Eckles Hall, University of Missouri, Columbia, Missouri 65211.*

Yersinia enterocolitica and *Aeromonas hydrophila* are facultative psychrotrophic pathogens. A survey was made of commercially available vacuum-packaged fresh pork held at 5°C for 7, 14, 21 and 28 days. Also, four vacuum-packaged leg roasts were stored for 21 days at 5°C then for 90 days at -18°C before sampling. Surface cores of meat were enriched in sorbitol bile broth 21 days at 5°C to enhance recovery of *Y. enterocolitica* on pectin agar. Of the 54 samples surveyed, 20% yielded highly pectinolytic colonies of *A. hydrophila* that were cytotoxic to Y1 and HeLa cells, 6% yielded *Y. enterocolitica* and 6% yielded *Yersinia intermedia*. *Yersinia* was recovered from both fresh and frozen samples. This is believed to be the first report of pectinolysis by *A. hydrophila* and recovery of cytotoxic *A. hydrophila* from vacuum-packaged pork. The presence and growth of psychrotrophic pathogens in raw and processed foods should be evaluated by cold enrichment and 25°C incubation on proper selective agar. Such methodology would enhance recovery of these bacteria and provide needed information regarding their incidence in food and human disease.

A food poisoning outbreak due to *Salmonella muenster*. N. H. Nabbut, E. K. Barbour, H. M. Al-Nakhli and S. I. Al-Zamel. *United States-Saudi Arabian Joint Commission for Economic Cooperation P.O. Box 5927, Riyadh, Saudi Arabia and Ministry of Agriculture and Water, Regional Agriculture and Water Research Center, Animal Production and Health Section, P.O. Box 17285, Riyadh, Saudi Arabia.*

An outbreak of *Salmonella* food poisoning affected 12 persons attending a home dinner in Riyadh on January 10, 1980. The clinical manifestations were mild in 3 of the patients and severe in the other 9. The incubation period ranged between 14 and 32 h with an average of 18 h. The illness lasted 3-4 d. The clinical symptoms included diarrhea, abdominal colics, vomiting, fever (38-40°C), chills, headache, dizziness, inappetence and muscle and joint aches. Six of the patients required the care of a physician. Two of them took a short course of chloramphenicol and one took pembritin; otherwise, treatment was mainly symptomatic. None of the patients required hospitalization. Epidemiological investigation of the outbreak revealed that the implicated food was roast beef. Nine persons who attended the same dinner, but did not eat roast beef, were not ill. The fresh roast beef, approximately 2 kg, was bought from a supermarket. It was cooked the night before the dinner, refrigerated for 24 h, reheated the next day and kept at ambient temperature in the kitchen for about 3 h before it was served. Bacteriological examination of the roast beef showed that *Salmonella muenster* was present in large numbers. Stool specimens of 11 of the patients, with ages ranging from 25 to 57 years, were positive for *S. muenster*. Eight of the patients excreted the same *Salmonella* up to 17 days after recovery from the illness; two other patients excreted this serotype up to 27 days after recovery.

Bacteriological monitoring of the Riyadh sewage treatment plant. N. H. Nabbut, E. K. Barbour, H. M. Al-Nakhli and S. I. Al-Zamel. *United States-Saudi Arabian Joint Commission for Economic Cooperation, P. O. Box 5927, Riyadh, Saudi Arabia and Ministry of Agriculture and Water, Regional Agriculture and Water Research Center, Animal Production and Health Section, P. O. Box 17285, Riyadh, Saudi Arabia.*

Bacteriological monitoring of the Riyadh Sewage Treatment Plant (RSTP) consisted of the bacteriological examination of raw sewage and treated sewage effluent for determination of total bacterial and coliform counts and the presence of salmonellae. Modified Moore's swabs were used for recovery of salmonellae. Results obtained indicate that the present system of sewage treatment at the RSTP is inefficient in producing effluents that meet the existing bacteriological standards. The number of coliform bacteria per 100 ml of effluent samples examined ranged between 4.0×10^5 and 3.9×10^7 . It is noteworthy that the chlorination process at the RSTP is very primitive, crude and inefficient in inactivating the bacterial flora in the effluent. Twenty-seven *Salmonella* isolates belonging to 10 different serotypes were recovered from the raw sewage on 16 occasions. Likewise, 54 *Salmonella* isolates, belonging to 13 different serotypes, were recovered from chlorinated effluents at 100 m, 1 km and 6 km from the chlorination site on 13, 12, and 7 occasions, respectively. The five most frequently isolated serotypes were: *S. agona*, *S. paratyphi* B., *S. livingstone*, *S. newport* and *S. senftenberg*. Other isolated serotypes included: *S. typhi*, *S. heidelberg*, *S. alerton*, *S. muenster*, *S. eastbourne*, *S. meleagridis*, *S. cerro* and *S. concord*. The effluent from the RSTP is a source for the spread of salmonellae in the environment and ultimately to humans and animals if this effluent is unrestrictedly used in agriculture and in other domestic purposes. It represents a potential hazard to both human and animal health.

Bean amylase inhibitor - Effect of amylase inhibitor from insect storage pests. J. R. Powers, J. Culbertson and J. J. Brown. *Department of Food Science & Technology and Department of Entomology, Washington State University, Pullman, Washington 99164.*

Kidney bean, as well as many other beans, contain an inhibitor of the mammalian digestive enzyme amylase. This protein inhibitor may be significant in several situations, including slowing starch hydrolysis in the mammalian gut. A second role for the inhibitor may be protection of the bean seed against insect predators. The latter possibility was investigated in vitro by testing the susceptibility of amylases extracted from several important storage insects to purified inhibitor. Amylases extracted from Mediterranean flour moth larva (*Anagasta kuhniella*), confused flour beetle adult (*Tribolium confusum*), yellow mealworm larva (*Tenebrio molitor*) and granary weevil adult (*Sitophilus granaria*) were inhibited by the bean inhibitor. These results suggest practical importance of the inhibitor in protection of dry beans during storage.

