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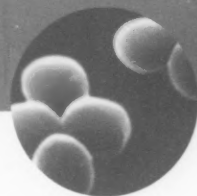
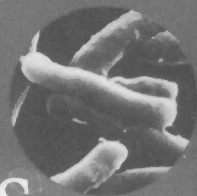
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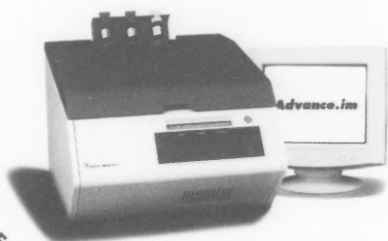
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Web site: www.foodprotection.org

DFES JOURNAL STAFF

David W. Tharp, CAE: Executive Director

E-mail: dthorp@foodprotection.org

Lisa K. Hovey: Managing Editor

E-mail: lhovey@foodprotection.org

Donna A. Bahun: Production Editor

E-mail: dbahun@foodprotection.org

Pam J. Wanninger: Proofreader

E-mail: pwanninger@foodprotection.org

INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION STAFF

David W. Tharp, CAE: Executive Director

E-mail: dthorp@foodprotection.org

Lisa K. Hovey: Assistant Director

E-mail: lhovey@foodprotection.org

Donna A. Bahun: Design and Layout

E-mail: dbahun@foodprotection.org

Julie A. Cattanach: Membership Services

E-mail: jcottonoch@foodprotection.org

Lucia Collison: Association Services

E-mail: lcollison@foodprotection.org

Bev Corron: Public Relations

E-mail: bcorron@foodprotection.org

Karla K. Jordan: Order Processing

E-mail: kjordan@foodprotection.org

Didi Sterling Loynachan: Administrative Assistant

E-mail: dloynochon@foodprotection.org

Beth Miller: Accounting Assistant

E-mail: bmiller@foodprotection.org

Pam J. Wanninger: Proofreader

E-mail: pwanninger@foodprotection.org

Tanya L. Wheeler: Audiovisual Library Coordinator

E-mail: twheeler@foodprotection.org

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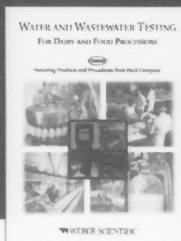
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EXECUTIVE DIRECTOR

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SCIENTIFIC EDITOR

William LaGrange, Ph.D., Iowa State University, Department of Food Science and Human Nutrition, Food Sciences Building, Ames, IA 50011-0001; Phone: 515.294.3156; Fax: 515.294.8181; E-mail: foodsci@exnet.iastate.edu

SCIENCE NEWS EDITOR

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QUOTATIONS

FROM JACK



By JACK GUZEWICH
President

“As my year as President comes to a close, I challenge each of you to submit a nomination for next year’s Awards”

Congratulations to the 2000 Award recipients! We are very fortunate to have deserving individuals, affiliates and organizations working with the International Association for Food Protection in “Advancing Food Safety Worldwide.” These individuals and groups will be honored at the IAFP Awards Banquet on August 9th at the Hilton Atlanta. Take a look at page 558 to see who will be on stage at this year’s Banquet.

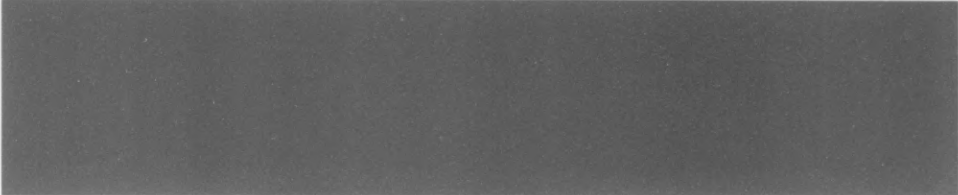
As my year as President comes to a close, I challenge each of you to submit a nomination for next year’s Awards. Virtually every Member is eligible for an award. We have awards for sanitarians, educators, involvement and dedication to IAFP, public service, corporate excellence in food safety, and distinctive work as a food safety professional. If you would like to learn more about any of the Awards or the nomination process, contact the Association office today!

It gives me great pleasure to introduce a new Association Award. At the spring Executive Board meeting, the Executive Board made the decision to recognize a Member who has made significant contributions in the laboratory. We wish to recognize those individuals whose careers have been at the bench or working closely with bench scientists (e.g., lab accreditation officers). Many of us began our careers in the laboratory but have since pursued non-laboratory aspects of food safety. The work laboratorians perform day in and day out is integral to all of our food safety and food quality activities.

Mr. Fred Weber of Weber Scientific has graciously agreed to sponsor this award in honor of his father Maurice Weber who has made significant contributions to laboratory science. Individuals who are interested in contributing to the development of criteria for this award are encouraged to contact Fred at 609.584.7677 or E-mail: fredweber@earthlink.net. The Maurice Weber Laboratorian Award will be presented for the first time at our 2001 Annual Meeting in Minneapolis.

Did you realize that the Association is 89 years old? As you may recall, in the September 1999 issue of *DFES* I issued a call for Members to come forward to develop a written history of our organization. I wanted to update you on the progress of this project. Thanks to Earl Wright, Harry Haverland, Jackie Runyan and David Tharp, this document is now in the review process. We plan to have this document available at the Annual Meeting for your viewing pleasure. It is also in the plans to publish this document as a series in *DFES*. It will be interesting to read about the evolution of the Association from the International Association of Milk and Dairy Inspectors to the International Association for Food Protection.

Do you have your plans in place to attend the 87th Annual Meeting in Atlanta? Congratulations if you do, and if you don’t, don’t worry, you still have time. Go to the Association Web site at www.foodprotection.org or call the Association office at 800.369.6337 and get signed up today! See you in Atlanta!



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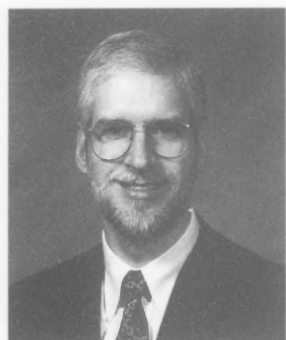
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COMMENTARY

FROM THE EXECUTIVE DIRECTOR



By DAVID W. THARP, CAE
Executive Director

“We look forward to your involvement and seeing you in Atlanta this August”

Only one month to go until the 87th Annual Meeting of the International Association for Food Protection! The 87th Annual Meeting. We say that proudly, but also many times we say it quickly without thinking about what it really means. Slow down for just a moment and think about what we are saying – the 87th Annual Meeting. Although science, health and our food supply are extending life expectancy, any way you look at it, 87 years is a long time; a long

history of providing food safety professionals with cutting-edge, educational, scientific information that enables you to perform your responsibilities successfully.

In 1912, the first Annual Meeting of the International Association of Milk and Dairy Inspectors took place in Milwaukee. Their purpose was to share information on improving the milk supply. The first two Presidential Addresses conclude our “Reflections from the Past” in this issue on page 527. These Addresses delivered by C. J. Steffen, offer real insight to our beginnings in 1911. Mr. Steffen served three years as the founding Association President showing his dedication to launching this “new” Association concerned with milk safety. Many Members have shown dedication to the Association over the years. I am sure we can name a number of current day leaders exhibiting extreme dedication to our Association. These Members have taken the Association to new heights.

One way that Members make an impact on the Association is through their work with our Annual Meeting. Professional Development Groups (PDG) propose symposium for presentation at the next Annual Meeting. PDG Members become active by convening symposia or giving presentations. Technical papers are also a way to become involved. Each paper and symposium is reviewed before being accepted as a part of the Meeting program. This review process is an essential part of the International Association for Food Protection Annual Meeting that ensures our continuous quality content making our Meeting THE Meeting of choice!

We recognize in recent years, as food safety has become a “buzz word,” many commercial ventures that produce meetings dealing with food safety have joined our efforts. We want you to consider the 87-year history that your Association has in producing a science-based, food safety conference. Ask yourself, “what are some of the differences between IAFP’s Annual Meeting and these newcomers?” Analyze who is behind these “new” meetings and conferences. Review the speaker list when making your decision of what conference to attend. Is a “commercial” venture or an association sponsoring the meeting? Many times you can tell by looking at the registration fees! Associations such as the International Association for Food Protection have a personal stake in holding down costs and offering economical registration rates. We are here to serve your needs – you are our Member; you are a part owner of the Association.

The International Association for Food Protection Annual Meeting is known for its quality content, our ability to allow one-on-one interaction with world leaders in food science, and we offer a great value for our registration fee. We encourage you to review the meeting schedule on page 560, then commit yourself to attending this year’s Annual Meeting. Become involved with a PDG and show your leadership abilities by convening and/or presenting during a session next year. We look forward to your involvement and seeing you in Atlanta this August.

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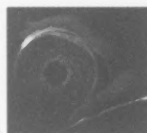
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Stainless Steels: An Introduction to Their Metallurgy and Corrosion Resistance

Roger A. Covert* and Arthur H. Tuthill

SUMMARY

The structure and properties of stainless steel alloys are reviewed. Comments on the varieties of nomenclatures for stainless steels are included, and examples are given of the differences between a number of grades. Corrosion principles and forms of corrosion as they apply to stainless steels are discussed. The various types, shapes and surface finishes available are considered.

This article has been peer reviewed by two professionals.

INTRODUCTION

Worldwide, in industry, in business and in the home, metals called stainless steels are used daily. It is important to understand what these materials are and why they behave the way they do. This is especially true because the word "stainless" is itself somewhat of a misnomer; these materials can stain and can corrode under certain conditions. People need to know why these metals are usually bright and shiny and why they sometimes depart from this expected appearance. In this paper, we hope to explain some of these phenomena and provide a

better understanding of stainless steels, especially to the non-metallurgist.

Industries are concerned with integrity of equipment and product purity. To achieve these, stainless steels are often the economical and practical materials of choice for process equipment. However, before intelligent decisions can be made regarding the proper selection from the various types of stainless steel, it is necessary to have an understanding of what stainless steels are. It is important to know what different grades of stainless steel are available, why they perform satisfacto-

rily and why they sometimes do not. In most cases, selection of the proper stainless steel leads to satisfactory performance.

COMPOSITION, NOMENCLATURE AND GENERAL PROPERTIES

Most metals are mixtures of a primary metallic element and one or more intentionally added other elements. These mixtures of elements are called alloys. Stainless steels are alloys, as are brasses (copper + zinc), bronzes (copper + tin), the many aluminum alloys, and many other metallic materials. In general, solid metals and alloys consist of randomly oriented grains that have a well-defined crystalline structure, or lattice, within the grains. In stainless steels, the crystalline structures within the grains have been given names such as ferrite, austenite, martensite, or a mixture of two or more of these. Many of the properties of stainless steels depend upon which crystalline lattice occurs. Examples of these crystal structures are given in Fig. 1, where the black dots represent atoms and the lines are present to help the structure to be seen.

Figure 1. Crystal structures of stainless steels

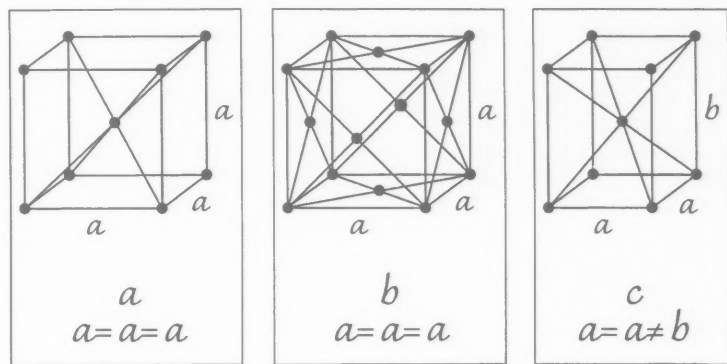
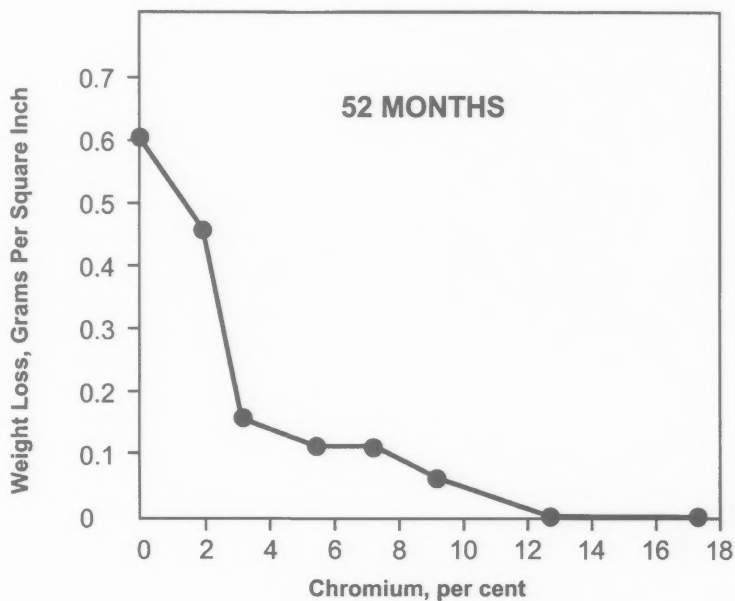


Figure 2. The influence of chromium on the atmospheric corrosion of low carbon steel



Ferrite is the basic crystal structure of iron or low-alloy steel at ambient temperatures. To understand it, envision a cube with an atom at each of the eight corners and in the geometric center of the cube. This body-centered cubic structure (Fig. 1a) is repeated regularly in three dimensions throughout the grain until it meets a grain of different orientation. At these contacts are areas termed grain boundaries. Grain boundaries consist of many things, including the interface, defects, impurities and

grains of other substances. They can be quite complicated and often play an important role in the mechanical properties and corrosion behavior of metals.

Austenite is the crystal form of unalloyed iron in the grains at higher temperature ($>800^{\circ}\text{C}$). It is different from ferrite. As in ferrite, there is an atom at each corner of a cube, but instead of one in the geometric center, there is one in the center of each of the six faces of the cube. This face-centered cubic ar-

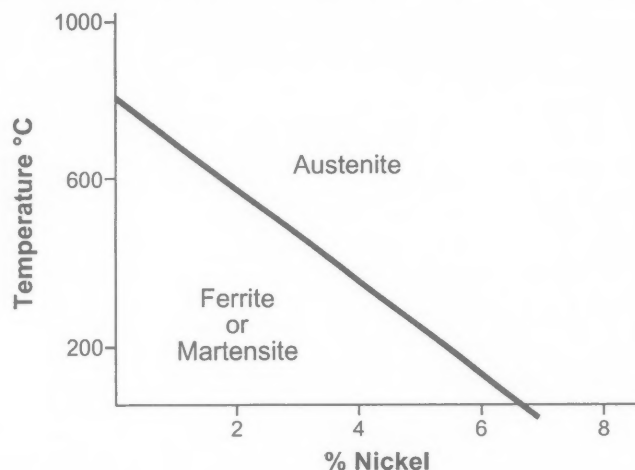
ray (Fig. 1b) becomes stable at room temperature if nickel, manganese, nitrogen, or carbon is added, singly or in combination, to iron or iron/chromium alloys. The resulting materials are called austenitic stainless steels. In general, they are easier to shape and bend, more weldable, and less brittle than ferritic alloys.

Martensite is a stable structure at ambient temperature and more similar to ferrite than to austenite. It also has a body-centered structure (Fig. 1c), but one axis of the cube has been elongated to form a tetragonal structure, that is, a crystal having all three axes at right angles and with two equal sides and one unequal. It is produced by heat treating or cold working cubic crystals of ferrite or austenite. Martensite is the hardest, and strongest of the three crystalline forms, but it is also the least workable. In fact, these alloys are seldom intentionally deformed.

As mentioned previously, alloys are combinations of two or more elements, at least one of which is always a metal. All of the many and varied stainless steels are alloys. They are always iron-chromium alloys, but they often contain other elements, such as molybdenum or nickel. The better known varieties of stainless steel are wrought (hot rolled or hot forged after casting into an ingot). There are also cast counterparts that have properties similar to those of most of the wrought grades but that are altered slightly in composition in order to improve casting properties. To define the different materials, the publication *Metals and Alloys in the Unified Numbering System* (1) lists over 250 types within the broad definition of stainless steels. These are iron base alloys containing more than 11% chromium. Various grades also contain nickel, molybdenum, manganese, nitrogen and other alloying elements. As can be seen in Fig. 2 (6), chromium's primary effect is to impart corrosion resistance. The diagram shows the influence of chromium on corrosion when it is added to iron or steel. As can be seen, when it reaches

Figure 3. Effect of adding nickel to Fe-Cr alloys

Effect of Nickel Addition to Fe-Cr Alloys



11-14%, corrosion is practically negligible in the atmosphere. Nickel in stainless steel promotes austenite stability and reduces the temperature at which austenite can exist. Figure 3 illustrates this effect. Above the diagonal line in the diagram, austenite is stable at the indicated temperature; below the line, either ferrite or martensite is the stable crystal structure.

Manganese is similar to nickel when it is added to or substituted for nickel and also increases strength. Molybdenum increases the resistance to localized corrosion phenomena, such as pitting and crevice corrosion. Nitrogen also improves resistance to crevice corrosion, as well as increasing strength and acting as an austenite stabilizer. Elements such as copper and silicon improve corrosion resistance in special environments, and silicon also improves casting properties.