Role of raw meat as a vehicle of antibiotic resistant gram-negative bacteria. D. Ramsay, R. Guay, R. Letarte, and Y. Lamontagne. *Microbiology Department, School of Medicine, Laval University, Quebec, Canada G1K 7P4.*

The origin of antibiotic resistance among bacteria implicated in human infections is still questionable but contaminated food supply is more and more thought as a source of antibiotic-resistant strains. This study was undertaken to ascertain the role of raw meat as a possible vehicle of these bacteria. A total of 459 samples were collected aseptically from animal carcasses in slaughter-houses and from butcheries as fresh meat. Distribution of samples was as follows: 208 pork, 157 beef, 62 veal, 27 chicken and 5 horse meat samples. Surface bacteria were collected after vigorous shaking with peptonized water. Gram-negative bacteria were isolated on MacConkey agar plates from 68% of the total samples and resistant strains were selected in 80% of these positive samples from MacConkey-ampicillin (25 µg/ml) agar by replica plating. Of the 618 ampicillin resistant gram-negative strains, 34 genera and species were identified with API-20E galleries. Kirby-Bauer antibiotic susceptibility profiles were performed using major antimicrobial agents such as: carbenicillin, cephaloridine, cloxacillin, cefoxitin, tetracycline, chloramphenicol, sulfonamides, gentamicin, streptomycin, kanamycin, tobramycin and rifampicin. Results show that pork and chicken meats were the most heavily contaminated with regard to antibiotic resistant bacteria and this resistance manifested in a majority of multi-resistance profiles in these strains.

Removing tuberculous meat from the human food chain: A case study in health benefits. Tanya Roberts. *USDA, National Economics Division, Food Economics Branch, Room 260, GHI Building, 500 12th Street, SW, Washington, DC 20250.*

Although many Government agencies have mandates that focus on preventing human health problems, their consequences are difficult to measure. This study examines prevention of human tuberculosis by inspecting beef carcasses after slaughter for signs of bovine tuberculosis. The methodology highlights: (a) alternative ways of predicting how many meat animals would have had bovine tuberculosis without the inspection program, (b) the likelihood of those infected animals causing human illness through aerosol contamination, through penetration of the skin via cuts and knicks, through cross-contamination of other foods in the home, and through consumption of meat and meat products, (c) costs of treating human cases of tuberculosis contracted from consumption of the meat or exposure to the animals and (d) problems of evaluating the benefits of preventing the death of some individuals. Comparing the health benefits--namely, the cases of tuberculosis prevented--with the program costs is complicated further by the joint nature of the inspection process; tuberculosis is but one of the many conditions inspected for simultaneously. Historically, the health benefits of inspection for bovine tuberculosis have exceeded the program costs; benefits probably still outweigh costs.

Chemical characterization of prickly pears pulp, *Opuntia ficus-indica*, and the manufacturing of prickly pears jam. W. N. Sawaya, H. Khatchadourian, W. Safi and S. Kelifeekh. *United States-Saudi Arabian Joint Commission for Economic Cooperation, P.O. Box 5927, Riyadh, Saudi Arabia and Ministry of Agriculture and Water, Regional Agriculture and Water Research Center, Food Science and Nutrition Section, P.O. Box 17285, Riyadh, Saudi Arabia.*

Attempts are made here for use of prickly pears fruits, *Puntia ficus-indica*, which are grown locally and are relatively inexpensive in the manufacturing of jams and jellies. Research studies included physical and chemical analysis of the prickly pears pulp (excluding seeds) and pilot plant studies for its manufacturing into jam and jellies. The Brix value, pH, acidity as citric acid and total solids of the strained pulp were found to be, respectively, 14.30, 5.75, 0.18 and 13.56. Proximate analysis of the pulp revealed low amount of protein (0.16%), fat (0.13), pectin (0.19%), fiber (0.11) and ash (0.41%), with all the sugars available being reducing sugars (6.8%) and are constituted mainly of glucose and fructose (1.45:1). Vitamin analysis showed that the pulp contains trace amounts of vitamin A (B-carotene) and 22.1 mg/100 g of vitamin C, whereas the mineral analysis including potassium, sodium, calcium, magnesium, phosphorus and iron showed that it is rich in potassium, poor in sodium and iron and fair in calcium, magnesium and phosphorus. Pilot plant studies included blanching trials of the pulp before cooking, variation in the amounts of sugar and pectin, kinds and quantities of acids, addition of different flavors and the inclusion of date pulp at various levels. Taste panel results on the jams showed that blanching improved slightly the mild off-flavor of the cooked pulp and that citric acid and a combination of citric and tartaric (50/50) were preferred over several others used. The addition of grapefruit flavor, orange, almond and cloves ranked best among several others that in addition to the inclusion of up to 20-25% of date pulp to the finished product.