To reduce confusion and simplify nomenclature, standard numbering systems have been developed for the various stainless steel alloys. For many years in the United States, the three digit method of the American Iron and Steel Institute (AISI) was common for wrought stainless steels. Another letter and number system, that of the Alloy Casting

Institute, applied to the cast grades. These early systems divided stainless steel alloys into groups according to crystal structure. However, many of the newer alloys did not fit into the earlier categories, and it became necessary to have a more complete system. Therefore, these older nomenclatures are now being replaced by the Unified Numbering System (UNS) (1) developed by the Society for Automotive Engineers (SAE) and the American Society for Testing and Materials (ASTM). These groups have developed a six character notation that assigns a unique designator to metals and alloys in a way that consistently defines a material. For example, the UNS number S30403 replaces AISI 304L; the final two digits, 03, indicate the maximum permitted carbon content. In other alloys, the various digits may refer to other parameters, so it cannot always be assumed that the latter numbers mean carbon content. The equivalent cast alloy is J92500, which formerly was ACI CF-3. It should also be noted that the letter before the numbers in the Unified Numbering System pertains to different alloy classes. All letters used will not be defined here, but those of importance will be mentioned. The S refers to heat and corrosion steels (including stainless

steels), valve steels and iron-base "super alloys", the J to cast steels (except tool steels), and N to nickel and nickel alloys. The UNS system also provides for classification of many of the newer, more complex alloys that would not fit into the old system, and it covers many types of alloys in addition to the stainless steels.

It should be noted that in other countries different nomenclatures and systems may be used. For example, in Europe the EN system of numbering alloys is in common usage. With this method, S30400 (304) and S31600 (316) are replaced by the numbers 1.4301 and 1.4401, respectively. Most stainless steels have similar designations, some of which are given in Tables 2 and 3.

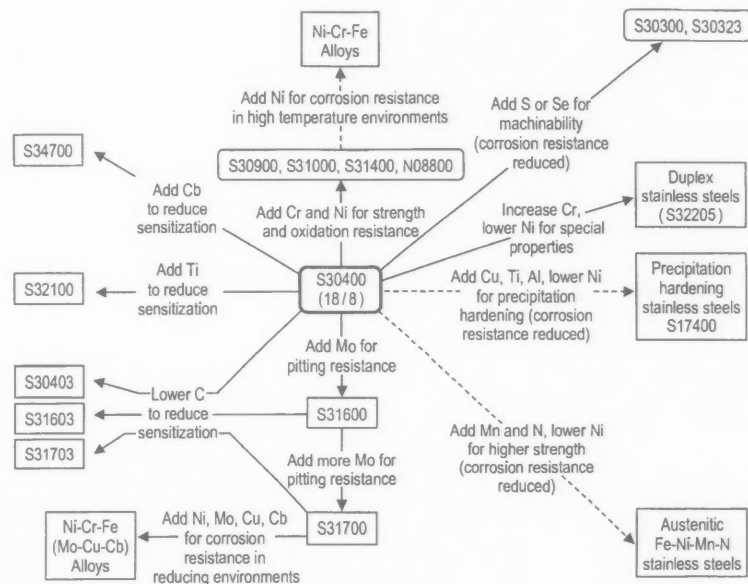
Figure 4 (6) shows how composition variations have led to many related stainless steels that have evolved from the basic S30400 (304) composition. By altering the composition, as indicated by the arrows and text in the figure, various compositions are produced to meet particular needs. In many cases, this is done by adding or omitting small amounts of other constituents without making major changes in the primary alloy content.

COMMON STAINLESS STEEL ALLOY SYSTEMS

Austenitic Alloys — Iron-chromium-nickel and iron-chromium-manganese-nickel alloys

Some of these alloys also contain nitrogen, copper, silicon, and other elements for special purposes. They have an austenitic, or face-centered, cubic crystal structure within the grains. To obtain this structure, the austenite/ferrite transition temperature is suppressed by the addition of alloying agents, primarily nickel, but also manganese and nitrogen, so that the resulting austenite is stable at ambient temperature (see Fig. 3). These alloys are grouped in the 300 and 200 series, respectively, in the old AISI system. They are non-magnetic, unless heavily cold worked, and hardenable only by cold work. The primary alloy of this type is S30400 (304), 18-20% Cr, 8-10.5%

Figure 4. Some compositional modifications of 18/8 austenitic stainless steel to produce special properties. Dashed lines show compositional links to other alloy systems.



Ni, and the balance iron. It is commonly referred to as 18-8 stainless steel because of the approximate chromium and nickel contents. Common applications are for an almost endless variety of equipment, including vessels, piping, and tubing, used in producing and processing industrial products. Many consumer products such as sinks and wash basins, cooking utensils, pots and pans, and flatware are made from this alloy. When welded fabrication is employed, the low-carbon grade S30403 (304L) is frequently used.

Ferritic Alloys — Iron-chromium alloys

These have a body-center cubic crystal structure. They have the corrosion behavior of stainless steels but are sometimes difficult to weld and fabricate. They are magnetic and hardenable only by cold work. An example is S43000 (430), 16-18%Cr, in the iron base. Less expensive consumer products, including automotive and appliance trim and flatware, are often made from ferritic alloys.

Martensitic alloys

These are iron-chromium alloys but higher in carbon and other hardening agents than the ferritic alloys. They are magnetic, hardenable by heat treatment, and somewhat difficult to weld and fabricate. S41000 (410), 11.5-13.5% Cr, .15max% C, and the balance iron is typical of these grades. Common uses are in making corrosion resistant bearings, knife and shear blades, and valve and compressor parts.

Precipitation or age-hardening alloys

These are primarily iron-chromium-nickel alloys to which other elements have been added to form compounds of small grains which precipitate when heated to intermediate or high temperature (500°C to 900°C) for a period of time. When present, these small grains strain the crystal and "harden" or strengthen the alloy. S17400 (17-4PH), 15-17.5% Cr, 3-5% Cu, 0.15-0.45% Cb, 3-5% Ni, and the balance iron is a common composition. These alloys are used where a combination of high

strength and corrosion resistance is needed. Many of them can be shaped and formed in the soft or annealed condition and subsequently hardened or "aged". One of the best known uses of age hardened stainless steels is for golf club heads.

Duplex alloys

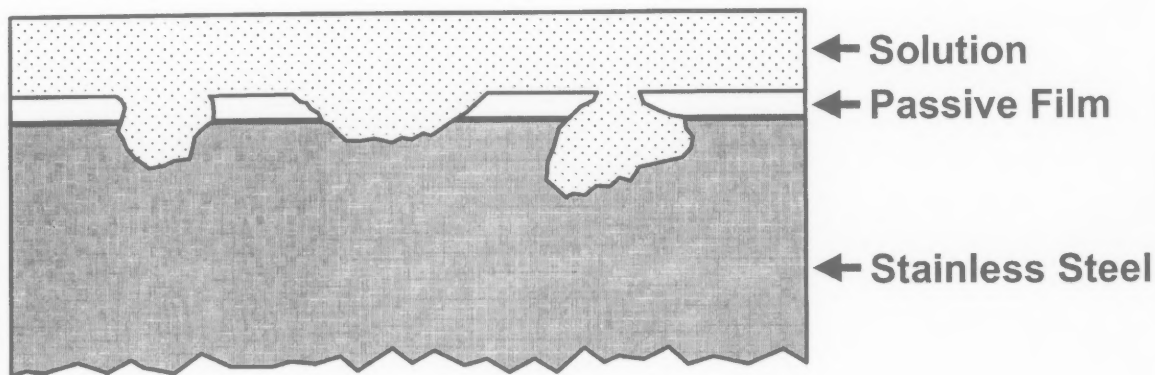
These are usually iron-chromium-nickel alloys with a nickel content lower than that of the austenitic grades. Some may also contain molybdenum or other elements. The duplex structure has grains of both austenite and ferrite. Duplex alloys are typically stronger than alloys that are solely austenitic, and their corrosion resistance is often at least as good as that of the alloys they replace. Duplex alloys are used in chemical, process, and petroleum industries, especially where better resistance to chloride stress corrosion cracking is required.

PRODUCTION OF STAINLESS STEELS

For many years, stainless steels were both melted and refined in an electric arc furnace. These steps are now frequently separated, with the molten charge in the electric furnace transferred to a separate unit for adjusting of composition and removal of impurities. Such operations normally use oxygen-inert gas injection (Argon Oxygen Decarburization, AOD) or oxygen injection under vacuum (Vacuum Oxygen Decarburization, VOD). These techniques permit the production of purer, cleaner steels with much more carefully controlled compositions.

Stainless steels require care during fabrication (5, 6). Their properties can vary depending on prior thermal and mechanical operation. Austenitic stainless steels are almost always placed in service in the annealed condition. This means they are quenched in water or other fast cooling media from the annealing temperature (1040°C - 1130°C). Thus, annealing has a different meaning than it has for carbon or low-alloy steels, which are generally slow cooled from the annealing temperature. For austenitic stainless steels,

Figure 5. Pitting corrosion



lack of, or improper, annealing may result in intergranular corrosion problems because of precipitated carbides at grain boundaries of the microstructure. Producers are well aware of this and ship only annealed material unless they are asked to do otherwise, although it is always best to specify the heat treatment. However, using low carbon or titanium or columbium stabilized grades is additional protection from this problem.

INTRODUCTION TO THE CORROSION BEHAVIOR OF STAINLESS STEELS

The aqueous corrosion of metals is generally considered an electrochemical action. That is, there are alternating sites of differing electrochemical activity on a metal surface. These sites act like the anodes and cathodes in a battery. At the anode, the metal oxidizes (corrodes), reacting with the environment to form rust or some other corrosion product. At the cathode, a reduction reaction such as the reduction of oxygen takes place. This completes the electrochemical cell and corrosion proceeds. In order to prevent corrosion, these cells must be interrupted in some manner.

The unique corrosion resistance of stainless steels is attributed to the existence of a thin, adherent, inac-

tive passive film that covers the surface. This film can conveniently be thought of as chromium oxide, but it also contains small amounts of the other elements in the alloy. Some investigators of the subject consider the film to be something other than an exact oxide, and they may be correct, but it is easier to think of the film as an oxide. Many people think stainless steel must be given a "passivating" treatment for this film to form properly. This is not true; if the surface is clean and free of contamination, the film forms instantaneously on exposure to air, aerated water, nitric acid, or other oxidizing media. It is extremely durable and reforms spontaneously.

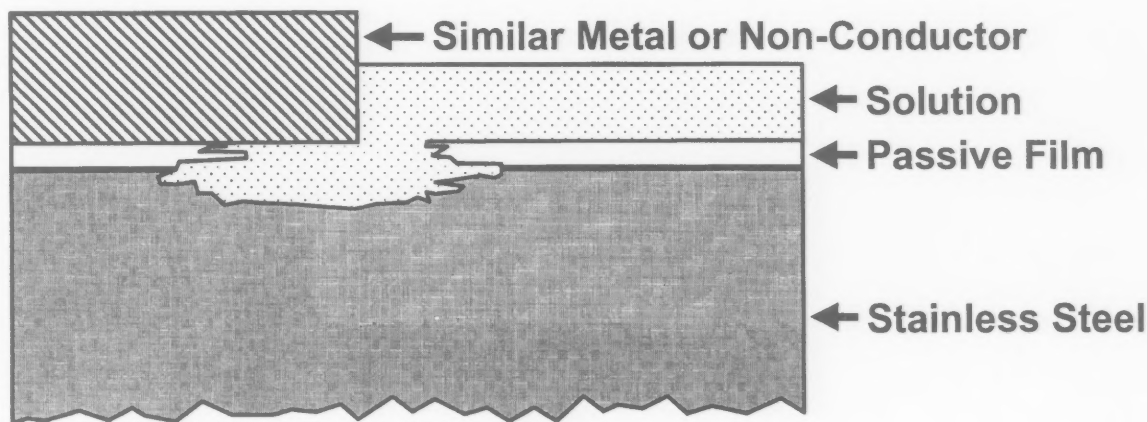
Because of this protective film, stainless steels do not corrode as carbon or low alloy steels or cast iron do. These materials "rust" or corrode uniformly through constantly changing anodes and cathodes on the surface. However, except in solutions such as hydrochloric acid, this general corrosion or uniform attack practically never occurs on stainless steels. The terms "corrosion rate" and "corrosion allowance" are usually meaningless when applied to stainless steels. While factors such as chemical environment, pH, temperature, equipment design, fabrication methods, surface finish, contamination, and maintenance procedures can affect the corrosion of stainless steels, they

usually cause only some form of localized corrosion. To explain this further, the various types of localized corrosion – pitting, crevice corrosion, intergranular corrosion, stress corrosion cracking, and galvanic corrosion – will be considered separately.

Pitting and crevice corrosion

Because pitting and crevice corrosion are very similar and the factors that affect their occurrence are essentially the same, these two phenomena will be considered together. Pitting (Fig. 5) is highly localized corrosion at individual sites on the surface of the metal. The figure also shows that pits vary in size, shape, and morphology. Some pits are broad and not very deep while some penetrate quite deeply and others may under-cut the passive film and spread out beneath it. Crevice corrosion (Fig. 6) is the attack that occurs at the interface between the corroding metal and another substance, usually one that is not electrically conductive. The corrosion usually spreads into the crevice beyond the point of contact. Both types of corrosion happen on stainless steel in certain media, especially those containing chlorides. Pitting can occur because of minor discontinuities in the passive film, inclusions or defects in the stainless steel, or dirt and contamination on

Figure 6. Crevice corrosion



the surface. Examples of common crevices are joints with gaskets, at points where scale or hard biofouling attaches and in places where materials overlap. Because the area of the attack is very small in comparison to the overall area of the metal surface, corrosion can be very intense and rapid at the site of attack. The most important single fact in the initiation of crevice corrosion is the presence of chloride ions, although higher environmental temperatures, oxygen or easily reducible ions such as ferric ions, and acid pH values can also have deleterious effects. Pitting is less apt to occur in aqueous solutions moving at moderate to high velocities than in stagnant ones.

Although we have previously said that pitting and crevice corrosion are essentially the same, some differences should be mentioned. Crevice corrosion can occur in environments that normally do not cause pitting in boldly exposed sheet or plate, particularly in tight stationary crevices in slow moving solutions.

If the environment cannot be controlled, by reducing acidity, or chloride content or by increasing solution velocity, more highly alloyed grades may be used to control pitting and crevice corrosion. This is usually done by adjusting chromium and nickel content and adding more molybdenum (and, to a lesser ex-

tent, nitrogen) to the alloys. The pitting resistance of a common material such as S30400 with no added molybdenum can be markedly improved in this way. Alloys such as S31600 (2-3% Mo), S31700 (3-4% Mo), N08904 (4-5% Mo), and the 6-7% Mo alloys have increasing pitting and crevice corrosion resistance with increasing molybdenum content. Good design and fabrication techniques that produce smooth, clean surfaces, rounded corners, and "drain away" designs also help resist pitting and crevice corrosion.

Intergranular corrosion

If an austenitic stainless steel of normal carbon content (0.03-0.08%C) is heated in the temperature range from 425°C (800°F) to 815°C (1500°F), chromium carbides are precipitated at grain boundaries and the structure is said to be "sensitized." The chromium-depleted zone around each grain is more susceptible to attack in some media, particularly acids. Exposure to this critical temperature range can result from improper annealing, stress relieving, or heating during forming and welding. Figure 7 is a representation of what can happen. As is seen, corrosion has proceeded from the surface down the grain boundaries to the extent that the grains can become detached and the surface is sometimes said to have "sugared".

Other than heat treatment, there are usually two solutions to sensitization: use of a low-carbon alloy such as S30403 (304L) or use of an alloy containing, or "stabilized" with, titanium, S32100 (321), or columbium, S34700 (347). In the first case, there is insufficient carbon in the alloy to form large amounts of chromium carbides and thus reduce chromium in the grain boundaries. In the latter case, the carbon is pre-combined with titanium or columbium and is therefore not available to the chromium. The titanium and columbium carbides are dispersed in the matrix of the grains and not localized at grain boundaries to promote intergranular corrosion. In recent years, as the AOD and VOD processes have become more successful and low carbon alloys easier to produce, the low carbon grades of stainless steel have largely supplanted the stabilized alloys for welded fabrication. Because of their ease of production, they are also replacing the standard carbon grades for many applications.

Stress corrosion cracking

The phenomenon of stress corrosion cracking (Fig. 8) of austenitic stainless steels in chloride-containing environments is not unique to stainless steels. Many types of alloys are susceptible to similar effects in different media, such as brass alloys

Figure 7. Intergranular attack in a sensitized austenitic alloy produced by exposure to a boiling sulfuric acid-ferric sulfite solution. Prolonged exposure causes grains to detach from surface. (100 \times)

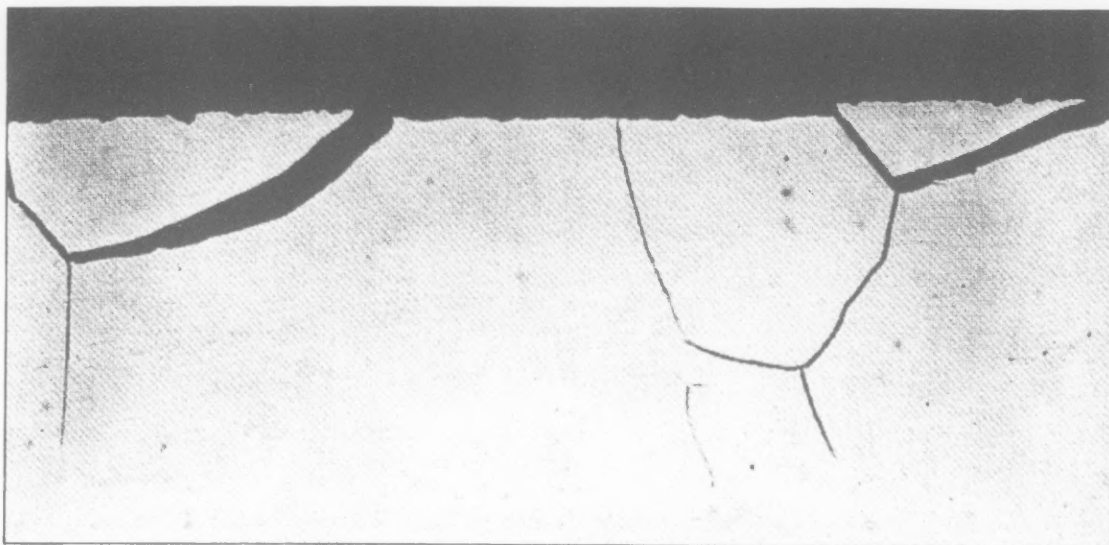
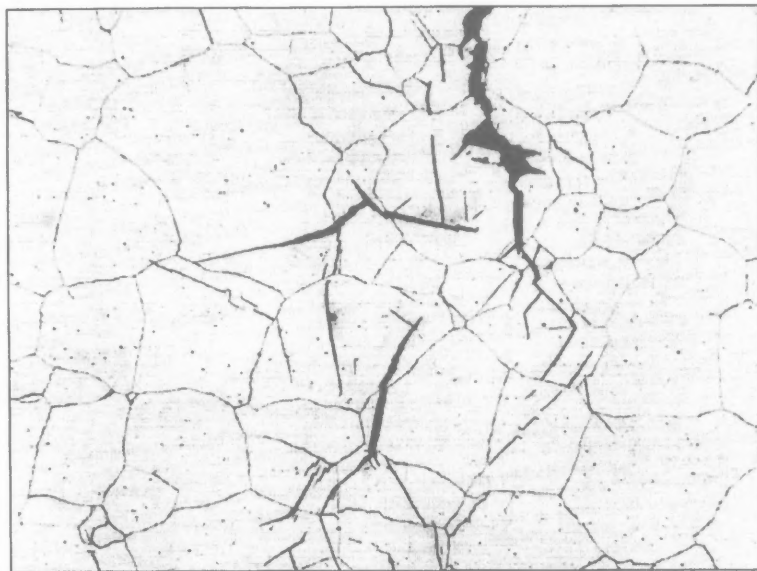


Figure 8. Transgranular chloride stress corrosion cracking of an austenitic stainless steel



in ammoniacal environments and carbon and alloy steels, including stainless steels, in strongly alkaline solutions. Chloride stress corrosion cracking, the most common form of environmentally induced cracking in austenitic stainless steels, requires the presence of chloride ions, tensile stresses, and elevated tempera-

ture. If these are moderate to low, oxygen is also required for stress corrosion cracking to occur. The necessary tensile stresses are almost always residual rather than applied. It is not the load put on a stainless steel vessel that leads to cracking, but how it is formed and welded. In properly annealed material, the

cracking is characteristically transgranular (across the grains). In poorly heat treated and in weld heat affected zones where carbides have precipitated at grain boundaries, the cracking is intergranular (at the grain boundaries). Minimum levels of chloride content, temperature, and stress are not known, because these variables are inter-related. The phenomenon is usually controlled by proper alloy selection, although altering the environment and reducing residual stresses can sometimes be effective. In general, ferritic and duplex stainless steels have more resistance to chloride stress corrosion cracking and are often substituted. Austenitic iron-nickel-chromium alloys also have increased resistance at nickel contents above 20%. In fact, some of the 6-7% Mo alloys with 17-23% Cr and 17-26% Ni have good resistance to chloride stress corrosion cracking. However, virtual immunity is probably found in austenitic alloys only when nickel levels are above 35% (4).

Galvanic corrosion

Galvanic corrosion, or dissimilar metal corrosion, is usually not a problem for stainless steels but can affect other metals in contact with them. For galvanic corrosion to take

TABLE I. Galvanic series of some metals and alloys in sea water

	Metal or Alloy	Potential vs. SHE ¹
Active (anodic)	Magnesium	-1.49
	Zinc	-0.81
	Cadmium	-0.64
	Aluminum	-0.61
	Steel	-0.38
	S30400 Stainless Steel (active)	-0.36
	Lead	-0.32
	Tin	-0.27
	Admiralty Brass	-0.12
	Hydrogen	0.00
	Copper	+0.02
	Nickel	+0.10
	N04400 (Manel Ni/Cu Alloy)	+0.13
	Titanium	+0.14
	S30400 Stainless Steel (passive)	+0.15
	Silver	+0.16
	Graphite	+0.49
Platinum	+0.50	
Passive (cathodic)	Gold	+0.50

¹SHE: Standard Hydrogen Electrode

place, two or more metals of different electrochemical activity need to be in intimate contact in an electrolyte solution. An abbreviated galvanic series, or electrochemical activity series, of materials in sea water is given in Table 1 (5). The standard hydrogen electrode is used as a reference against which electrochemical activity of a material is measured. The activity of hydrogen is set at zero and other materials are measured as more

active (-) or more passive (+) with regard to it. In this table, the more negative or active metals (at the top of the table), will corrode preferentially to any less active metal to which they are electrically coupled. If the surface area of the active component is small in relation to that of the other member of the couple, the corrosion rate can be very high. Such would be the case if carbon steel bolts or rivets were used to connect

stainless steel sheet or plate. Sometimes, when the film is disrupted, stainless steel can become the active metal (as shown in Table 1) and corrode in an active manner. Also, once pitting and crevice corrosion begin, these forms can be considered galvanic corrosion. In both cases, the result is a small active area (the pits or the crevices) surrounded by a large area of film-protected, inactive stainless steel. Most galvanic corrosion problems can be avoided by proper design or electrical insulation.

DESIGN AND SELECTION OF STAINLESS STEEL EQUIPMENT

By factoring the properties of stainless steel into the design of equipment, a great number of benefits can be realized. Unwanted corrosion can be prevented and product purity ensured. Because stainless steels are easy to clean and maintain, a number of different products can be produced in the same equipment. If properly utilized, equipment made of stainless steel can be expected to last for many years.

In selecting austenitic stainless steels, a number of factors other than corrosion performance should be considered. Among these are their usually attractive appearance, good mechanical properties, and excellent fabrication characteristics. On a life cycle basis, the alloys are often the most cost effective. The common alloys are usually readily available. They are a valuable recycling product and because of their lack of reactivity do not contaminate the environment. Recently many of the low carbon grades have been "dual" certified. That is, they are guaranteed to have not only low carbon contents but also the mechanical properties of the higher carbon grade.

Tables 2 and 3 give the nominal chemical composition and minimum mechanical properties of some representative wrought stainless steel alloys. The compositions are for wrought alloys and are taken from Metals and Alloys in the Unified Numbering System (1). The mechanical properties are also for wrought alloys and are from the Steel Products Manual of the Iron and Steel

TABLE 2. Chemical composition of some common stainless steels**(Composition in Weight Per Cent - Balance Iron)**

UNS Number	EN Number	AISI Type	ACI Type	C	Cr	Ma	Ni	Structure ³
S17400 ¹	1.4542	17-4PH ²	CB-7CU-1	.07max	15.0-17.5	-	3.0-5.0	PH
S41000	1.4006	410	CA-15	.15max	11.5-13.5	-	-	Mart
S43000	1.4016	430	-	.12max	16.0-18.0	-	-	Ferr
S30400	1.4301	304	CF-8	.08max	18.0-20.0	-	8.0-10.5	Aus
S30403	1.4306	304L	CF-3	.03max	18.0-20.0	-	8.0-12.0	Aus
S31600	1.4401	316	CF-8M	.08max	16.0-18.0	2.0-3.0	10.0-14.0	Aus
S31603	1.4404	316L	CF-3M	.03max	16.0-18.0	2.0-3.0	10.0-14.0	Aus
S31703	1.4438	317L	CG-3M	.03max	18.0-20.0	3.0-4.0	11.0-15.0	Aus
N08904	1.4539	904L ²	CN-3M	.02max	19.0-23.0	4.0-5.0	23.0-28.0	Aus
S31803 ¹	1.4462	2205 ²	CD3MN	.03max	21.0-23.0	2.5-3.5	4.5-6.5	Dup
S32205	1.4462	2205N ²	CD3MN	.03max	22.0-23.0	3.0-3.5	4.5-6.5	Dup

¹S17400 also contains 3.0-5.0% Copper and .15-.45% Niobium (Calumbium).

S31803 also contains .08-.20% Nitrogen.

S32205 also contains .14-.20% Nitrogen.

²These are not AISI Types, but the common names used in North America.

³Structure names are abbreviated. PH is a Precipitation Hardening Martensite, Mart is Martensite, Ferr is Ferrite, Aus is Austenite and Dup is Duplex (Ferrite + Austenite).

Society (2). In general, mechanical properties are not the critical factor in selecting stainless steels, but they are more than adequate for most uses. Almost all of these wrought alloys have cast counterparts, which differ only slightly in chemical composition and in mechanical properties. These are indicated by the ACI numbers. For example, S30400 (304) has a cast version, J92600 (CF-8). The wrought alloy has a composition of 0.08% max C, 18-20% Cr, 2% max Mn, 8-10.5% Ni, 1% max Si. The cast alloy has 0.08% max C, 18-21% Cr, 1.5% max Mn, 8-11% Ni, 2% max

Si. Except for slightly higher amounts of Cr, Mn and Ni, only silicon is noticeably higher, at 2%. This increased silicon is permitted for higher fluidity and better casting properties in the liquid phase. Similarly, S31600 (316) has a cast version, J92900 (CF-8M), which has similar variations permitted. Castings also are heat treated to produce a small amount of ferrite in the microstructure, which reduces cracking during welding. The EN numbered alloys may also differ slightly in chemical composition and mechanical properties but are very similar. Minor alloying elements and im-

urity levels in the various systems can also be different, but not to any significant degree.

COMMON STAINLESS STEEL ALLOYS

The following list of some of the more common stainless steel alloys currently in use is not complete, but it gives examples of the various grades of alloys.

S43000 (430). This common ferritic, iron-chromium stainless steel is used for applications such as tableware and appliance trim where

TABLE 3. Minimum mechanical properties of some common wrought stainless steels alloys are in the annealed condition except where noted

UNS Number	EN Number	AISI Type	Yield Strength ³ Mpa(ksi)	Tensile Strength Mpa (ksi)	Elongation %
S17400 ¹	1.4542	17-4PH ²	1172 (170)	1310 (190)	10
S41000	1.4006	410	207 (30)	448 (65)	22
S43000	1.4016	430	207 (30)	448 (65)	22
S30400	1.4301	304	207 (30)	517 (75)	40
S30403	1.4306	304L	172 (25)	483 (70)	40
S31600	1.4401	316	207 (30)	517 (75)	40
S31603	1.4404	316L	172 (25)	483 (70)	40
S31703	1.4438	317L	207 (30)	517 (75)	40
N08904	1.4539	904L ²	220 (31)	490 (71)	35
S31803	1.4462	2205 ²	450 (65)	620 (90)	25
S32205	1.4462	2205N ²	450 (65)	620 (90)	25

¹Solution annealed at 927°C (1700°F), cooled and hardened at 482°C (900°F) for 1 hour, and air cooled.

²These are not AISI Types, but common names used in North America.

³Stainless steels do not have a true yield strength as do carbon and low alloy steels. This property has been measured at the 0.2% offset strength on the stress/strain curve for stainless steels.

extensive welding and forming are not required and low cost is desired.

S30400 (304). The most widely used of all stainless steels, this is an austenitic iron-chromium-nickel alloy. S30400 finds applications in a broad spectrum of industries including beverage, food, pharmaceutical, petroleum refining, consumer product, electric power, chemical process and architecture. It has good corrosion resistance in a wide range of environments as well as good formability, weldability, and moderate cost.

S30403 (304L). This low-carbon version of S30400 (304) has superior resistance to intergranular corrosion following welding or stress relieving and is suggested for equipment that

is fabricated by welding and cannot be subsequently annealed.

S31600 (316). This most popular austenitic iron-chromium-nickel-molybdenum stainless steel has corrosion resistance superior to that of S30400 (304), particularly where pitting and crevice corrosion may be a problem.

S31603 (316L). This low-carbon version of S31600 (316) has intergranular corrosion resistance similar to that of S30403 (304L). It is suggested where welding is required and improved corrosion resistance is desired.

S31703 (317L). The higher molybdenum, low-carbon version of S31600, with even better resistance to pitting and crevice corrosion is

used for special applications in pulp and paper, food and beverage, and chemical process industries.

S31803 (2205). This example of a duplex, austenitic-ferritic iron-chromium-nickel-molybdenum-nitrogen stainless steel has good resistance to chloride stress corrosion cracking. A more controlled chemistry version, S32205, is commonly available. Both have higher strength than either the austenitic or ferritic grades.

N08904 (904L). This material, a very low-carbon austenitic iron-chromium-nickel-molybdenum-copper stainless steel, has corrosion resistance superior to that of S31703 (317L). The addition of about 1.5% copper improves resistance to cor-

rosion in some acids. N08904 may be available only on special order from selected mills.

OTHER STAINLESS STEEL ALLOYS

As mentioned previously, there are many stainless steels alloys other than the ones discussed in this paper and shown in Tables 2 and 3. One of them, S30300 (303), has sulfur added to it to improve machinability. However, corrosion resistance suffers greatly, especially at sites of sulfide or similar inclusions. Other compositions, such as S30900 (309) and S31000 (310) and their variations, contain increased chromium and nickel to improve their strength and corrosion resistance at high temperatures. Cast alloys such as J92600 and J92620 are basically S30400 (304) and S30403 (304L) with up to 2% added silicon to increase fluidity in the liquid phase and improve casting properties.

Another group of stainless steels alloys to which we have previously referred but that are not in Tables 2 and 3 are those containing 6-7% molybdenum. These so-called "super austenitic stainlesses" also contain about 17-23% Cr and 17-26% Ni, with some variations. There are six or eight alloys in this class, some of which contain nitrogen or other elements. They are mostly proprietary to their manufacturers and it is difficult to choose between them; does not seem fair to emphasize one over the others. Their main attributes are their resistance to pitting and crevice corrosion. In most cases they are superior to lower-molybdenum alloys in saline solutions at ambient and slightly elevated temperature. As mentioned before, they also have useful resistance, but not immunity, to chloride stress corrosion cracking.

AVAILABLE PRODUCT FORMS

There is considerable variation in the availability of all alloys in all product forms. The more common materials such as S30400, S30403, S31600, and S31603 can usually be

purchased "off-the-shelf" from warehouses and producers in standard shapes and sizes, but less common alloys often require special requests and long delays.

Plate is a flat rolled product over 254 mm (10 in) in width and over 4.76 mm (0.1875 in) in thickness. It is produced from hot rolled material and has a relatively rough surface finish compared to cold rolled, or cold rolled and polished, sheet or strip.

Sheet is a flat rolled product 610 mm (24 in) and over in width and under 4.76 mm (0.1875 in) in thickness.

Strip is also a flat rolled product, but it is under 610 mm (24 in) in width and, like sheet, under 4.76 mm (0.1875 in) in thickness.

Bar or rod are straight lengths that can be round, oval, square, rectangular, or other in cross section. They are produced by a number of different methods such as hot rolling, forging, extruding, and/or cold drawing.

Wire is usually round or oval in cross section. It is a cold reduced product that is drawn from small diameter bars or rods.

Tubing of various types are hollow products, round or any other shape in cross section. They are made from sheet or strip and can be either seamless or welded.

Pipe is often a welded, relatively large diameter, hollow, round product made from strip, sheet or plate, it can also be extruded from billets and be seamless.

Shapes is a catchall term that includes a wide variety of angles, U-sections, and similar forms produced by rolling or extruding.

Fittings, flanges, forgings, etc. are specialty products that are widely available in numerous standard and non-standard sizes.

Castings refer to the cast counterparts of most of the common grades of wrought stainless steel. The composition of these may be slightly altered to ensure good castability and properties, but their corrosion resistance is comparable to the equivalent wrought products. The shapes and applications are almost limitless.

COMMON SURFACE FINISHES ON STAINLESS STEEL

The product forms mentioned above are commercially available in various surface finishes, most of which are described in ASTM Specification A480/A480M - 96a (3). It is generally necessary to specify a particular surface finish when ordering stainless steel products and equipment. The different finishes are described by a system of numbers, letters and, sometimes, words. However, a given finish is often produced by different sequences and methods of operation by different producers. It may be important to know these processing steps, if surface finish or appearance is critical. A few standard finishes in common use are defined below.

No. 1 Finish or HRAP. Hot rolled, annealed and pickled (chemically descaled) is the common finish on stainless steel plate. Other finishes must be specially requested for product over 3/16 in. in thickness. This finish is rougher and may have more defects than the cold rolled and/or abraded finishes to be described. It is generally used in industrial applications where smoothness is not particularly important.

No. 2B Finish. This bright, cold rolled finish is produced when annealed and descaled flat products receive a final light cold rolling pass on polished rolls. This general purpose finish can be used as is or for products to be subsequently polished, and is most often seen on sheet and strip products.

No. 4 Finish. This is a general purpose polished finish primarily used on sheet and strip for a wide variety of industrial and consumer products. To produce it, a 2B finish surface is initially ground with coarser abrasives but is polished last with abrasives of approximately 120 to 150 mesh. It is commonly called a "brushed" finish. It does not show fingerprints or water spots as readily as unabraded finishes.