Growth and compositional changes during the various developmental stages of some Saudi Arabian date cultivars. W. N. Sawaya, H. Khatchadourian, W. Safi, and S. Kleifeekh. *United States-Saudi Arabian Joint Commission for Economic Cooperation, P.O. Box 5927, Riyadh, Saudi Arabia and Ministry of Agriculture and Water, Regional Agriculture and Water Research Center, Food Science and Nutrition Section, P.O. Box 17285, Riyadh, Saudi Arabia.*

This investigation was carried out to determine the morphological and chemical changes occurring during ripening of two major important date cultivars, Khudri and Sullaj, grown in Central Saudi Arabia and to determine some accurate indices for fruit maturity and consequently proper dates of picking for further utilization. All chemical analysis (A.O.A.C., 1975) and detailed sugar monomers determination (HPLC equipped with differential refractive index), as well as physical measurements of the weight, height, diameter and weight of seed/date were done on different date samples at four successive stages; namely: Kimri, green and turgid, Khalal, mature color characteristic of the species, Rutab, start of softening and dimming in color and Tamr, complete softening and brownish in color. Physical analysis of both varieties showed that the weight, height, diameter and weight of seed/date follow a sigmoid curve where most of the increase occurred during the beginning of the Khalal stage. Chemical analysis results showed that the total nitrogen, ether extract, ash, fiber, tannins, vitamin C and β -carotene were highest at the early stages of development and progressively decreased towards the end of the Tamr stage. The total sugar content tended to increase during the maturation process but decreases slightly at the Rutab and Tamr stage with respect to the Sullaj variety. Reducing sugars were dominant and showed a progressive increase with glucose and fructose as the only

detected constituents. Sucrose content reached its maximum in both varieties in the Khalal and Rutab stage consecutively and dropped drastically at the Tamr stage. Mineral analysis of 10 elements (Na,K, P, Ca,Mg,Mn,Fe,Cu,Zn,B.) showed that in general they tend to decrease during ripening with potassium constituting the major part and with the occurrence of a fair amount of iron among the micronutrients.

Standardizing Cheddar cheese making using phage-insensitive, multiple-strain starters. R. K. Thunell, W. E. Sandine and F. W. Bodyfelt. *Department of Food Science and Technology and Department of Microbiology, Oregon State University, Corvallis, Oregon 97331.*

Bacteriophage-insensitive *Streptococcus cremoris* strains were selected by plaquing cheese whey against a bank of potential starter strains. From those found phage insensitive, six strains were selected and characterized for use in cheesemaking. This six-strain mixture was used exclusively. As phage appeared, the infected strain was removed from the mixture and cheesemaking continued with five strains. A phage-insensitive, fast-acid mutant of the infected strain was isolated and characterized. This mutant, possessing the same parent-strain qualities, was returned to the strain mixture. Make times (3.5 to 4 h), milling acidities (.47%) and cheese pH (5.1) were essentially identical for each vat of cheese produced. Plant A used the six-strain mixture for over 24 months to produce over 8,400 consecutive vats of cheese. Plant B used the culture blend for over 16 months to produce 8,880 consecutive vats. Since adopting this culture system, no plants have experienced starter failure due to phage attack. Total cheese production for four cheese plants using the multiple-blend exclusively was over 60 million lb. (27.3 million kg). These data emphasize the technological and economic advantages of this culture methodology which could result in savings of millions of dollars annually to the cheese industry.

Incidence of *Campylobacter fetus* subsp. *jejuni* in retail foods. E. M. Timm and C. Jane Wyatt. *Department of Food Science and Technology, Oregon State University, Corvallis, Oregon 97331.*

In the last few years, *Campylobacter fetus* subsp. *jejuni* has been shown to cause acute gastroenteritis in humans. Food and water have been implicated as sources of the organism. Samples of raw pork, beef, chicken, turkey, fish and milk were obtained from selected food stores. The incidence of *C. fetus* subsp. *jejuni* was determined by isolating and enumerating the organism on Skirrow medium incubated at 42°C for 24-48 h in a microaerophilic atmosphere. The ability of the products to support growth of *C. fetus* subsp. *jejuni* under simulated conditions of the food distribution system were also determined. An homogenate of the food was inoculated with low levels of the organism and then incubated at different temperatures to simulate retail conditions. At various intervals a sample was taken and the organism was enumerated. It appears that the organism does not grow well in foods as normally handled in the food distribution system, however low level contamination of the organisms may be of public health concern. Treatments that can effectively inactivate the organism in foods will be studied.

Microbiological quality of frozen cream-type pies sold in Canada. E. C. D. Todd, K. F. Weiss, G. W. Riedel, S. Charbonneau and G. A. Jarvis. *Food Directorate and Field Operations Directorate, Health Protection Branch, Health and Welfare Canada, Ottawa, Ontario, K1A 0L2.*

Four hundred and twenty of nine types of domestically-produced frozen cream pies and 45 of six types of pies imported from the United States were analyzed for aerobic colony counts, yeasts and molds, *Escherichia coli*, *Staphylococcus aureus* and *Salmonella*. The variations in counts depended more on the manufacturer than on the type of pie and the ingredients used. Five pies, all from one manufacturer, had counts in excess of 10^5 aerobic colony counts/g, whereas the median value for all the pies examined was between 10^2 and 10^3 /g. About half of the pies had detectable levels of yeast and molds, but counts were $<10^3$ /g in 98.5%. *E. coli* was detected in 9.5%, and *S. aureus* in 1.7% of pies, mainly made by one manufacturer, but levels were generally low; there was no correlation between high aerobic colony counts and these organisms. *Salmonella* was not found in any of the pies. Data were weighed in relation to production volumes to calculate frequency distributions which, in turn, are being used to develop national guidelines.