Electropolished Finish. Surface material is electrochemically dis-

solved, leaving a bright, mirror-like appearance. Some people believe that electropolished items are easier to clean and sanitize and have better corrosion resistance. This finish is widely used for process equipment in the food and beverage industries.

Options other than these four finishes and those in ASTM A480 – 480M – 96a (3) may be requested. Some of them are produced by rolling, some by abrading with different size grit, and some by a combination of the two processes. Mirror-like finishes similar to electropolished ones can be produced by abrading with very fine polishing grit or compounds. Embossed patterns made with special rolls are common.

ABOUT THE AUTHORS

Covert Consulting, Inc., 94 Deepdale Dr., Middletown, NJ 07748; Phone: 732.671.0601; Fax: 732.671.0602; Tuthill Associates, Inc., P.O. Box 204, Blacksburg, VA 24060; Phone: 540.953.2626; Fax: 540.953.2636.

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A Pasteurization Holding Tube for Dairy Foods

John E. Stauffer

SUMMARY

A continuous process is described for the pasteurization of dairy products, including milk, cream, and yogurt mixes. A special feature of the process is use of a holding tube that incorporates a static mixer, which provides improved control over the residence time of the dairy product under pasteurization conditions. The static mixing device evens out the flow rates between the fastest and the slowest moving particles of dairy product. By providing improved control over the pasteurization process, such a static mixer will ensure the complete destruction of harmful microorganisms and at the same time reduce the development of cooked flavors and other undesirable properties. Implementation of the proposed process will depend on development of a sanitary design for the static mixer. The achievement of this goal should permit the process to be in compliance with all regulatory requirements.

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INTRODUCTION

In the modern processing of dairy products, pasteurization is relied upon to provide safe and high quality consumer products. Pasteurization consists of a heat treatment step that destroys pathogenic microorganisms as well as a wide variety of other organisms while minimizing the development of off-flavors. To achieve these objectives, the proper combinations of pasteurization temperatures and holding times are necessary.

Pasteurization is a critical control point in the processing of dairy products. Under accepted practices in the food industry, every process must be evaluated by the principles of Hazard Analysis and Critical Control Points (9). Dairy products, because of their susceptibility to microbial contamination and high pH, are subject to tight regulatory control. The conditions required for pasteurization are specified in detail and must be closely followed.

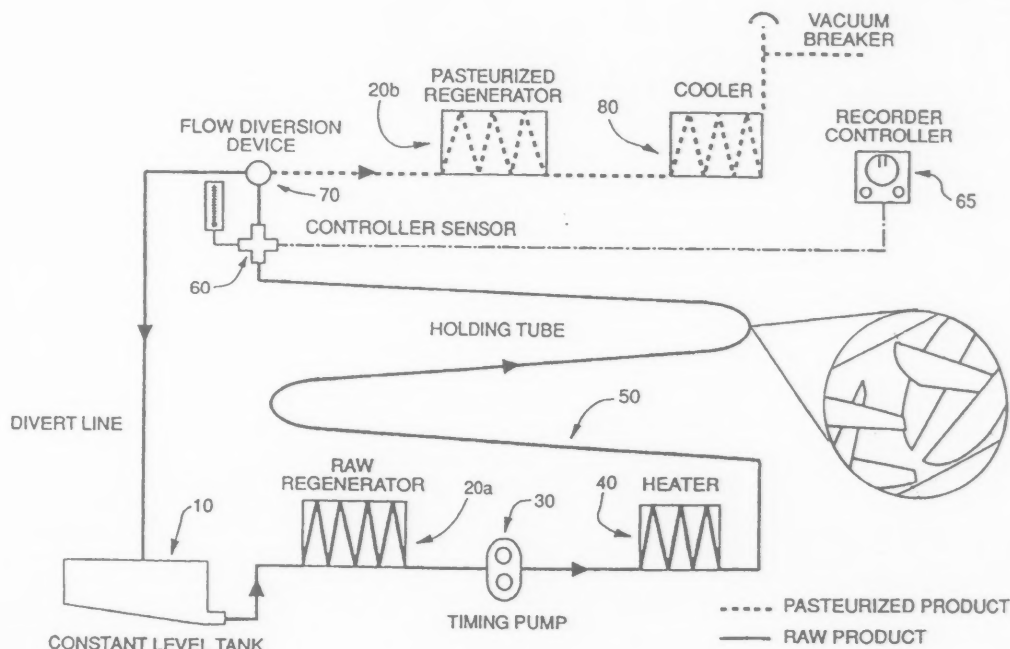
Originally, a batch process was used to pasteurize dairy products, but this method has largely been replaced by continuous processes, which are more efficient and result in higher quality products. Several continuous pasteurization processes are available. In the High-Temperature, Short-Time (HTST) pasteurization of raw milk, each particle of milk must be heated to 72°C (161°F) and held at this temperature for 15 seconds. In Higher-Heat, Shorter Time (HHST) pasteurization, milk is heated to various higher temperatures and held at correspondingly shorter times than in HTST pasteurization. Ultra-High Temperature (UHT) pasteurization is used to achieve sterilization but at some sacrifice in taste of the treated product.

An object of a pasteurization process should be to ensure the complete destruction of any pathogens present and at the same time reduce the development of off-flavors and other undesirable properties. Such a process should be simple in design, economical to operate, and compatible with clean-in-place (CIP) sanitary procedures. Its advantages need to be great enough in order to justify the cost and effort of introducing new technology.

PASTEURIZED MILK ORDINANCE

Pasteurization conditions in the United States are specified by the Grade "A" Pasteurized Milk Ordinance (2). This regulation requires

Figure 1. HTST pasteurization



that the holding tube in an apparatus for continuous pasteurization shall be designed to provide for the retention of every particle of milk or milk product for at least the time specified in the definition of pasteurization. Furthermore, the holding tube shall be so designed that the temperature difference between the hottest and coldest milk in any cross section of flow will not be greater than 0.5°C (1°F). This requirement may be assumed to have been satisfied without testing if the holding tube is 17.8 centimeters (7 inches) or less in diameter.

The code further states that holding tubes shall be installed so that sections of pipe cannot be left out so as to result in a shortened holding time. No portion between the inlet and the temperature sensor at the exit of the tube shall be heated. The holding tube shall be installed so as to have a continuously upward slope in the direction of flow not less than 2.1 centimeters per meter (0.25 inch per foot).

Other conditions are specified by the manual *Milk Pasteurization Controls and Tests* (3). The required

length of the holding tube for HTST pasteurization is determined by a salt conductivity test. For HHST pasteurization, however, the sensitivity of the instruments for the salt conductivity test is not sufficient to measure the residence time accurately. Therefore, the assumption is made that the dairy product moves through the holding tube in laminar flow wherein the maximum fluid velocity at the tube centerline is twice the average velocity. Thus, to ensure proper treatment of every particle of milk, the holding time must equal twice the specified time given in the definition for pasteurization. This requirement provides for a large margin of safety, since it has been shown that even the most viscous dairy product will not achieve laminar flow, and in the case of condensed skim milk, the maximum velocity is only 1.7 times greater than the average velocity.

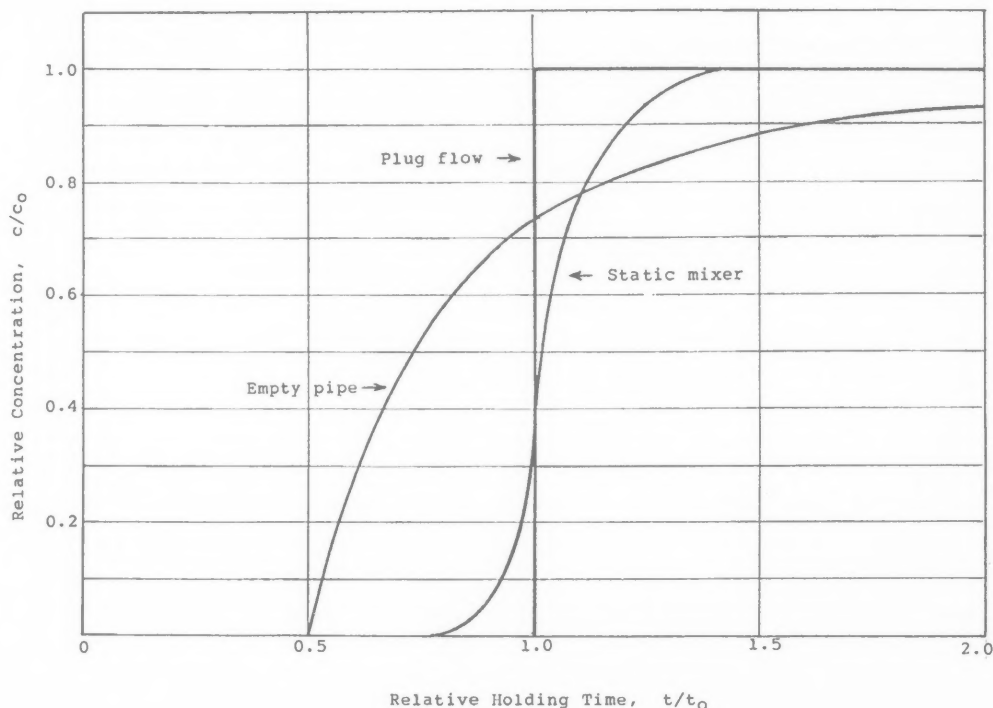
Details concerning the fabrication of a holding tube are supplied in the *3-A Sanitary Standards* (5). The holding tube, including its inlet and outlet connections, shall be constructed of sanitary pipe and fittings. Said sanitary pipe shall have product

contact surfaces with a polished finish, free of all imperfections such as pits, folds, and crevices. Stainless steel of the AISI 300 series is a suitable material of construction.

DESCRIPTION OF THE PROCESS

In the continuous process for the pasteurization of dairy products, a holding tube is employed to achieve the correct residence time under pasteurization conditions. This holding tube incorporates a static mixing device that has a mixing efficiency sufficient to even out or minimize the linear flow rate differences between the fastest moving and the slowest moving particles of dairy product (10). In one embodiment of the process, the static mixing device consists of a series of disk and donut baffles in the holding tube. In another configuration, the static mixer comprises a series of parallel baffles, alternately aligned in different directions in the holding tube. These and other designs are described in the literature in considerable detail (1, 6, 8).

Figure 2. Effect of stotic mxing



Heretofore, static mixers, also known as motionless mixers, have been used in many applications. One of their advantages is that there are no moving parts, which greatly simplifies their design (7). Any obstruction in a pipe can act as a mixing device. Such crude devices, however, have given way to sophisticated designs that are much more efficient in converting energy supplied by the moving fluid into the desired mixing effect. Thus, the required horsepower to pump the dairy product and to circulate the cleaning solution through the holding tube can be minimized.

The object of using a static mixer in the pasteurization process is to provide a more uniform treatment of the dairy product. As previously noted, such a device will minimize the difference in the flow rates between particles of fluid. The theory of fluid dynamics shows that fluid moving along the centerline of a pipe flows at maximum velocity, whereas fluid closer to the wall moves at slower speeds. Liquids that

are relatively viscous and are moving at slow speeds will exhibit laminar flow such that radial mixing is absent. Less viscous fluids, when moving at higher flow rates, will display turbulent flow. Under these conditions, the maximum velocity is closer to the average velocity; nevertheless, plug flow, defined as the condition in which all particles of fluid travel at the same velocity, cannot be attained. With use of a static mixing device, however, the ideal condition of plug flow can be more closely approximated.

A detailed description of the process is provided by Fig. 1 (11). Raw milk is drawn from a constant level tank, 10, into the raw side of the regenerator, 20a, where it is heated by hot pasteurized product. The timing pump, 30, delivers the milk at a constant flow rate to the rest of the system. In the heater, 40, the warmed milk is further heated by hot water or steam to the required pasteurization temperature. Next, the milk flows through the holding tube, 50, which contains a series of

baffles to induce radial mixing. The pasteurized product is partially cooled in the pasteurized side of the regenerator, 20b, and further cooled in the cooler, 80.

Controls are provided to ensure that the milk is heated to the proper temperature and held at that temperature for the required time interval in the holding tube. Timing pump controls (not shown) make sure that the milk is flowing at a rate no greater than specified so that its residence time in the holding tube is at least the required minimum. A controller sensor, 60, and recorder controller, 65, measure and record the temperature of the milk exiting from the holding tube. Product not sufficiently heated is diverted by the flow diversion device, 70, to the constant level tank, 10.

ADVANTAGES OF THE PROCESS

The advantages of the process are quite pronounced. The results are best illustrated by the curves in

Fig. 2 (6). This graph shows the concentration, for example, of a saline solution as a function of residence time, measured at the exit of the holding tube. At time zero, the fluid at the inlet is switched from pure water to a salt solution of concentration c_0 . The effect for an empty pipe is shown by the curve farthest to the left in the figure. For laminar flow, salt is first detected by a conductivity meter when the time is equal to half the average holding time t_0 . The salt concentration increases with time and eventually approaches c_0 . The ideal condition of plug flow is shown by the vertical curve. At the relative holding time equal to 1, there is a breakthrough of saline solution such that the concentration abruptly increases from 0 to c_0 . The effect of a static mixer is given by the s-shaped curve. As noted, these conditions approach that of plug flow but never attain the ideal condition.

The implications of these data are significant. Particles of dairy product closest to the wall in laminar flow move at slow speeds. The quantity of the slow moving particles may be small, but their effect is out of proportion to their concentration. This is because, as the slow moving particles are held for an extended period of time, they develop off-flavors, which can be detected at a very low threshold. Depending on processing conditions, the cooked flavor can approach a scorched taste that quickly spoils the freshness of the pasteurized product.

Thus, it is seen that the use of a static mixer greatly enhances the flavor of the dairy product that is pasteurized. Alternatively, without any sacrifice in flavor, the microbial quality of the product may be improved by reducing the spoilage microorganisms so as to extend the shelf life of the product (3). The simplicity of the process ensures that

these benefits can be achieved at little or no additional cost.

IMPLEMENTATION

Commercialization of the proposed process will depend on development of a sanitary design for the static mixing device. At the same time, a mixer with maximum efficiency is desired. Considering the geometry of most mixers, there does not seem to be a problem with developing a sanitary design. The vanes or baffles can be fabricated from stainless steel. These pieces can be welded together to produce joints with fillets of minimum radii. The entire assembly can be made self-draining. Additionally, the apparatus, can be constructed so that it can easily be disassembled for inspection if necessary.

No provision in the *Pasteurized Milk Ordinance* precludes the use of a static mixing device. Furthermore, such a device would be supportive and in complete agreement with the goals of this ordinance. Concerning the *3-A Sanitary Standards*, this document states that the holding tube shall be constructed of one piece, welded tubing (5). Of particular interest is another standard that provides for the continuous blending of liquid dairy products (4). Presumably "agitators" covered in this provision include static mixers. Finally, consideration needs to be given to the determination of the proper length of the holding tube that contains the static mixer. Because, under the provisions, the salt conductivity test can be used only for HTST pasteurization, the proposed process would be restricted to this mode, at least initially.

The proposed new technology has general utility; applications include the processing of milk, skim milk, cream, ice cream mixes, and

yogurt mixes. Only a catalyst is needed to get a development program started. The International Association for Food Protection is in a unique position to supply this initiative.

ABOUT THE AUTHOR

John E. Stauffer is president of Stauffer Technology, 6 Pecksland Road, Greenwich, CT 06831; Phone: 203.869.7451; Fax: 203.618.0479; E-mail: Staufftek@aol.com.

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A Comparison of Commercial ATP Bioluminescence Hygiene Monitoring Systems with Standard Surface Monitoring Techniques in a Baking Facility

Rebecca A. Illsley,¹ Eric D. Jackson,² Kenneth B. McRae² and Joellen M. Feirtag^{1*}

SUMMARY

Standard surface swabbing techniques and commercial adenosine triphosphate (ATP) bioluminescence hygiene monitoring systems were compared, to determine the adequacy of the bioluminescence systems as rapid methods for evaluating the sanitation program in a baking facility. Two different baking facilities were tested on three occasions. Samples were collected from stainless steel equipment surfaces and from non-food contact surfaces, both before and after sanitation. The numbers of microbiological contaminants detected with use of standard surface monitoring techniques were compared to the ATP recovered with the ATP bioluminescence systems. The rates at which the techniques passed or failed a surface were in good agreement. It was concluded that the ATP bioluminescence hygiene monitoring systems could be used in a baking facility to evaluate cleaning and sanitation effectiveness.

This article has been peer reviewed by two professionals.

INTRODUCTION

An effective sanitation program is critical to the quality and safety of manufactured food products. Unhygienic processing conditions lead to increased diversity in the initial microbial load and a shorter shelf life (10). The standard microbial techniques for monitoring food contact surfaces take days to process. By the time the test results are known, the product has already been produced and may have been distributed. Adenosine triphosphate (ATP) bioluminescence hygiene monitoring systems provide a more rapid means to assess sanitation effectiveness by indicating whether a surface should be re-cleaned (5, 8).

ATP bioluminescence hygiene monitoring systems measure ATP, the universal energy donor for metabolic reactions in all living cells (5). This allows these systems to detect plant, microbial and animal residues on equipment surfaces, so that any

food residue that can act as a nutrient source for bacteria can be detected. This differs from traditional surface swabbing, which can detect only microbial contaminants.

An ATP bioluminescence assay uses proprietary prepared reagents provided by the manufacturer. Once a surface is swabbed, a wetting agent lyses the cells, which releases their ATP. The dilution buffer then rinses the ATP off the swab, neutralizing and diluting interfering sanitizers. The buffered solution containing ATP is then introduced to the luciferin/luciferase reagent (13). The bioluminescent reaction emits photons, and the intensity of photons, in relative light units (RLU), is measured by a luminometer. The amount of light emitted is proportional to the amount of ATP and therefore to the degree of contamination (13). The reaction occurs in seconds, so that results allow plant personnel to determine immediately if plant conditions are suitable for processing. This rapid method is particularly useful in the case of a shelf stable product that might be particularly sensitive to increased microbiological diversity.

MATERIALS AND METHODS

Experimental design

The study was conducted in 2 different production facilities (Plants A and B). Two types of surfaces (stainless steel and painted concrete) in 2 different locations (mixing and production areas) of each production facility were sampled before and after cleaning and sanitation. The surfaces were sampled with traditional swabbing techniques and with the ATP bioluminescence assay technique. A 2-stage experimental design (4, 9) was used to assign the factor combinations to each surface tested. Location in the plant was the main plot, and the surface type was the subplot. Each surface was divided into 24 sections in Plant A and into 36 sections in Plant B. Twelve randomly selected sections were sampled with the traditional swabbing technique and 12 with each of the two rapid techniques. Each method was used to collect 6 random samples before

sanitation and 6 after sanitation. The study was repeated on 3 separate days at each site. A total of 144 samples (48 × 3 repetitions) were taken with each method at each plant.

Data on the effects of sanitation, surface type, and location in the plant on the percentage of times the two methods agreed to pass or to fail a test surface were tested using analysis of variance (ANOVA) with the Genstat 5 statistical package (Copyright 1992; Lawes Agricultural Trust, Rothamsted Experimental Station, Harpenden, Herts).

Adenosine triphosphate (ATP) hygiene monitoring assay

ATP bioluminescence hygiene monitoring systems and a luminometer were obtained from Biotrace[®] Inc. (Plainsboro, NJ) and IDEXX Laboratories, Inc. (Westbrook, ME). At Plant A, the Biotrace Uni-Lite[®] Hygiene System was used with multi-shot swab devices (ULH25) (3). At Plant B, the Biotrace Uni-Lite[®] Xcel Hygiene System (an upgrade from the Biotrace Uni-Lite[®] Hygiene System) was used with single-shot (UXL100) swab devices. A second ATP bioluminescence assay system was used at Plant B, the IDEXX Lightning[™] Cleaning Validation system with one-step swab devices (6). The multi-shot swab device required a 3-step procedure to (i) reconstitute the enzyme with a diluent, (ii) transfer the rehydrated enzyme to a dropper bottle, and (iii) pour the enzyme into a vial to react with the swab. The single-shot, or one-step, swab devices have the enzyme system incorporated into the device so that no mixing or dilution is required. A 100 cm² area was swabbed in a zig-zag pattern in two opposite directions while the swab was rotated. The samples were assayed for ATP according to the manufacturer's instructions, and the reading was taken immediately after swabbing was done.

Control assays were performed by following the procedure already described using fresh, unused swabs. Blank readings of instrument light outputs were recorded by taking light readings in the absence of any reagents to ensure there was no background light interference.

Plate count assay at Plant A

Sterile cotton wool swabs (Fisher Scientific, Pittsburgh, PA) were used to swab the surfaces tested. The swabs were pre-moistened in sterile D/E Neutralizing Broth (Difco Laboratories, Detroit, MI). A 100 cm² (10 cm × 10 cm) area of the test surface was swabbed in a zig-zag pattern in two opposite directions while the swab was rotated (2, 7). The swab was then returned to the plastic test tube containing 10 ml of D/E neutralizing broth and refrigerated (14). The refrigerated sample was analyzed within 24 h of sampling. Following agitation by vortexing for 10 s to remove microbial cells from the swab, 0.1 ml samples of the swab diluent were spread plated onto Tryptic Soy Agar (TSA) (Difco Laboratories, Detroit, MI). When necessary, ten-fold serial dilutions of the swab diluent were prepared in 0.1% peptone water (Difco Laboratories, Detroit, MI). The TSA plates were incubated at 30°C for 48 h.

Plate count assay at Plant B

The sampling procedure was the same for Plant B as for Plant A. The swab diluent was spiral plated onto Tryptic Soy Yeast Agar (TSY) (Difco Laboratories, Detroit, MI) using a Model CU spiral plater (Spiral Systems, Inc., Cincinnati, OH). Inoculated plates were incubated at 30°C for 48 h.

RESULTS AND DISCUSSION

The ATP bioluminescence hygiene monitoring systems and the traditional surface monitoring techniques were compared as to the percentage of times the methods agreed to pass or fail a surface. A surface passed (i.e., was considered acceptable for processing food) if it scored less than 2.5 on the IDEXX Lightning[™] system as recommended by the manufacturer (6), less than 200 RLU on the Biotrace Uni-Lite[®] or Uni-Lite[®] Xcel (11), and less than or equal to 100 CFU/100 cm² (14) with traditional methods. The rapid and traditional methods were considered to be in agreement when both meth-

TABLE 1. Breakdown of samples according to pass/fail criteria for the plate count method and the ATP bioluminescence assays. A surface passed if it scored less than 2.5 with the IDEXX Lightning™, less than 200 RLU with the Biotrace Uni-Lite® or Uni-Lite® Xcel, and less than or equal to 100 CFU/100 cm² with the plate count assay. The number of samples that passed or failed by both methods are indicated by an asterisk

Plate Count	Biotrace Uni-Lite® Plant A		Biotrace Uni-Lite® Xcel Plant B		IDEXX Lightning™ Plant B	
	Pass	Fail	Pass	Fail	Pass	Fail
Pass	48*	1	52*	10	46*	16
Fail	24	63*	14	44*	4	54*
% Agreement	81.6%		80%		83.3%	

ods passed, or both methods failed the same surface.

The agreement between the results of the traditional surface swab technique and the results of the ATP bioluminescence techniques is shown in Table 1. Problems associated with working in a manufacturing facility rather than in a controlled laboratory made it impossible to collect all 144 samples as planned. Therefore, the total number of observations under each method in Table 1 is equal to the actual number of swabs collected with each method. The numbers of occasions in which the traditional technique agreed with the rapid technique are indicated by asterisks. The test sections that failed by the plate count assay and passed by the ATP bioluminescence technique probably resulted from the presence of low numbers of microorganisms, sufficient to yield a failing result by the plate count criterion (>100/swab) but containing insufficient ATP to be detected by the bioluminescence assay (7). The ATP bioluminescence systems have been reported to have a sensitivity of down to about 1 picogram (10⁻¹²g) of ATP in a sample volume of 100µl, which represents the approximate amount of ATP in one thousand bacterial cells (13). In some cases, this microbial load was high enough to be detected by the plate count assay but

below the sensitivity of the ATP bioluminescence assay, so that the same surface could pass with the rapid technique but fail by the traditional technique. Differences in sensitivity between the Biotrace Uni-Lite® system used in Plant A and the more recent model, the Biotrace Uni-Lite® Xcel, as well as differences in the sensitivities of the multi-shot swabs and the single shot swab devices, may explain why this number was higher in Plant A than in Plant B (24 versus 14).

The test sections that were determined to be unacceptable by the ATP assay but acceptable by the plate count method (1 in Plant A; 10 with the Biotrace Uni-Lite® Xcel and 16 with the IDEXX Lightning™ systems in Plant B) probably reflect the ability of the ATP bioluminescence technique to detect product debris present on a surface where microorganisms were either present in low numbers or absent (7, 12).

In Table 2, the agreement between the ATP bioluminescence systems and the swab and plate method is broken down. According to area of the production facility, type of surface, and whether the sample was taken before or after sanitation with the Biotrace Uni-Lite® system, the overall agreements were 82% at Plant A and 80% at Plant B. The IDEXX Lightning™ system, used only

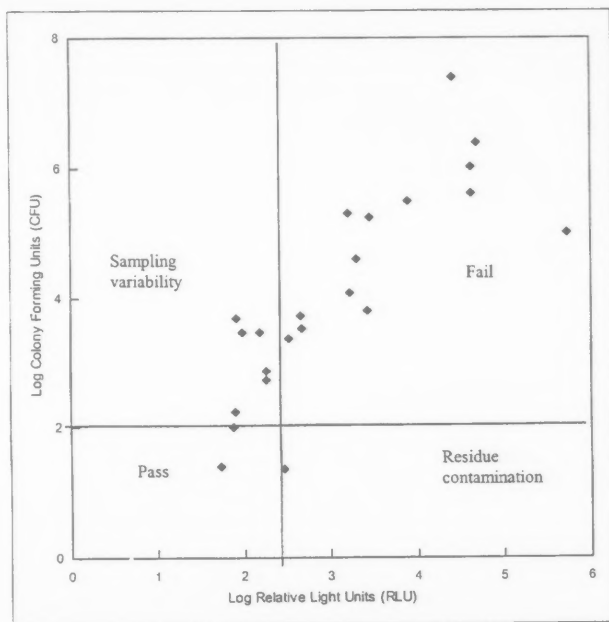
in Plant B, had an overall agreement of 83%. These results are similar to those reported by Bautista et al (1), who found total agreement of 74% when comparing ATP bioluminescence systems to standard swab and plate methods in a milk processing facility, who obtained 84% agreement to the results of Ogden (11), in a brewery. An agreement of 100% was not expected, because the microbiological swabs measure only microbial contaminants, whereas the ATP bioluminescence systems detect food residue along with microbial contaminants.

An analysis of variance (ANOVA) was conducted on the percent agreement between each ATP bioluminescence system used in Plant B and traditional swab techniques. The ANOVA was conducted on the results from Plant B because of the large difference in contamination levels between the two plants. The location in the facility ($P = 0.414$) and the type of surface tested ($P = 0.882$) did not affect the comparison between the traditional and rapid techniques. The ANOVA indicated that the Biotrace Uni-Lite® Xcel and IDEXX Lightning™ ATP bioluminescence systems did not differ significantly ($P = 0.693$) and thus that either brand of ATP bioluminescence system could be used in the baking facility to assess plant hygiene. The ANOVA also indicated that the condition of the surface, either before or after sanitation ($P = 0.393$), did not significantly affect the agreement between the ATP bioluminescence systems and the traditional plate count method. The fact that the level of contamination and type of surface did not affect the way the rapid method assessed a test area, as compared to the traditional method, means that ATP bioluminescence hygiene monitoring systems are a reliable and appropriate rapid tool to replace swab and plate methods.

The relationship between ATP recovered and microbial contamination

To determine the relationship between the ATP and microbial contaminants recovered from the equipment surface, means of the 6 sub-

Figure 1. Relation between relative light units measured with ATP bioluminescence systems and the plate counts of the microbiological surface swabs at Plant A. Each point represents the means of 6 samples collected from the same surface. The plot is split into 4 quadrants according to the pass/fail standards of the traditional and rapid methods.



samples were taken. For example, on the stainless steel surface in the mixing room, 6 samples were collected with each technique before sanitation and 6 after. The comparison was made between the means of the 6 samples taken with the various techniques. Figure 1 shows the log of the colony forming units (CFU/100 cm²) from the microbiological swabs versus the log of the relative light units (RLU/100 cm²) for each of the ATP bioluminescence techniques. Figure 1 shows an increasing trend in the CFU count with increasing RLU. It is not appropriate to relate the quantity of ATP recovered from a surface to the level of microbial contamination, because the ATP assay detects ATP from food residues as well as microbial sources. However, by splitting the plot into four quadrants, at the cut-off points for the respective techniques, the relationship between the results of the two methods can be graphically presented. The quadrants labeled "pass" and "fail" represent the results that were in agreement. Data points in the "fail" region

TABLE 2. Percent agreement between the ATP bioluminescence systems and traditional surface monitoring methods according to location in plant, type of surface, and sanitation treatment

Location in Plant	Surface Type	Surface Condition	Percent agreement (%)		
			Uni-Lite® Plant A	Uni-Lite® Xcel Plant B	Lightning™ Plant B
mixing area	stainless steel	before sanitation	83	83	58
mixing area	stainless steel	after sanitation	61	83	83
mixing area	painted concrete	before sanitation	94	67	92
mixing area	painted concrete	after sanitation	100	72	89
production area	stainless steel	before sanitation	55	78	83
production area	stainless steel	after sanitation	67	89	94
production area	painted concrete	before sanitation	100	92	75
production area	painted concrete	after sanitation	100	75	83
Mean Percent Agreement (%)			82	80	83

for the plate count method and in the "pass" region for the ATP bioluminescence technique indicate sampling variability or differences in sensitivities, as previously mentioned. The quadrant representing "pass" by the plate count method but "fail" by the ATP assay represents food residue contamination, which is not detected with traditional microbiological methods.

From this comparison study, it was concluded that the ATP bioluminescence hygiene monitoring systems tested are reliable alternatives to traditional surface swabbing and plate count methods. Therefore, the ATP bioluminescence systems are a suitable rapid method to be used in the baking facilities tested. However, the ATP bioluminescence hygiene monitoring systems may not be appropriate in locations where dry cleaning is used, because the large amount of residual ATP left on the surface (5). It is also important to note that traditional microbiological surface swabs should not be abandoned entirely; because ATP bioluminescence techniques do not indicate the types of microorganisms present on the equipment, therefore, occasional microbiological surface swabs are useful in determining the types of bacteria recovered, providing a microbial profile of the facility to aid in proper sanitation.

ABOUT THE AUTHORS

¹Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108, Phone: 612.624.3629, Fax: 612.625.5272; E-mail: jfeirtag@tc.umn.edu. ²Agriculture and Agri-Food Canada, Research Station, Kentville, Nova Scotia, Canada, B4N 1J5.

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SPECIAL SESSION

"The Results of FDA Risk Assessments of *Vibrio parahaemolyticus* and *Listeria monocytogenes*"

Wednesday, August 9, 2000 • 1:30 p.m. – 5:00 p.m.

At the request of the Food & Drug Administration, a Special Session on The Results of FDA Risk Assessments of *Vibrio parahaemolyticus* and *Listeria monocytogenes* has been incorporated into the IAFP Annual Meeting as this topic is of great importance to our Members. The National Advisory Committee on Microbiological Criteria for Foods (NACMCF) will be meeting at the Hilton Atlanta, August 10-11 to review this risk assessment.

Reflections from the Past

Presidential Address

C. J. Steffen

First Annual Meeting
of the International Association of Dairy and Milk Inspectors
October 25-26, 1912
Milwaukee, Wisconsin

Wisconsin, the greatest dairy state in the Union, extends greetings to all associations whose purpose is the teaching of the gospel of sanitation and cleanliness in producing and marketing the products of the dairy cow. This Association, organized in this room one year ago by men who are actually engaged in advocating and insisting on cleaner methods in the production of our milk supply, marks an epoch in the development of dairy and milk inspection.

It is but proper to remind you, in coming to Wisconsin, that you are in the state which is the home of such pioneer dairymen as Hiram Smith, C.P. Goodrich, Stephen Fayle, and ex-Governor Wm. D. Hoard. These men many years ago organized the Wisconsin Dairymen's Association, and the place

Wisconsin occupies today as a dairy state is due, to a large extent, to the untiring efforts of the members of that organization. They taught our dairymen the advantages to be derived from breeding and feeding better cows, and to exercise a greater care in handling the product of their herds.

Few questions are receiving greater attention today than the improvement of the milk supply. It is a lamentable fact in the great movement for a more wholesome milk supply that the producer, who should set a high standard and sell his milk on its merits, has done so only in a comparatively few instances. Milk consumers in general have shown the same indifference towards the question of clean milk by refusing to pay more for clean milk than for dirty milk, with the result that laws have been enacted by many states and

Reflections:

With this issue of *Dairy, Food and Environmental Sanitation*, we are concluding the "Reflections from the Past" which we have published since October 1999. We hope that you enjoyed reading Presidential Addresses from earlier times. We enjoyed preparing them for you. Since we did not have Annual Reports from our earliest years of existence when we began this feature column, we will conclude where it all began. In this issue, we are presenting the first and second Presidential addresses given in 1912 and 1913 by our first President, C. J. Steffen.

cities compelling the dairyman to maintain his premises in a reasonably sanitary condition if he would market the product of his herd. States and cities have also enacted laws and ordinances providing that all milk sold within their limits must be of a certain composition and providing certain tests and minimum legal limits which the producer and milk dealer are compelled to meet before they can legally sell their products to the consumer.

The milk question, too, is so closely allied with questions of health that municipalities have been compelled to regulate the sale and distribution of milk in order to conserve the public health. Typhoid fever, diphtheria, scarlet fever, pneumonia, and tuberculosis are liable to be transmitted to human beings through the medium of milk supplies. The infant mortality of cities which directly and efficiently supervise the production and sale of milk has been greatly reduced during the past few years. This conservation of human lives and the prevention of disease is a most important factor in the conservation of the world's resources, and is a splendid tribute to the efficient work of dairy and milk inspectors.