Equivalency Testing of the Whirl-Pak Bag Containing Sodium Thiosulfate for the Collection of Potable Water Samples. Jerry Williams, Bonnie Goodykuntz, Clete Lewis and Nancy Westphal. *A. D. H. S. Laboratory, Phoenix, Arizona, Arizona Water Analysis Laboratory, Phoenix, Arizona, Arizona Biological & Chemical Laboratory, Flagstaff, Arizona and Badger Laboratories, Appleton, Wisconsin.*

The Nasco Whirl-Pak bag B-1040 was introduced in 1979 for collection of chlorinated water samples. The Whirl-Pak bag differs from currently acceptable collecting vessels in that it is flexible-walled and contains the dechlorinating agent in tablet form. Five public water supply systems were sampled weekly by collecting four samples each in currently acceptable containers and Whirl-Pak bags. Samples were collected for 6 weeks to obtain 240 samples. Samples were analyzed in three different laboratories. The Whirl-Pak bag was ascertained to be as efficient as currently acceptable containers for the collection, transport and analysis of potable water samples.

INVITED PAPERS

Volcanic ash and agriculture. James C. Barron. *Cooperative Extension, Washington State University, Pullman, Washington 99164.*

Mount St. Helen's eruptions deposited ash on a wide area of Washington, Northern Idaho, Canada and the Dakotas. Damages of the ashfall on agriculture in Washington were estimated at approximately \$55,000,000 or under 4% of a normal year's crop and livestock production in the affected area. The physical nature of the ash was quite abrasive, damaging insects and equipment. On the surfaces of plant leaves the ash interrupted photosynthetic activity and caused dust and harvesting problems. It was not hazardous to animals when present in feed rations. The ash changed the color of soils which resulted in greater reflectance of light from ash covered surfaces. This caused lower peak soil temperatures and less

water evaporation. Despite early fears of a significant impact on agriculture, the ash has not created a serious problem. There will be some changes in soil temperature and erosion problems which may last for several years, but there is no indication of serious or permanent damage.

Food additives - risks and benefits. A. L. Branen. *Department of Food Science & Technology, Washington State University, Pullman, Washington 99164.*

Development and use of food additives have increased significantly in recent years as the result of increased shipments, long-term storage of foods and the development of new, extensively processed foods. The wide-spread use of food additives has resulted in numerous confrontations between consumerism and food development groups concerning the value of adding these chemicals to our food supply. In this presentation, the benefits and risks of using food additives as well as the type, function, safety and current legal status of these chemicals are summarized. In addition, the impact of food additives on the cost and availability of our current food supply is discussed.

Raw milk consumption - implications to health. John C. Bruhn. *Department of Food Science & Technology/Cruess Hall, University of California, Davis, California 95616.*

This paper emphasizes and contrasts viewpoints for and against consumption of raw milk and milk products. Most who advocate consumption of unpasteurized milk and milk products point to presumed health benefits, many of which are unsupported scientifically; others suggest that citizens should have a choice as to whether they consume unpasteurized dairy foods and therefore government agencies should not prescribe that all dairy foods be pasteurized. Yet, there is a health risk associated with consumption of unpasteurized dairy foods, examples include recent disease outbreaks associated with *Salmonella* sp., *Coxiella burnetii*, *Yersinia enterocolitica* and *Campylobacter jejuni*. The slight nutritive loss due to pasteurization is not significant and of less consequence than the potential for developing an illness due to the consumption of unpasteurized dairy products.

An update on Standard Methods for the Examination of Dairy Products - 15th edition. Ron Case. *Kraft, Inc., Glenview, Illinois 60025.*

Manuscripts are now being prepared for the 15th edition of *Standard Methods for the Examination of Dairy Products* due to be published in 1983. Appendix A and B will be eliminated, with all methods placed in the chapters. A classification system reflecting the approval status of each method will be used. A consensus procedure will allow review by users of *Standard Methods for the Examination of Dairy Products*.

Food establishment inspections and the computer. Carroll Farmer. *Food and Dairy Division, Oregon Department of Agriculture, 635 Capitol NE, Salem, Oregon 97310.*

The Oregon Department of Agriculture, Food and Dairy Division, issues approximately 8500 licenses for 32 different types of food establishments. The computer is a valuable tool for both the sanitarian and the program managers for use in licensing and inspection activities. Two files are maintained by

the computer: (a) licensing and (b) inspection activities. The data for these two files all originate with the sanitarian. The files are used to produce many reports useful in program planning and evaluation. These files and reports are used to generate or record: establishment assignment listings, inspection frequency, workload calculation, inspection, sampling, egg grading scheduling and results, performance standards, resource allocations and inspection standardization and uniformity. Many other special listings or analysis are also available and provide data to better plan and manage many aspects of the various programs involved.

Qualitative and quantitative assay of beta lactam residues in milk by a disc assay method. R. E. Ginn, R. Case, V. S. Packard and S. Tatini. *DQCI, Inc., 2353 No. Rice St., St. Paul, Minnesota 55113, Kraft, Inc., Glenview, Illinois 60025 and Department of Food Science & Nutrition, University of Minnesota, St. Paul, Minnesota 55108.*

The search for fast and more sensitive methods for detection of beta lactam residues in milk have been pursued for several years. Recently two collaborative studies were conducted by the NCIMA laboratory committee on a disc assay procedure, using *Bacillus stearothermophilus* as test organism. The first study evaluated the impact of several different test conditions, i.e., disc size, kind of medium and incubation temperature. The application in this instance was as a qualitative procedure to be used to screen milk samples for beta lactam and other inhibitors. For several years the FDA has used the *Sarcina lutea* cylinder plate method as a quantitative procedure, with a legal actionable level of 0.0125 unit per ml of milk. This method is cumbersome and time consuming and not generally acceptable for routine analyses. In an attempt to overcome these short-comings, a study was undertaken to quantitate the *B. stearothermophilus* disc assay method. This procedure simulates the qualitative procedure except that 90 μ l of milk sample are added to the disc via a micro-liter pipetter. Test results are then analyzed using a paired-t statistical analysis.