The question of clean milk and the methods to pursue to obtain clean milk are questions which practically every city in the country is now attempting to solve. The systems and methods of inspection differ, and officials do not always agree as to the best methods of procedure. Practically every large city in the country has some form of dairy and milk inspection. In some cities systematic and efficient inspection has solved the question. In others, dairy and milk inspection is still regarded as a joke, and the milk inspector is appointed and holds office as a reward for his fealty to and service rendered the particular political party in power. In the past, it was not unusual to meet men who were called milk inspectors who had absolutely no practical or theoretical knowledge of the fundamental principles of milk production, transportation or distribution. I have known carpenters, locksmiths, ward politicians, plumbers, and a cobbler to be appointed as dairy inspectors. Is it any wonder our market milk producers refuse to be taught by such men? How can the standards of milk production be elevated by inspectors whose knowledge of the dairy industry is less than that of the men whose business and premises they are appointed to inspect? Veterinarians having practically no knowledge of the dairy industry or of dairy sanitation have, in some places, attempted to monopolize dairy inspection, and have advanced rather flimsy arguments to bolster up their claims as being the only qualified men for this particular work. Ringbone, spavin, colic, hog cholera, and most other animal diseases are not difficulties that milk inspectors are called upon to diagnose or to cure. In the past, much of the bad feeling generated as a result of dairy and milk inspection has been due to incompe-

tent inspectors. But the old-time political appointees and the old-time horse-doctors are disappearing from the work, and in their places we are finding specially trained and experienced men from the agricultural colleges. Instruction at the dairy farm by inspectors who are well informed regarding the feeding and care of cattle, the building or improving of barns for the housing of the herds, the proper construction and care and cleaning of dairy buildings, and dairy equipment, the best method of securing and handling milk, is more likely to secure the confidence and cooperation of the men on the farms who are daily engaged in this work, than in the more sensational wielding of the "big stick."

There are many details which I believe the milk producer, the student of the dairy industry, the teacher and investigator of our agricultural colleges and experiment stations and the well informed dairy inspector must study and must thoroughly understand - if we are to have a safe milk supply. The beginning of the milk industry is with the owner of the dairy cow, and the starting point to improve our milk supply is with the owner of the dairy farm. The demand for cleaner and more wholesome milk is universal. How to proceed to more completely safeguard the milk supply, and to encourage the employment of competent, experienced men as inspectors and to standardize and make uniform our work, are some of the objects for which this Association was organized, and for the accomplishment of which this Association will labor.

Dairy and milk inspection is today largely a question of education, supplemented by necessary legislation. Various methods are employed in different places. Some cities depend almost wholly on farm inspection to insure the purity of their milk supply. Others, again, rely more largely on the bacteria test. Still others rely solely on fat tests to indicate what constitutes lawful and wholesome milk, and still others see little need for anything but the application of the tuberculin test to all herds. The discussion of these and other problems will follow as a part of the program of this Convention and I hope the members will render every assistance in their power, through the agency of this organization, to bring about desired changes and reforms and a unification of methods and procedure. I trust the result of our work will be received by our superiors throughout this and other countries in the spirit and for the purpose for which this Association was organized, namely, to elevate and to improve the work and to place it in the hands of men who are best qualified and fitted to do the work. Let us labor to secure a purer and more wholesome milk supply for our people in general and for the babies in particular, thereby safeguarding the public health and promoting the best interests of all classes.

Reprinted from *First Annual Report of Dairy and Milk Inspectors*, October 25-26, 1912.

Presidential Address

C. J. Steffen

2nd Annual Meeting
of the International Association of Dairy and Milk Inspectors
October 24-25, 1913
Milwaukee, Wisconsin

In behalf of the International Association of Dairy and Milk Inspectors, I wish to express to General Manager Skinner and to President Van Norman, of the National Dairy Show, our appreciation of their kind words of welcome.

Some of us are not accustomed to receive such a cordial greeting from dairymen and milk dealers whom we meet in the performance of our duty. This convention of dairy and milk inspectors, held here on the invitation of the National Dairy Show Association, portends a change in the attitude of the dairy and milk interests toward inspection.

Milk and dairy inspection is an important factor in the great upward movement toward a higher standard for dairy products, a more wholesome food, and better living conditions in general. The extent to which inspection can influence this question of improved dairy products will depend largely upon instruction and educational methods.

The men chosen to do this work must be intelligent, competent, and practical; the more practical and better qualified they are the more potent will be their influence in bringing about the desired reform.

The object and purpose of our organization is to elevate the standard of dairy inspection and to lead the dairy and milk industry to a higher level. This greeting from the General Manager and from the President of this great show marks another milestone in this upward movement and exemplifies the proper spirit of the dairy interests toward inspection.

We have assembled here to discuss the best methods of elevating the standard of milk production and distribution. Should we gain a new idea or learn a better or a more practical way of doing our work, our errand to your city will have been accomplished.

Two years ago, seven men met in Milwaukee and laid the foundation of this organization. What they lacked in numbers they made up in enthusiasm. The incentive they had was the need which they could plainly see for such an organization. The spirit which animated them was the necessity of welding into one body the thought and the ability now possessed by men engaged in dairy and milk inspection, for the purpose of awakening in them a feeling of brotherly

interest, for the purpose of elevating the standard of inspection by means of uniform methods, and to encourage inspection by men best qualified for the work.

Our membership now represents twenty-three states, Canada and Australia. This growth and the interest taken by our Members in this organization speaks well for its future. Our efforts must be directed along lines long recognized. Educational and practical methods of dairy and milk inspection must be developed and established if the Association is to render the greatest service to the dairy industry and to the consumer of dairy products.

To me it is always a sad commentary on inspection when told of the many cases of prosecution, and nothing at all is said about the bacteria count of the milk, or the value of the improvements which the inspectors have convinced the dairymen were necessary to properly conduct their business. Practically all states and most cities have some form of dairy and milk inspection. In some instances inspection is by police power only, in others by means of elaborate milk laws and ordinances so far advanced for the city or state that they cannot be and are not enforced. In other instances we find cities devoting a great deal of time and money to educational work in a philanthropic spirit because of inadequate laws or lack of moral support to enforce compliance with the suggestions and requirements of the inspectors.

The men responsible for this diverse direction of time and money of their respective cities all believe that their own system of work is best or the surest method of securing a clean and safe milk supply. Sometimes, however, the question of politics is the determining influence and the deciding factor as to who shall do the work and how it shall be done.

What a fertile field for the instruction and educational work among milk inspectors, law makers, and some of the governing forces of our states and cities! How many of you living in cities where the milk is shipped in from another state, have experienced a visit to certain dairy sections from which the milk is shipped to different points, and after giving your instructions to the dairyman have heard him say,

"I will do what you say, but the inspector from Blankville was here last week and he said just the contrary to what you told me to do. Now, what I want to know is which one of you fellows is right and which one knows what he is talking about?" Each of these men may have been following the law or ordinance in giving his instructions to the dairyman, but what a feeling of resentment toward inspection was engendered here, although each inspector was doing his work according to the laws of his state.

It is sometimes amusing to hear of the adoption of ideal milk ordinances, and after allowing sufficient time to elapse to compel compliance with these laws, find conditions practically the same as before, and yet the lives of the babies actually depend upon those very laws (at least the people were so informed). Why, then, put on the statute laws which are impracticable and which no one dares enforce?

We need a coming together, so to speak, on these milk problems. As long as the creameries and milk dealers pay as much for an inferior, filthy product as for a clean product, just so long will they be putting a premium upon filthy milk, and all the inspection imaginable will not secure clean milk for our people or enable us to make the desired progress.

The question of farm inspection will be presented for your consideration by the Committee on Farm Inspection, and their investigations possibly may suggest a method for us to pursue to improve conditions.

Pasteurization of milk is now recommended for practically all milk, by some of the leading authorities.

Somehow I cannot acquiesce in this view without voicing my protest against these recommendations of constantly increasing from year to year the expense for pasteurizing without a corresponding increase in time and money toward securing a clean supply. Not one line do we find as to the duty of the factory owner or milk dealer toward this question of securing for his business a clean and safe supply. It seems to me that one who goes into a business of supplying food to our people should be compelled in some degree, be it ever so little, to improve that food article from year to year, and not depend altogether upon the pasteurization

process to insure its safety. I am not sure but that we are somewhat lax in this question of pasteurization when we demand that all milk be pasteurized when sold for drinking purposes, and then permit butter, buttermilk, and other dairy products to be manufactured from raw milk and sold to our people for food.

Is it any wonder that we are making but little progress in the control of bovine tuberculosis so long as we permit milk to be taken back from creameries, infected with tubercle bacilli to be fed to calves and other live stock on the farm? Denmark and a number of foreign countries are far advanced in this respect as compared to what we are doing in this country, and the time is not far distant when legislation must be enacted to compel pasteurization of all milk along lines which I have mentioned.

To overcome the problems of the various states and cities, the question of milk laws and more uniformity in their enactment and application is becoming of more importance daily, for the reason that as cities grow and expand, milk is shipped to them not from one county or one state, but from two to five or more counties, and to some cities from as many states. State inspection is to be welcomed, but provision must be made to inspect all dairy farms and milk establishments better than is done by cities at the present time, or state inspection will fail. Inspection to be of benefit must be frequent, thorough, and in a spirit of helpfulness rather than prosecution.

Reasonably clean dairies, the use of small top pails, milk cooled promptly and stored in clean milk houses, properly handled by clean, intelligent men, will insure a reasonably safe milk.

Farm inspection and the use of the score card go hand in hand, but the utility of the score card is small indeed compared to what it might be were it possible to measure with it accurately the quality of milk. Ours is an organization whose aim it is to improve and elevate the milk industry. The results possible for us to attain will depend upon the kind of men and women who do the work and the spirit in which the work is done.

Reprinted from *Second Annual Report of Dairy and Milk Inspectors*, October 24-25, 1913.

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UpDates

Silliker Names Lawlor New Lab Director

Silliker Laboratories recently announced the appointment of Kathleen A. Lawlor, Ph.D., as laboratory director of its Sinking Spring, PA, testing facility. She is responsible for managing scientific operations, quality systems, and staff to provide accurate, timely services to the food industry in the eastern region of the United States.

Prior to joining Silliker, Dr. Lawlor was a microbiologist with USDA's Food Safety and Inspection Service (FSIS). As a member of the FSIS Special Projects and Outbreak Support Laboratory, she evaluated rapid pathogen detection methods, collaborated on foodborne outbreak investigations, and provided technical support and training to FSIS field service laboratories. Dr. Lawlor also served in management capacities with General Foods Corporation. She directed applied microbiological research programs, performed risk assessments of manufacturing facilities, provided HACCP and GMP training, and ensured the safety and stability of a wide range of refrigerated, frozen, and intermediate-moisture food products. Dr. Lawlor is a graduate of Virginia Polytechnic Institute and State University, with a Ph.D. in food science and technology.

The International Fresh-cut Produce Association Adds a Full Time Technical Director to Staff

James R. Gorny, Ph.D. has joined the IFPA as technical director as of May 1, 2000. Dr. Gorny was previously senior vice president of technology at Davis Fresh Technologies in Davis, CA. At

Davis Fresh Technologies, he provided technical expertise to the produce industry in matters related to postharvest handling. He is an expert in modified atmosphere packaging design and testing; food safety; and product and process development.

Jim Gorny received his Ph.D. at UC-Davis in 1995. He worked in the fresh-cut produce industry both before and after his doctoral work. He will maintain an office in Davis, CA for his work with the International Fresh-cut Produce Association.

Floros to Head Penn State Food Science Department

John Floros, professor of food process engineering and packaging at Purdue University, has been appointed head of the department of food science in Penn State's College of Agricultural Sciences, effective June 28.

"Along with his superb research record, John brings to this position excellent preparation and experience in curriculum development and enhancement, and strong leadership skills to continue to move our food science programs to higher levels," says Robert Steele, dean of the college. "He is a great addition to our college's leadership team."

Floros has made substantial contributions in the application of chemical engineering, applied mathematics and industrial statistics to understand the many phenomena that drive food process engineering and packaging systems. His work has generated significant innovations in efficient food processing and packaging systems, while improving the value, quality, safety and shelf life of food products.

His accomplishments include developing effective peeling processes for fruits and vegetables, optimizing a calcification process for diced tomatoes and establishing new, environmentally friendly techniques to commercially ferment vegetables using low-salt brines. He also designed "active" packaging films with antimicrobial properties that improve food safety and extend the shelf life of some packaged foods.

A native of Greece, Floros received his bachelor's and master's degrees in food science and technology from the Agricultural University of Athens, Greece, and his doctorate in food science and technology from the University of Georgia in 1988. Beginning as a technician and production supervisor at a fruit processing plant in Andravida, Greece, he advanced to plant manager. Later, he served as a research assistant first at the University of Athens, then at the University of Georgia, before coming to Purdue University, where he rose to the rank of full professor.

Carlisle Sanitary Maintenance Products Announces New Director of Operations

Carlisle Sanitary Maintenance Products, a division of Carlisle FoodService Products, has announced Tim Larson as new director of operations.

Larson brings to Carlisle Sanitary Maintenance Products over 14 year's experience within the broad-based manufacturing, engineering and operations

management. In his new position, Larson will be directing plant operations for Carlisle Sanitary Maintenance.

Larson has a bachelor's degree in science and engineering from the University of Wisconsin.

MOCON Announces Promotion of Robert L. Demorest

MOCON, Inc. announced the formal promotion of Robert L. Demorest to the positions of chairman of the board and chief executive officer of MOCON, Inc. Mr. Demorest is assuming the duties of William N. Mayer, who has retired as of April 1, 2000.

Mr. Demorest joined MOCON in 1974 and has been its President since 1995. Prior to becoming President, Mr. Demorest served as the executive vice president of sales and marketing. He has been a director of the Company since 1995.

Torrente and Smith Join Bell Laboratories, Inc.

Sergio Torrente and Scott Smith recently joined the sales staff of Bell Laboratories. As technical sales representatives, Torrente and Smith advise distributors and PCOs through individual consultations and trade show.

Sergio Torrente acts as Bell's Southern technical representative.

Based in Winter Park, FL, he assists distributors and PCOs in Florida, Puerto Rico and Mexico.

Backed by a strong science background, Torrente holds a bachelor's degree in geological sciences from Southern Methodist University in Dallas, TX. Before joining Bell, Torrente developed his territory management and sales training skills in technological manufacturing. His expertise in account management stems from employment as an account representative.

Like Torrente, Scott Smith, Bell's new South Central technical representative, has well-rounded credentials. He earned a bachelor of science degree in entomology from Texas A&M University.

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Olmsted County, Minnesota Wins 2000 Crumbine Award

The winner of the 2000 Samuel J. Crumbine Consumer Protection Award is the Olmsted County Public Health Services in Rochester, MN.

The Crumbine Award, named for one of this century's most renowned public health sanitarians, is presented each year to the local public health agency that demonstrates excellence in food protection. Agencies that win the Crumbine Award become model programs for other local public health agencies across the nation. Among environmental health and public health professional circles, the Crumbine Award is the most prestigious recognition that a public health agency can receive.

Mary Ellen Burris, director of consumer affairs at Wegmans Food Markets, Inc. and chair of the 2000 Crumbine jury said, "Selecting a winner among the ten entries this year was very difficult. In the final analysis, though, what set Olmsted County's application apart was the demonstration of extraordinary innovation and risk taking." Burris also pointed out that the jury recognized Olmsted County's program for its outstanding risk orientation, excellent industry participation, superior epidemiological capabilities, strong enforcement component, and good communication component.

Mary Wellik, director of Olmsted County Public Health Services, said, "We can most effectively help the foodservice industry reduce the threat of foodborne illness with inspections based on risk, scheduled with people most knowledgeable about their business practices. The Crumbine Award draws valuable attention to this successful education and consultation process."

The Olmsted County Public Health Services will receive the Crumbine Award at the Annual Meetings of the International Association for Food Protection (IAFP), National Association of



NEWS

County and City Health Officials (NACCHO), and the National Environmental Health Association (NEHA).

In addition to IAFP, NACCHO and NEHA, other sponsors of the Crumbine Award include the Conference for Food Protection, American Academy of Sanitarians, Association of Food & Drug Officials, Foodservice & Packaging Institute, Inc., International Food Safety Council, Underwriters Lab, Inc., and National Sanitation Foundation.

World Health Organization (WHO) Adopts Resolution on Food Safety

The World Health Assembly, the supreme governing body of WHO, adopted at its last session in May 2000 a resolution on food safety. This is a historic achievement since it is the first resolution of this kind in the 52 year history of WHO.

The resolution expresses deep concern that foodborne illness associated with microbial pathogens, biotoxins, and chemical contaminants in food represents a serious threat to the health of millions of people in the world and urges *inter alia*, the integration of food safety into the essential public health functions.

The two US federal agencies responsible for food safety, i.e., FDA and FSIS, had initiated discussions on food safety in WHO's governing bodies; the resulting resolution was supported unanimously by all WHO member states. To see the full text of the resolution, visit WHO's home page under www.who.int/wha-1998/WH00/anglais.htm, then click on WHA53.1 to WHA53.17. The food safety resolution has the code #WHA53.15.

Lab Test Simultaneously Detects Foodborne Pathogens

A laboratory test that simultaneously detects *Salmonella* and a deadly form of *E. coli* O157:H7 has been developed by Agricultural Research Service microbiologists in Ames, IA.

The new test uses a technique called fluorescent polymerase chain reaction (PCR) to detect the two foodborne pathogens. PCR makes many copies of genetic material called DNA, the basic genetic building blocks of bacteria and other living organisms. Then two fluorescent probes, which are present in the PCR tube, specifically detect *Salmonella* and O157:H7 by detecting the DNA specific to these bacteria.

So far, the test has been evaluated to detect between one and 10 bacterial cells in meats and feces that are cultured for 6 to 16 hours prior to performing PCR, which requires only 4 hours. This makes the new test several hours faster than standard culturing techniques now used to detect bacterial contamination in meat or livestock feces.

Detecting the deadly *E. coli* O157:H7 is critical to stopping the spread of this disease-causing bacterium, which causes bloody diarrhea and can be fatal. *Salmonella* and *E. coli* are found in animal feces and spread to humans through undercooked contaminated foods. Each year, about 40,000 reported cases of salmon-

ellosis and 73,000 estimated cases of diarrheal illness due to O157:H7 occur in the United States.