Water activity - principles and application in food. Henry K. Leung. *Department of Food Science & Technology, Washington State University, Pullman, Washington 99164.*

The importance of water activity (a_w) in food safety is exemplified by its inclusion in Good Manufacturing Practices (GMP) by FDA in 1979. In this paper, the concept of a_w and water sorption will be examined from the physical chemical standpoint. Different methods of water activity determination will be critically evaluated. The effect of a_w on microbial growth, toxin production, enzymatic changes and other chemical deterioration in foods will be reviewed. Finally, application of the principles of a_w to intermediate moisture foods will be discussed.

Selection of equipment for the food service industry. William W. Manahan. *Manahan & Cleveland, Inc., 2366 Eastlake Avenue East, #205, Seattle, Washington 98102.*

The 1980's will further complicate the specifier's task in selecting equipment for the food service industry. Today we have not only the concern of the sanitary aspects of such equipment, but also considerations such as energy efficiency, UL listing, AGA listing, NFPA compliance, durability, service

and parts availability, aesthetics, and, that particular consideration becoming evermore important, "cost". This discussion will explore these aspects of the problem and endeavor to assist the sanitarian in better understanding the role of the food service consultant and his varied responsibilities. With this awareness it is hoped that sanitarians will be able to reassess their ideas regarding recommendations for equipment selection in the future.

Irradiation of food for public health protection. R. Burt Maxcy. *Department of Food Science and Technology, University of Nebraska, Lincoln, Nebraska 68583.*

Irradiation of food has a long history and has potential for improving public health protection, yet the technology is still not being used commercially. Public acceptance of the process has been hindered by fear and controversy, which involved the erroneous definition of radiation as a food additive followed by some ill-conceived and ill-interpreted research. In general, all research has indicated radiation to be bactericidal with various degrees of effectiveness depending on the specific bacteria being studied. Gram-negative psychrotrophic bacteria, as well as members of the family *Enterobacteriaceae*, are quite sensitive to radiation and these bacteria are of particular interest in those persons responsible for protecting the quality of fresh red meat. Bacteria resisting less than sterilization doses in irradiation processes have been studied. Acquired increased resistance of bacteria through exposure survival, and subsequent growth of pure cultures can be obtained only through special laboratory manipulations. None of the presently available data indicate bacteria surviving irradiation are of special public health significance.

***Limulus* ameocyte lysate assay - its potential for detection of psychrotrophic spoilage organisms in food systems.** E. M. Mikolajcik and R. B. Brucker. *Food Science and Nutrition, Ohio State University, Columbus, Ohio 43210.*

The *Limulus* Ameocyte Lysate assay (LAL) is a rapid, inexpensive and highly sensitive method to detect endotoxins in biological systems. The test utilizes an aqueous extract from the ameocytes of the horseshoe crab, which reacts with endotoxin to form a firm clot upon 1 h incubation at 37°C. Endotoxin activity is associated with the Lipid A segment of lipopolysaccharides constituting the outer cell membrane of gram-negative bacteria (GNB). Both viable and non-viable GNB are detected. The LAL is used extensively in clinical, pharmaceutical and public health areas. It is finding increasing use as a rapid indirect indicator of gram-negative spoilage organisms in refrigerated meat and dairy products. Ground beef has been studied extensively and a good correlation between LAL titers, extract release volumes and total GNB counts was reported by Jay et al. A simple screening test has been described by Jay which shows excellent potential as a predictor of microbial quality of ground beef. Within the last year, two papers describing application of LAL to milk have appeared. These findings and unpublished research in our laboratory and elsewhere indicate that the LAL will detect 10^3 - 10^4 GNB/ml of milk. The significance of the LAL and its application to the food area will be discussed.

Results of a survey of raw milk quality and their significance. E. M. Mikolajcik, J. H. Reeder, and Faye J.

Feldstein. *Food Science & Nutrition, Ohio State Univ., Columbus, Ohio 43210, Maryland & Virginia Milk Producers Assoc., Arlington, Virginia 22209, and Environmental Systems Service Ltd., College Park, Maryland 20740.*

Data are presented for 2331 individual milk samples analyzed over a 2-year period. Standard Plate Count (SPC) averaged 34,000/ml in 1979 and 29,000/ml in 1980 with 72 and 75% of the samples having counts of $\leq 20,000$ /ml in 1979 and 1980, respectively. Preliminary Incubation (PI) count (12.8°C - 18 h) averaged 70,000/ml in 1979 and 110,000/ml in 1980, with 43 and 41% of samples having PI of $\leq 20,000$ /ml. Generation times (G_t) for the organisms after PI were calculated and 36% of the samples in 1979 and 46% in 1980 had organisms with G_t of < 8 h. Acid Degree Value (ADV) averaged 0.868 in 1979 and 0.909 in 1980, with 87 and 82% having ADV of ≤ 1.19 . Estimated Somatic Cell Counts (ESCC) averaged 623,000 in 1979 and 514,000 in 1980 with 45 and 58% of samples having ESCC of $\leq 500,000$. The freezing point averaged -0.543°C in 1979 and -0.540°C in 1980 with only 0.4 and 0.6% of samples being $\leq -0.524^\circ\text{C}$. Monthly variations of SPC, PI, and G_t of the milks and their significance as predictors of milk quality were discussed.