ARS microbiologists Vijay K. Sharma and Steve A. Carlson at ARS' National Animal Disease Center in Ames, IA validated the test by using artificially contaminated beef, chicken and cattle feces. The test would be just as accurate on pork.

The meat processing industry, which slaughters more than \$50 billion worth of livestock annually, could use this technology to meet current federal regulations that mandate zero tolerance for visible fecal contamination and for *E. coli* O157:H7.

Sharma presented the findings at the American Society for Microbiology (ASM) meeting in Los Angeles.

Outbreak of *Listeria gastroenteritis* in Italy Caused by Contaminated Corn Salad

An outbreak of febrile gastroenteritis caused by *Listeria monocytogenes* associated with eating cold salad of corn and tuna affected over 1,500 people in northern Italy in May 1997, and its investigation was reported recently.

Most of the cases were children and staff at two primary schools and some were students at the nearby University of Turin. All 2,189 of those interviewed had eaten at cafeterias served by the same caterer, and 1,566 reported symptoms that included headache, abdominal pain, fever, vomiting, diarrhea, and joint and muscle pain. Illness was significantly associated with having eaten a cold salad of corn and tuna before developing symptoms. Altogether 292 had to be admitted to hospital.

Common enteropathogens were detected in only two of the 292 faecal specimens obtained from patients admitted to hospital and in none of the 40 blood culture specimens. *L. monocyto-*

genes serotype 4b was cultured from one blood specimen, however, and from 123 of the 141 stool specimens taken subsequently, as well as from the caterer's sample of the salad and from environmental samples collected from the catering plant. DNA analysis showed that all *Listeria* isolates were identical.

On the day before the outbreak began the food processing plant that supplied the sector prepared 2,750 portions of corn and tuna salad and 200 portions of corn salad. The cans of corn and tuna were opened in the early morning and the contents left to drain on separate trays before being mixed without the addition of any dressing or spices. Experimental contamination of sterile samples of the implicated foods showed that canned corn kernels (once opened) sustained the growth of *L. monocytogenes* until a high load was reached after 10 hours at room temperature.

The outbreak incurred substantial health costs and caused considerable public concern, especially because many of the patients were children. Procedures intended to reduce contamination with *Listeria* – for example, the hazard analysis and critical control point scheme – can prevent cases of invasive disease in immunocompromised patients as well as large outbreaks of gastrointestinal febrile illness in immunocompetent patients.

Common Household Items Could be Sources of Infections

Common activities such as using a telephone, turning the kitchen faucet on and off, or wringing out a sponge may result in infection with disease agents such as *Shigella*, *Salmonella*, the cold virus and other agents, say researchers from the University of Arizona. They report their results at the 100th General Meeting of the American Society for Microbiology (ASM).

The degree of transfer of *Serratia rubideae* (a bacterium similar to *Shigella* and *E. coli*, agents of diarrheal disease) and PRD-1 (a bacterial virus similar to a human virus) from common articles in the home to the hand was studied. Transfer efficiency was found to be particularly high for faucet handles (28% and 34%) and phone receivers (39% and 66%). Further studies showed that 34% of the *Serratia rubideae* as well as the PRD-1 virus could be transferred from a contaminated fingertip to the lower lip.

These results were coupled with the published information regarding the infective dose (number of microbes required to cause an infection) and levels of disease-causing microbes called pathogens found in human fluids such as stool and nasal secretions. The research was performed by Dr. Patricia Rusin, Dr. Charles Gerba and Sheri Maxwell at the University of Arizona, Tucson. The work was funded by Procter and Gamble.

Examples of several possible scenarios of disease transmission from common articles to humans may be drawn from these results. A telephone receiver could easily serve to transmit disease. Large numbers of *Salmonella* (a common bacterial cause of diarrhea) may be found in the stool of an infected person. Hence, if even only a tiny amount of stool were transferred from an infected person's contaminated hand to a telephone receiver, the next user could have 107,104 *Salmonella* cells on the fingertip. If this were placed in the mouth, the person would receive a dose of 36,383 cells which could easily result in disease.

We know that viruses can survive (remain infectious) for hours to days on a hard surface, infectious doses are often very low and large numbers are often found in human fluids such as nasal drainage and stools. Hence, if a virus such as the rotavirus (a diarrheal virus) were on the surface of a telephone receiver, infectious doses could easily be

transferred to persons using the telephone. For example, if a telephone receiver were contaminated with a low concentration of rotavirus agent (e.g. 10,000 viruses) 6,580 of these would be transferred to the hand during normal use of the telephone with 211 of them found on the fingertip. Our results show that 72 viruses could be ingested by the user which would very likely result in disease.

Faucet handles have also been shown to be highly contaminated sites, especially in the kitchen. We know that high levels of the cold virus may be found in the nasal secretions of infected persons and the infectious dose is very very low. We also know that this virus can survive for several hours on surfaces such as faucet handles. Hence, if an infected person deposited even a small amount of infected nasal secretion onto a kitchen faucet handle, 1,037 viruses could be deposited onto the hand of another family member who touched the faucet handle. If this person then places the fingertip in the mouth, nose or eye, 11 viruses would most likely be transferred into the opening. This would, again, be quite likely to result in infection.

Previous studies by the authors show that the common household sponge may contain 320,000,000 opportunistic bacterial pathogens. Based on a 0.0009% transfer efficiency to the hand, 2,912 bacteria would be transferred to the hand. Assuming 3.2% (93) of these bacteria are distributed on the fingertip, then 34% or 32 cells would be transferred into the mouth. This means that if pathogenic bacteria were in the sponge, such as *E. coli*, in high numbers, infectious doses could be transferred to the mouth.

This work shows that everyday activities in a contaminated household or workplace could

easily result in the transmission of disease. Disease can probably be transmitted in the home more often than these studies suggest because many of these articles are used repeatedly in the home. For instance, a homemaker will handle a contaminated kitchen sponge many times during the day multiplying the probability of disease transmission.

President Clinton Announces Aggressive Food Safety Strategy to Combat *Listeria* in Hot Dogs and Other Ready-to-eat Foods

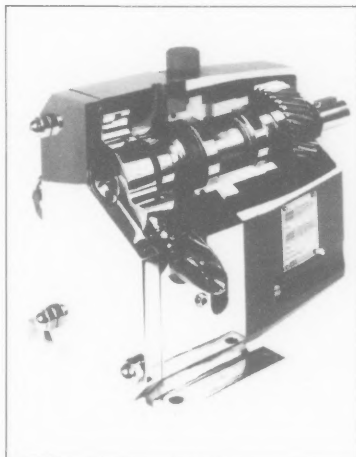
In a May 6 radio address, President Clinton announced an aggressive new strategy to significantly reduce the risk of foodborne illnesses caused by *Listeria monocytogenes* in ready-to-eat foods such as hot dogs and lunch meats.

According to the Centers for Disease Control and Prevention, 2,518 people each year become ill from *Listeria*, and 20 percent of cases result in death. Foodborne listeriosis has particularly high fatality rates for newborns, the elderly, and those with weakened immune systems. The President will direct the Departments of Agriculture and Health and Human Services (HHS) to take a range of actions, including new regulations, to cut the risk of illness and death from *Listeria*. He will also push Congress to fully fund his food safety initiative and criticize Congress for voting to undermine that initiative.

President Clinton announced an aggressive new interagency effort to combat foodborne illness caused by *Listeria*. In particular, the President will direct USDA to

complete proposed regulations that include any appropriate microbiological testing and other measures by industry to: (1) prevent cross-contamination in the processing environment; (2) ensure that the processing of ready-to-eat products meets appropriate standards; and (3) ensure that such products are safe throughout their shelf life. In addition, the President will direct HHS to develop an action plan identifying further steps to reduce *Listeria* contamination, including identification of control measures for at-risk foods and the publication of guidance to processors, retailers, and food service facilities. Finally, both USDA and HHS will consider the need for enhanced labeling to provide additional consumer safeguards. The Administration's goal is to cut in half, by the year 2010, the number of illnesses caused by *Listeria* (from 0.5 to 0.25 cases per 100,000). These actions should enable the Administration to reach this goal five years early.

The President urged Congress to provide the full \$68 million increase he has requested for the initiative, which would, among other things, protect millions of Americans from the dangers of *Salmonella* poisoning in eggs and enable FDA to expand the number of inspections of imported and certain domestic foods. The President also will call on Congress to pass two key pieces of food safety legislation. One bill, sponsored by Senators Mikulski, Kennedy, and Durbin and Rep. Eshoo, ensures that imports of fruits, vegetables, and other food products meet US food safety requirements. The second bill, sponsored by Sen. Harkin, gives USDA authority to issue mandatory recalls and impose civil penalties for unsafe meat and poultry.



Viking Pump, Inc.

Viking Pump Announces New Sanitary DuraLobe® Pump with O-Ring Seal Design

To simplify strip cleaning in food, dairy and other sanitary applications, Viking Pump, a Unit of IDEXX Corporation, has released a new design of its DuraLobe bi-rotor lobe pumps with O-ring shaft seals instead of traditional mechanical seals. O-ring seals make frequent strip cleaning simpler and faster, and eliminate the possibility of damage to mechanical seals. O-rings are readily available, inexpensive to replace, and reduce the initial cost of the pump.

The DuraLobe O-ring Seal Design pumps are available in twelve sizes, from 1 to 390 gpm (0.2 to 88 m³/h), at pressures to 200 psig (14 bar). With temperature capabilities to 300°F (149°C), these pumps are also suitable for

Clean In Place and Sterilize In Place installations. Single and double O-ring models allow handling fluids with viscosities from 28 to 500,000 SSU (0 to 110,000 cSt). The near-pulseless flow is perfect for both transfer and metering of nearly any sanitary product, including food slurries and shear-sensitive liquids.

DuraLobe pumps conform to 3A standards for sanitary/hygienic applications including food, dairy, brewing and beverage with quick-clamp or ACME ports. Special finishes are available for ultrapure applications. The pump can be mounted with ports in both horizontal or vertical planes as well as top or bottom shaft drive.

Viking Pump, Inc., Cedar Falls, IA

Reader Service No. 280

Advanced Instruments Introduces ThermaZyme™ ACP Test for Proper Cooking Verification and Process Control

For processing and food safety needs, the ThermaZyme ACP Test is the only Peer Verified Method that allows you to confirm process control and proper cooking of meat and poultry products. The ThermaZyme Test System provides documented results that are accurate, repeatable, and extremely sensitive. Test results are quantitative and do not rely upon operator interpretation as other methods do, and its ability to perform testing even after product has cooled makes the

ThermaZyme Test System the ideal tool to help your plant avoid unnecessary wash-downs and maximize production capacity.

An ISO 9001 compliant company, Advanced Instruments, Inc. designs and manufactures automated systems that assure product quality and improve food safety, reduce operating expenses and assist you in yielding higher revenues. Backed by an experienced team of food scientists, Advanced Instruments offers process monitoring systems that address your HACCP verification needs for processed meats.

Advanced Instruments, Norwood, MA

Reader Service No. 281

New — for Highly Sensitive Chemiluminescent Detection of DNA Blots, Choose New Kits from Pall Gelman Laboratory

Pall Gelman Laboratory's new DNA Hybridization and Detection Kit with Biodyne® B Membrane includes membrane and reagents optimized for the chemiluminescent detection of DNA. The kit provides sensitivity equaling radioactive detection without the associated hazards or disposal concerns, and is more sensitive than colorimetric systems. Blots typically require less than 30-minute exposures.

DNA can be transferred to the membrane by Southern blotting or dot blotted directly on the mem-

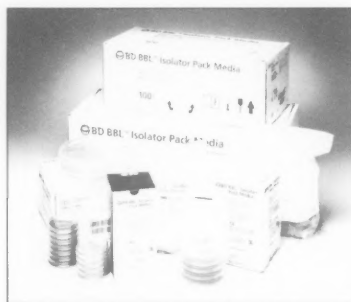
The publishers do not warrant, either expressly or by implication, the factual accuracy of the products or descriptions herein, nor do they so warrant any views or opinions offered by the manufacturer of said articles and products.

brane. After hybridization with a biotinylated DNA probe, detection is accomplished with a highly sensitive chemiluminescent substrate. Signal can be measured using a camera luminometer or by exposing X-ray film to the membrane. Blots can be easily stripped and reprobbed after detection.

Pall Gelman Laboratory's new Random Primer DNA Biotinylation Kit provides reagents and buffers used to synthesize biotinylated DNA probes through incorporation of biotin-N4-dCTP during random-primer extension. Probes synthesized using this kit are stable for at least one year when stored at -20 T.

Pall Gelman Laboratory, Ann Arbor, MI

Reader Service No. 282



BD Biosciences

Sterile Media for Isolators Now Available

BD Biosciences has announced an expansion in the line of widely used BBL™ Sterile Pack Prepared Plated Media: BBL Isolator Pack, specially designed for use within isolator systems. This innovation in environmental monitoring has been performance-validated after exposure to the vaporized hydrogen peroxide atmosphere used during isolator facility decontamination cycles. Where media in other packaging configurations may show diminished growth promo-

tion capabilities under these conditions, BBL Isolator Pack Prepared Plated Media maintains excellent growth promotion characteristics. The multi-wrap packaging employed with BBL Isolator Pack Prepared Plated Media prevents exposure of the media to vaporized hydrogen peroxide.

BBL Isolator Pack Prepared Plated Media is gamma-irradiated and validated sterile according to AAMI guidelines. It is manufactured in a cGMP facility and packaged to protect against the risk of introducing contaminants into critical environments.

BD Biosciences, an ISO 9000-registered media manufacturer offering a complete line of prepared and dehydrated media, with each formulation lot-tested to ensure the highest level of performance. BBL Sterile Pack Prepared Plated Media is available in a broad range of media and plate configurations including D/E Neutralizing Agar, Trypticase™ Soy Agar, the original RODAC™ dish for surface monitoring and Sterile Pack Finger Dab™ Agar plates for sampling gloved hands.

BD Biosciences, Sparks, MD

Reader Service No. 283

Expanded Spraying Systems Co. QuickMist™ Air Atomizing Nozzle Line Offers More Model Choices and Spray Set-up Options

Spraying Systems Co. has recently expanded their line of QuickMist air atomizing nozzles, to include more model choices and set-up options. The line now includes the QMJ (standard body), QMJML (standard body with mountings lugs), and the new QMJAU (offering controlled on-off

operation). In addition, users can choose from a variety of pressure and siphon-fed spray set-up options, including round spray, wide angle round spray, flat spray, and external mix flat spray.

The patented QuickMist spray nozzle uses up to 50 percent less air than conventional air atomizing nozzles, depending on the spray set-up, while providing the same degree of atomization at the same liquid flow rates. A quick-connect, no tool spray set-up keeps maintenance time to a minimum. Hand installation and removal of the nozzle's spray setup assembly – air cap, VITON® O-rings, and fluid cap can be completed in seconds.

Each QuickMist spray nozzle features an automatic self-aligning spray set-up which improves product quality and eliminates the time-consuming task of manual nozzle alignment. Ribs on the nozzle body and retainer cap guide the spray set-up sub-assembly into place, allowing for easy 45° increment alignment on flat sprays.

A super tough PVDF – chemical-resistant fluoropolymer – construction makes the QuickMist spray nozzle more versatile than metal air atomizing nozzles. Able to withstand temperatures up to 200°F (93°C), PVDF is particularly well suited to applications requiring a variety of temperature ranges and resistance to acids, bases, and oxidizing agents.

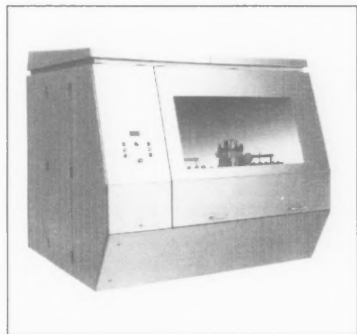
A new addition to the line is the QMJAU QuickMist spray nozzle. With an internal air cylinder for controlled on-off operation, the nozzle is perfect for automating many spray applications, including die lubrication, spray injection, chain lubrication, web spraying, moistening, and pattern lubrication. Its KYNAR® (PVDF) construction withstands tough, corrosive chemical environ-

ments and is available for both normally open (continuous spray) and normally closed (event driven spray) valve operation.

The three QuickMist models, the QMJ, QMJML, and QMJAU, each feature 1/4" NPT or BSPT (F) threads for both the air inlet and liquid inlet connections.

Spraying Systems Co.,
Wheaton, IL

Reader Service No. 284



APV

New Generation APV Homogenizer Boosts Operating Efficiencies in High-Capacity Processing Plants

APV announces the introduction of the APV 200 kW homogenizer – the company's highest capacity unit-capable of handling up to 14,000 gallons per hour.

The unit's sextuplet displacement plunger design helps reduce flow fluctuations, significantly reducing pipeline vibration common on smaller machines.

A choice of application-specific homogenizing valve assemblies include APV's patented Micro-Gap Valve Technology that makes it possible to process milk at up to

one-third less operating pressures than a conventional valve. Using a 275 horsepower motor, reduced pressure can lower energy costs by \$20,000 annually. Single-stage and two-stage homogenizing valve assemblies also can be specified in a choice of hydraulic or pneumatic actuation.

Despite its high capacity, the 200 kW homogenizer operates at a slower eccentric speed to increase the life of moving parts and reduce replacement costs. In addition, the unit incorporates an enclosed gearbox that reduces noise and vibration to less than 80 dba – industry leading levels for a unit this size.