Quality aspects of vacuum-packaged meats. H. D. Naumann and W. C. Stringer. *Department of Food Science and Nutrition, 228 Eckles Hall, University of Missouri-Columbia, Columbia, Missouri 65211.*

Vacuum packaging inhibits the deteriorative processes in meats attendant to the presence of atmospheric oxygen and to desiccant properties of the atmosphere. Vacuum-packaged cured meat and meat products have color stability for over 10 weeks and commensurate microbial stability under normal commercial refrigeration environments. Vacuum-packaged fresh meats exhibit the dark purplish red color associated with reduced, unoxxygenated myoglobin pigment. Microbial spoilage and desiccation are substantially reduced. Vacuum packaging permits a practical package life of approximately one month. The meat industry is now distributing over half of supermarket beef in vacuum packaging. Vacuum packaged fresh meat converts to normal color when removed from the package and placed in an aerobic environment. Extended vacuum storage under refrigeration results in increased anaerobic populations dominated by lactics. There is the potential for flavor change due to increased acidity and to the accumulation of volatile odors in the vacuum package.

Nutrition nonsense. Mary C. Rowland. *Washington State Dairy Council, 3830 Stone Way North, Seattle, Washington 98103.*

There probably is no other field which lends itself to so many self-proclaimed experts as diet and nutrition. Due to the increased awareness of the public in their health, Americans are forever looking to diet as the cure-all. Unfortunately, this interest in diet has had the "backfire" effect of making people overzealous in their search for the answers to their health-related questions, and many people have become too anxious to grab onto any information that sounds good, whether or not it has been scientifically proven. Another problem that exists is that not even nutritional scientists can offer proven answers to all the questions that abound in the area of diet and health. In comparison to many of the other

health sciences, nutrition is still in its infancy stages. There are as yet many of the basic issues, such as exact nutrient needs, that need to be worked out before we can resolve some of the other more vague questions regarding diet and health. But many people want the answers right now, and this is the reason they turn to other so-called "experts" who claim they do know all the answers. Faddists and quacks have an open market of ready and willing buyers.

Nitrosamines in foods. Richard A Scanlan. *Department of Food Science & Technology, Oregon State University, Corvallis, Oregon 97331.*

N-Nitrosamines are formed by chemical reaction between nitrosatable amines and a nitrosating agent. Primary amines usually do not form nitrosamines. Secondary and tertiary amines, however, are nitrosated to form stable N-nitroso derivatives. One of the more common nitrosating agents is dinitrogen trioxide (N_2O_3), formed from nitrite under acidic conditions. Since nitrite is added to most cured meats to prevent outgrowth and toxin production by *Clostridium botulinum*, attention first focused on nitrosamine formation in these products. More recently it has been shown that nitrosamines can be formed in certain direct-fire dried foods. Examples are formation of N-nitrosodimethylamine in direct-fire dried malt and nonfat dry milk. Presumably oxides of nitrogen, formed in the burner, become mixed with the drying air. Reaction between the nitrosating agent(s) and

amine(s) in the product being dried forms N-nitrosodimethylamine. Nitrosamine formation in direct-fire dried malt can be very significantly reduced when sulfur dioxide is introduced into the drying air of direct-fired dryers.

Effects of very low electrical currents on milk secretion. Grady F. Williams. *Washington State University, WWREC, Puyallup, Washington 98371.*

Sublethal currents of electricity (0.5 to 10 volts) interfere with milk letdown, preventing complete milkout, causing increased somatocyte counts and mastitis. Additional effects include severe depressions in milk production, intermittent periods of nervousness in cattle that resist parlor entry, reduced feed intake and reduced water intake. Cattle vary in their reactions and are more sensitive to low electrical currents than humans. For detection, use voltmeters that measure either AC or DC in the zero to 10 volt range. Neutral currents below 0.5 volt are anticipated in power distribution and seem harmless. Voltages as low as 1.0 volt have depressed annual yields to 3000 lb. of milk/cow. Three volts have depressed feed intake by 8 lb./cow and water intake by 50%. Five volts will knock some animals down. Prevention and control include proper electrical installation and maintenance, bonding all conductors, proper grounding, equipotential planes, isolation transformers and interruption of common neutrals between primary and secondary power lines.

JFP Abstracts

Abstracts of papers in the October Journal of Food Protection

Sensory Attributes of Precooked, Calcium Alginate-Coated Pork Patties, K. G. Wanstedt, S. C. Seideman, L. S. Donnelly and N. M. Quenzer, Departments of Nutrition-Food Science and Animal Science, South Dakota Agricultural Experiment Station, South Dakota State University, Brookings, South Dakota 57007

J. Food Prot. 44:732-735

Ground pork patties were prepared containing 37% fat and assigned to one of five treatments: (a) control; (b) precooked, no calcium alginate coating; (c) calcium alginate coated, no precooking; (d) calcium alginate coated before precooking and (e) calcium alginate coated after precooking. The calcium alginate coating significantly improved sensory attributes. Warmed-over flavor (WOF) was eliminated in precooked, alginate-coated patties as judged by sensory scores and TBA values. Coated patties with no precooking, and patties coated after precooking were found to be more desirable than control patties.

Growth and Synthesis of Aflatoxin by *Aspergillus parasiticus* in the Presence of Sorbic Acid, Ahmed E. Yousef and Elmer H. Marth, Department of Food Science and the Food Research Institute, University of Wisconsin-Madison, Madison, Wisconsin 53706

J. Food Prot. 44:736-741

Two media [basal (M_1) and enriched (M_2)] containing potassium sorbate (0-300 ppm as sorbic acid) were inoculated with spores (10^4 - 10^6 /flask) of *Aspergillus parasiticus* and incubated for 5 days at 28 C. The greater the amount of sorbate added, the higher was the pH of the media after incubation and the smaller was the yield of mold mycelium. Intermediate amounts of sorbate sometimes resulted in greater accumulation of aflatoxin than when media were free of sorbate. Sorbate more effectively inhibited mold growth and aflatoxin production in medium M_2 than M_1 and when the small rather than the large inoculum was used. A second trial was done with 10^6 or 10^5 spores/flask of M_2 (ca. 27 ml) and 10^5 spores/flask of M_2 (ca. 27 ml) containing sorbate (200 ppm of sorbic acid). Cumulative data for mold growth, pH and content of aflatoxin in the medium showed that relative effects of different treatments changed during the incubation period. An index to measure the capacity of molds to synthesize aflatoxins was developed. Application of the index indicates that sorbate delayed mold growth but did not inhibit biosynthesis of aflatoxin. The ability to synthesize aflatoxin was greatest in the early stages of mold growth and then decreased linearly as mold growth progressed.

An Incident of Predominance of *Leuconostoc* sp. in Vacuum-Packaged Beef Strip Loins--Sensory and Microbial Profile of Steaks Stored in O_2 - CO_2 - N_2 Atmospheres, J. W. Savell, M. O. Hanna, C. Vanderzant and G. C. Smith, Meats and Muscle Biology Section, Department of Animal Science, Texas Agricultural Experiment Station, Texas A&M University, College Station, Texas 77843

J. Food Prot. 44:742-745

The microflora of steaks prepared from 14-day old vacuum-packaged beef strip loins obtained from a commercial packing plant consisted primarily of *Leuconostoc* sp. with smaller percentages of *Pseudomonas* sp. and homofermentative lactobacilli. Steaks stored for 10 days at 1 ± 1 C in O_2 (65-80%) + CO_2 (20-25%) + N_2 (0-10%) atmospheres in the dark were rated inferior (surface discoloration, overall acceptability) to steaks prepared from loins which had been stored for an additional 10 days in vacuum packages. Additional storage for 4 days under retail conditions (2 ± 2 C) caused further deterioration of quality. Aerobic plate counts of steaks prepared from loins which had been stored in vacuum packages for an additional 10 days were about 2 logs lower than those of comparable steaks held in O_2 - CO_2 - N_2 atmospheres.

Microbiological Quality of Pasta Products Sold in Canada, M. K. Rayman, K. F. Weiss, G. W. Riedel, S. Charbonneau and G. A. Jarvis, Food Directorate and Field Operations Directorate, Health Protection Branch, Health and Welfare Canada, Ottawa, Ontario, Canada K1A 0L2

J. Food Prot. 44:746-749

Four hundred and ninety-nine samples of Canadian manufactured pasta and 130 samples of imported pasta were analyzed by standard procedures for aerobic colony counts, *Staphylococcus aureus*, coliforms and *Escherichia coli*, *Salmonella* and yeasts and molds. The microbial quality of these products varied considerably. One imported and two domestic products were contaminated with *Salmonella*. Based on the analytical results, a three-class plan for microbial guidelines for pasta is proposed in which four parameters determine the acceptability of a product.

Gas Chromatographic Detection of Pre-Processing Spoilage of Bacterial Origin in Pet Foods, G. N. Venkataramaiah and A. G. Kempton, Department of Biology, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada

J. Food Prot. 44:750-755

Gas chromatographic analysis of sterile canned pet foods revealed the presence of metabolites indicative of pre-processing spoilage. The number and type of aerobic and anaerobic bacteria in each raw ingredient were determined. It was found that pre-processing spoilage was due to the action of the predominant anaerobe or anaerobes in the major ingredient by comparing the gas chromatographic profiles of the organisms with the chromatograms of the finished products. This type of spoilage was more common in pet foods manufactured by cereal companies who may use dead stock than in similar products manufactured by meat packing companies.

Effects of Storage in Recovery Media on Sublethally Heated Polio and Echo Viruses, Glenna J. Kophen and Norman N. Potter, Department of Food Science, Cornell University, Ithaca, New York 14853

J. Food Prot. 44:756-761

In vitro renaturation of heat-denatured virus particles was studied using poliovirus type 1, strain CHAT and echovirus type 6, strain D'Amori. Six recovery media were chosen to simulate heat-processed foods and mildly processed or raw foods and to represent a range of compositions. Virus was suspended in four heating media and processed to various degrees of inactivation. After cooling, the stressed virus was resuspended in the recovery media and incubated at 30 C for up to 7 days. Titers were determined at intervals from 3.5 h to 7 days in African Green Monkey kidney cells. The suspending medium influenced poliovirus susceptibility to heat treatments. The acidic medium produced a higher degree of inactivation in shorter time than the nutrient and ion-rich media. Echovirus was less affected than poliovirus by medium composition. No increase in titer of either virus occurred in any of the recovery media, indicating absence of renaturation mechanisms. Instead, independent of medium composition, virus titers slowly decreased over the 7-day storage period.

Dissolved Oxygen Concentration and Iron Valence in a Model System, S. J. Nojeim and F. M. Clydesdale, Department of Food Science and Nutrition, Massachusetts Agricultural Experiment Station, University of Massachusetts, Amherst, Massachusetts 01003 and The Procter & Gamble Company, Winton Hill Technical Center, 6071 Center Hill Road, Cincinnati, Ohio 45231

J. Food Prot. 44:762-764

The effect of dissolved oxygen concentration on the ionization and valence of four food grade iron compounds was investigated. Nitrogen and oxygen gases were bubbled in

varying ratios into potassium biphthalate buffers, pH 4.2, until the desired level of oxygen (<1, 6 or 12 $\mu\text{g}/\text{ml}$) was reached. The iron compounds were added, then analyzed for total ionic iron and ferrous ion concentrations after 2, 7, 14, 21 and 28 days. This model system showed that the concentration of dissolved oxygen had no significant effect on the percentage of added iron that became ionized or the percentage of iron present in the ferrous state.

Effects of Potassium Sorbate and Sodium Benzoate of Inactivating Yeasts Heated in Broths Containing Sodium Chloride and Sucrose, L. R. Beuchat, Department of Food Science, University of Georgia Agricultural Experiment Station, Experiment, Georgia 30212

J. Food Prot. 44:765-769

Six genera of yeasts possessing a wide range of physiological characteristics were tested for their sensitivities to heat when suspended in media (pH 4.5) with reduced water activities (a_w). Five of six strains had increased tolerance to heat, compared to controls, when cells were suspended in broth containing 3% sodium chloride. Further protection was afforded to three strains in broth containing 6% salt, whereas one strain showed increased tolerance to heat when sodium chloride was present in broth at a concentration of 12% ($a_w = 0.926$). Sucrose, at levels up to 60% ($a_w = 0.892$), protected five of six strains against heat inactivation. Addition of potassium sorbate or sodium benzoate at 500 or 1000 ppm to heating menstrua resulted in significantly decreased D values for all yeasts. At the same concentration, the extent to which the two preservatives acted synergistically with heat was dependent upon the nature of the solute used to lower the a_w of the heating media.

Bacterial Growth at Foodservice Operating Temperatures, C. P. Rivituro and O. P. Snyder, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, Minnesota 55108

J. Food Prot. 44:770-775

A search of current literature was conducted to determine the mean generation times (MGT) at various temperatures for growth of *Staphylococcus aureus*, *Clostridium perfringens*, *Salmonella* and total aerobes in various foods. The data were graphed and a regression line was plotted to begin to form a more definitive time-temperature basis for specification of safe foodservice recipe procedures and to increase sensory quality through control of spoilage organisms. The results show that generation times vary significantly over the range of temperatures normally found in foodservice, and pathogenic bacterial growth slows rapidly below 15-20 C. The results also show that data are quite limited and that there is need for additional studies.

Bacterial Spore Injury - An Update, P. M. Foegeding and F. F. Busta, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, Minnesota 55108

J. Food Prot. 44:776-786

Injury has long been recognized in bacterial spores, especially in evaluation of apparent survival after administration of treatments to control these resistant entities. Compared to vegetative cells, the complexity of the germination and outgrowth processes has retarded research activity on injury and resuscitation. Heat-injury has been observed and studied to the greatest extent, but irradiation and chemical treatments also damage spores from anaerobic or aerobic bacteria. Injury has been associated with germination or specific steps in outgrowth or both. Damage of enzymes, DNA, RNA, membranes or other systems may be implied by resuscitation studies. Injury has been manifested by increased sensitivity to selective or antimicrobial agents or by increased requirements for germination and growth. The need for extensive fundamental research on bacterial spore injury continues to exist, especially to aid in explaining unique spore resistance.

Foodborne and Waterborne Disease in Canada - 1976 Annual Summary, E. C. D. Todd, Bureau of Microbial Hazards, Food Directorate, Health Protection Branch, Health and Welfare Canada, Ottawa, Ontario K1A 0L2, Canada

J. Food Prot. 44:787-795

Data on foodborne disease in Canada in 1976 were compared with data for 1975. A total of 858 incidents, comprising 752 outbreaks and 106 single cases, causing illness in 5367 persons were reported for 1976. The number of outbreaks increased by 5.9% over those for 1975, but the total number of cases decreased by 24.5%. As for previous years, *Staphylococcus aureus* was responsible for more incidents (27) than any other agent. Other incidents were caused by *Salmonella* spp. (25), *Clostridium perfringens* (19) suspect mold and yeast (17), *Bacillus* spp. (10), *Clostridium botulinum* (4) and suspect *Pseudomonas aeruginosa* (4). Seven incidents of trichinosis occurred. Chemicals implicated in causing illness included metals, rancid compounds, a pesticide and solvents. The deaths of five persons were attributed to foodborne disease. About 35% of incidents and 41% of cases were associated with meat and poultry. Bakery products, vegetables, fruits and Chinese food continued to play a prominent role in the spread of foodborne disease, as in previous years. Mishandling of food took place mainly in foodservice establishments (18.9% of incidents, 52.7% of cases) or homes (10.5% of incidents, 6.8% of cases). However, mishandling by the manufacturer caused some problems, including three separate incidents involving fermented sausages. More than 60% of reported foodborne disease incidents occurred in Ontario and the number of incidents per 100,000 population was highest in Ontario and British Columbia. Narrative reports of foodborne outbreaks are presented. Relatively few illnesses resulted from consumption of, or contact with, water; a total of 9 incidents and 1476 cases occurred from ingestion of water and a further three incidents were recorded as a result of penetration of the skin by swimmers' itch parasite (many hundreds of cases) and invasion of wounds in swimmers by *Vibrio parahaemolyticus*.

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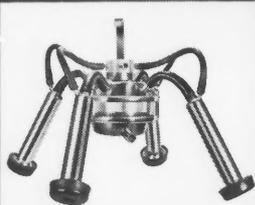
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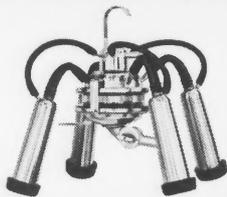
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