All aseptic cylinders and homogenizing valve assemblies are designed for sterilization with steam or hot water at temperatures up to 300°F. APV's sanitary in-line flow pattern eliminates dead ends to reduce cleaning and sterilization costs.

APV, Rosemount, IL

Reader Service No. 285

Raytek Announces A Sub-zero Model for Raynger MX Series

Raytek Corporation, maker of high-performance noncontact infrared thermometers, is offering a new sub-zero option for the MX2 and MX4+ models in its successful Raynger MX series. The Raynger MXSZ is a modified unit that has been designed to expand the range of applications addressed by the company's handheld IR products, particularly the measurement challenges in the range from -50° to 500°C (58° to 932°F).

Many low-temperature environments, especially those for cold storage, cold transport for food,

and certain food processing environments, require measurement below -30°C (-22°F). In addition, scientific applications in Arctic winter climates require this expanded capability.

The sub-zero option is the ideal solution for any situation requiring low temperature measurement. This includes industrial predictive and preventive maintenance such as checking for icing on airplane wings and checking for depleted refrigeration media; for deep cold storage and walk-in refrigeration applications; and for frozen food safety and processing, including "flash freezing."

The MXSZ combines several competitive advantages:

- Optically matched coaxial laser sighting system that uses a 16-point laser circle to precisely match the unit's optics to the measurement target area at all distances
- Fastest available response time (250mSec), ensuring instant measurement even when the target area temperature is changing rapidly
- Best-in-class 60:1 optical resolution, measuring a 3-inch diameter target at 15 ft

The Sub-Zero units retain the same advanced features as the standard MX models, including tenth-degree resolution, 1% accuracy, audible/visible high alarm, adjustable emissivity, maximum/minimum temperature, backlit display, low battery indicator, automatic off, data logging, report writing, data management software, and a seven-second hold on the display after trigger release.

Raytek Corporation, Santa Cruz, CA

Reader Service No. 286

Audiovisual Library

(A Member Benefit of IAFP)

DAIRY

- D1170 3-A Symbol Council**—(8 minute videotape). A video which was developed to make people in the dairy and food industries aware of the 3-A program and its objectives.
- D1180 10 Points to Dairy Quality**—(10 minute videotape). Provides in-depth explanation of a critical control point in the residue prevention protocol. Illustrated with on-farm, packing plant, and milk-receiving plant scenes as well as interviews of producers, practicing veterinarians, regulatory officials and others. (Dairy Quality Assurance-1992) (Rev. 1998)
- D1010 The Bulk Milk Hauler: Protocol & Procedures**—(8 minute videotape). Teaches bulk milk haulers how they contribute to quality milk production. Special emphasis is given to the hauler's role in proper milk sampling, sample care procedures, and understanding test results. (Iowa State University Extension-1990). (Rev. 1998)
- D1020 Causes of Milkfat Test Variations & Depressions**—(30 minute-140 slides-tape-script). This set illustrates the many factors involved in causing milkfat test variations or depressions in your herd, including feeding, management, stage of lactation, age of samples, handling of samples, and testing procedures. The script was reviewed by field staff, nutritionists, laboratory personnel and county extension staff. It is directed to farmers, youth and allied industry. (Penn State-1982)
- D1030 Cold Hard Facts**—This video is recommended for training personnel associated with processing, transporting, warehousing, wholesaling and retailing frozen foods. It contains pertinent information related to good management practices necessary to ensure high quality frozen foods. (National Frozen Food Association-1993) (Rev. 1998)
- D1040 Ether Extraction Method for Determination of Raw Milk**—(26 minute videotape). Describes the ether extraction procedure to measure milkfat in dairy products. Included is an explanation of the chemical reagents used in each step of the process. (CA-1988) (Rev. 1998)
- D1050 The Farm Bulk Milk Hauler**—(30 minute-135 slides-tape-script). This set covers the complete procedure for sampling and collecting milk from farms. Each step is shown as it starts with the hauler entering the farm lane and ends when he leaves the milk house. Emphasis is on universal sampling and automated testing. Funds to develop this set were provided by The Federal Order #36 Milk Market Administrator. (Penn State-1982) (Rev. 1998)
- D1060 Frozen Dairy Products**—(27 minute videotape). Developed by the California Department of Food and Agriculture. Although it mentions the importance of frozen desserts, safety and checking ingredients; emphasis is on what to look for in a plant inspection. Everything from receiving, through processing and cleaning and sanitizing is outlined, concluded with a quality control program. Directed to plant workers and supervisors, it shows you what should be done. (CA-1987) (Rev. 1997)
- D1070 The Gerber Butterfat Test**—(7 minute videotape). Describes the Gerber milkfat test procedure for dairy products and compares it to the Babcock test procedure. (CA-1990) (Rev. 1998)
- D1080 High-Temperature, Short-Time Pasteurizer**—(59 minute videotape). Provided by the Dairy Division of Borden, Inc. It was developed to train pasteurizer operators and is well done. There are seven sections with the first covering the twelve components of a pasteurizer and the purpose and operation of each. The tape provides the opportunity for discussion after each section or continuous running of the videotape. Flow diagrams, processing and cleaning are covered. (Borden, Inc.-1986) (Rev. 1997)
- D1090 Managing Milking Quality**—(33 minute videotape). This training video is designed to help dairy farmers develop a quality management process and is consistent with ISO 9000 certification and HACCP processes. The first step is to evaluate the strengths and weaknesses of a dairy operation. The video will help you find ways to improve the weaknesses that are identified on your farm.
- D1100 Mastitis Prevention and Control**—(2-45 minute videotapes). This video is ideal for one-on-one or small group presentations. Section titles include: Mastitis Pathogens, Host Defense, Monitoring Mastitis, Mastitis Therapy, Recommended Milking Procedures, Postmilking Teat Dip Protocols, Milk Quality, Milking Systems. (Nasco-1993)

- D1110 Milk Plant Sanitation: Chemical Solution—**(13 minute videotape). This explains the proper procedure required of laboratory or plant personnel when performing chemical titration in a dairy plant. Five major titrations are reviewed... alkaline wash, presence of chlorine and iodophor, and caustic wash and an acid wash in a HTST system. Emphasis is also placed on record keeping and employee safety. (1989)
- D1120 Milk Processing Plant Inspection Procedures—**(15 minute videotape). Developed by the California Department of Food and Agriculture. It covers pre- and post-inspection meeting with management, but emphasis is on inspection of all manual and cleaned in place equipment in the receiving, processing and filling rooms. CIP systems are checked along with recording charts and employee locker and restrooms. Recommended for showing to plant workers and supervisors. (CA-1986)
- D1130 Pasteurizer - Design and Regulation—**(16 minute videotape). This tape provides a summary of the public health reasons for pasteurization and a nonlegal definition of pasteurization. The components of an HTST pasteurizer, elements of design, flow-through diagram and legal controls are discussed. (Kraft General Foods-1990) (Rev. 1998)
- D1140 Pasteurizer - Operation—**(11 minute videotape). This tape provides a summary of the operation of an HTST pasteurizer from start-up with hot water sanitization to product pasteurization and shut-down. There is an emphasis on the legal documentation required. (Kraft General Foods-1990) (Rev. 1998)
- D1150 Processing Fluid Milk—**(30 minute-140 slides-script-tape). It was developed to train processing plant personnel on preventing food poisoning and spoilage bacteria in fluid dairy products. Emphasis is on processing procedures to meet federal regulations and standards. Processing procedures, pasteurization times and temperatures, purposes of equipment, composition standards, and cleaning and sanitizing are covered. Primary emphasis is on facilities such as drains and floors, and filling equipment to prevent post-pasteurization contamination with spoilage or food poisoning bacteria. It was reviewed by many industry plant operators and regulatory agents and is directed to plant workers and management. (Penn State-1987) (Rev. 1998)

ENVIRONMENTAL

- E3020 Acceptable Risks?—**(16 minute videotape). Accidents, deliberate misinformation, and the rapid proliferation of nuclear power plants have created increased fears of improper nuclear waste disposal, accidents during the transportation of waste, and the release of radioactive effluents from plants. The program shows the occurrence of statistically anomalous leukemia clusters; governmental testing of marine organisms and how they absorb radiation; charts the kinds and amounts of natural and man-made radiation to which man is subject; and suggests there is no easy solution to balancing our fears to nuclear power and our need for it. (Films for the Humanities & Sciences, Inc.-1993) (Rev. 1998)
- E3030 Air Pollution: Indoor—**(26 minute videotape). Indoor air pollution is in many ways a self-induced problem...which makes it no easier to solve. Painting and other home improvements have introduced pollutants, thermal insulation and other energy-saving and waterproofing devices have trapped the pollutants inside. The result is that air pollution inside a modern home can be worse than inside a chemical plant. (Films for the Humanities & Sciences, Inc.) (Rev. 1998)
- E3040 Asbestos Awareness—**(20 minute videotape). This videotape discusses the major types of asbestos and their current and past uses. Emphasis is given to the health risks associated with asbestos exposure and approved asbestos removal abatement techniques. (Industrial Training, Inc.-1988) (Rev. 1998)
- E3055 Effective Handwashing-Preventing Cross-Contamination in the Food Service Industry—**(3 1/2 minute videotape). It is critical that all food service workers wash their hands often and correctly. This video discusses the double wash method and the single wash method and when to use each method. (Zep Manufacturing Company-1993)
- E3060 EPA Test Methods for Freshwater Effluent Toxicity Tests (Using Ceriodaphnia)—**(22 minute videotape). Demonstrates the Ceriodaphnia 7-Day Survival and Reproduction Toxicity Test and how it is used to monitor and evaluate effluents for their toxicity to biota and their impact on receiving waters and the establishment of NPDES permit limitations for toxicity. The tape covers the general procedures for the test including how it is set up, started, monitored, renewed and terminated. (1989) (Rev. 1998)
- E3010 The ABCs of Clean-A Handwashing & Cleanliness Program for Early Childhood Programs—**For early childhood program employees. This tape illustrates how proper handwashing and clean hands can contribute to the infection control program in daycare centers and other early childhood programs. (The Soap & Detergent Association-1991)

- E3010 The ABCs of Clean-A Handwashing & Cleanliness Program for Early Childhood Programs—**For early childhood program employees. This tape illustrates how proper

- E3070 EPA Test Methods for Freshwater Effluent Toxicity Tests (Using Fathead Minnow Larva)**—(15 minute videotape). A training tape that teaches environmental professionals about the Fathead Minnow Larval Survival and Growth Toxicity Test. The method described is found in an EPA document entitled, "Short Term Methods for Estimating the Chronic Toxicity of Effluents & Receiving Waters to Freshwater Organisms." The tape demonstrates how fathead minnow toxicity tests can be used to monitor and evaluate effluents for their toxicity to biota and their impact on receiving waters and the establishment of NPDES permit limitations for toxicity. (1989) (Rev. 1998)
- E3075 EPA: This is Super Fund**—(12 minute videotape). Produced by the United States Environmental Protection Agency (EPA) in Washington, D.C., this videotape focuses on reporting and handling hazardous waste sites in our environment. The agency emphasizes community involvement in identifying chemical waste sites and reporting contaminated areas to the authorities. The primary goal of the "Super Fund Site Process" is to protect human health and to prevent and eliminate hazardous chemicals in communities. The film outlines how to identify and report abandoned waste sites and how communities can participate in the process of cleaning up hazardous sites. The program also explains how federal, state and local governments, industry and residents can work together to develop and implement local emergency preparedness/response plans in case chemical waste is discovered in a community.
- E3080 Fit to Drink**—(20 minute videotape). This program traces the water cycle, beginning with the collection of rain-water in rivers and lakes, in great detail through a water treatment plant, to some of the places where water is used, and finally back into the atmosphere. Treatment of the water begins with the use of chlorine to destroy organisms; the water is then filtered through various sedimentation tanks to remove solid matter. Other treatments employ ozone, which oxidizes contaminants and makes them easier to remove; hydrated lime, which reduces the acidity of the water; sulfur dioxide, which removes any excess chlorine; and flocculation, a process in which aluminum sulfate causes small particles to clump together and precipitate out. Throughout various stages of purification, the water is continuously tested for smell, taste, titration, and by fish. The treatment plant also monitors less common contaminants with the use of up-to-date techniques like flame spectrometers and gas liquefaction. (Films for the Humanities & Sciences, Inc.-1987)
- E3110 Garbage: The Movie**—(25 minute videotape). A fascinating look at the solid waste problem and its impact on the environment. Viewers are introduced to landfills, incinerators, recycling plants and composting operations as solid waste management solutions. Problems associated with modern landfills are identified and low-impact alternatives such as recycling, re-use, and source reduction are examined. (Churchill Films) (Rev. 1998)
- E3120 Global Warming: Hot Times Ahead**—(23 minute videotape). An informative videotape program that explores the global warming phenomenon and some of the devastating changes it may cause. This program identifies greenhouse gases and how they are produced by human activities. Considered are: energy use in transportation, industry and home; effects of deforestation, planting of trees and recycling as means of slowing the build-up of greenhouse gases. (Churchill Films-1995)
- E3130 Kentucky Public Swimming Pool & Bathing Facilities**—(38 minute videotape). Developed by the Lincoln Trail District Health Department in Kentucky and includes all of their state regulations which may be different from other states, provinces and countries. This tape can be used to train those responsible for operating pools and waterfront bath facilities. All aspects are included of which we are aware, including checking water conditions and filtration methods. (1987). (Rev. 1998)
- E3135 Plastics Recycling Today: A Growing Resource**—(11:35 minute videotape). Recycling is a growing segment of our nation's solid waste management program. This video shows how plastics are handled from curbside pickup through the recycling process to end-use by consumers. This video provides a basic understanding of recycling programs and how communities, companies and others can benefit from recycling. (The Society of the Plastics Industry, Inc.-1988)
- E3140 Putting Aside Pesticides**—(26 minute videotape). This program probes the long-term effects of pesticides and explores alternative pest-control efforts; biological pesticides, genetically-engineered microbes that kill objectionable insects, the use of natural insect predators, and the cross-breeding and genetic engineering of new plant strains that produce their own anti-pest toxins. (Films for the Humanities & Sciences, Inc.) (Rev. 1999)
- E3150 Radon**—(26 minute videotape). This program looks at the possible health implications of radon pollution, methods homeowners can use to detect radon gas in their homes, and what can be done to minimize hazards once they are found.

E3160 **RCRA-Hazardous Waste**—(19 minute videotape). This videotape explains the dangers associated with hazardous chemical handling and discusses the major hazardous waste handling requirements presented in the Resource Conservation and Recovery Act. (Industrial Training, Inc.)

The New Superfund. What It is & How It Works—A six-hour national video conference sponsored by the EPA. Target audiences include the general public, private industry, emergency responders and public interest groups. The series features six videotapes that review and highlight the following issues:

E3170 **Tape 1—Changes in the Remedial Process: Clean-up Standards and State Involvement Requirements**—(62 minute videotape). A general overview of the Superfund Amendments and Reauthorization Act (SARA) of 1986 and the challenge of its implementation. The remedy process — long-term and permanent cleanup—is illustrated step-by-step, with emphasis on the new mandatory clean-up schedules, preliminary site assessment petition procedures and the hazard ranking system/National Priority List revisions. The major role of state and local government involvement and responsibility is stressed.

E3180 **Tape 2—Changes in the Removal Process: Removal and Additional Program Requirements**—(48 minute videotape). The removal process is a short-term action and usually an immediate response to accidents, fires and illegal dumped hazardous substances. This program explains the changes that expand removal authority and require procedures consistent with the goals of remedial action.

E3190 **Tape 3—Enforcement & Federal Facilities**—(52 minute videotape). Who is responsible for SARA clean-up costs? Principles of responsible party liability; the difference between strict, joint and several liability; and the issue of the innocent land owner are discussed. Superfund enforcement tools—mixed funding, De Minimis settlements and the new non-binding preliminary allocations of responsibility (NBARs) are explained.

E3210 **Tape 4—Emergency Preparedness & Community Right-to-Know**—(48 minute videotape). A major part of SARA is a free-standing act known as

Title III: The Emergency Planning and Community Right-to-Know Act of 1986, requiring federal, state, and local governments and industry to work together in developing local emergency preparedness/response plans. This program discusses local emergency planning committee requirements, emergency notification procedures, and specifications on community right-to-know reporting requirements such as using OSHA Material Safety Data Sheets, the emergency & hazardous chemical inventory and the toxic chemical release inventory.

E3220 **Tape 5—Underground Storage Tank Trust Fund & Response Program**—(21 minute videotape). Another addition to SARA is the Leaking Underground Storage Tank (LUST) Trust Fund. One half of the US population depends on ground water for drinking—and EPA estimates that as many as 200,000 underground storage tanks are corroding and leaking into our ground water. This program discusses how the LUST Trust Fund will be used by EPA and the states in responding quickly to contain and clean-up LUST releases. Also covered is state enforcement and action requirements, and owner/operator responsibility.

E3230 **Tape 6—Research & Development/Closing Remarks**—(33 minute videotape). An important new mandate of the new Superfund is the technical provisions for research and development to create more permanent methods in handling and disposing of hazardous wastes and managing hazardous substances. This segment discusses the SITE (Superfund Innovative Technology Evaluation) program, the University Hazardous Substance Research Centers, hazardous substance health research and the DOD research, development and demonstration management of DOD wastes.

E3240 **Sink A Germ**—(10 minute videotape). A presentation on the rationale and techniques for effective handwashing in health care institutions. Uses strong imagery to educate hospital personnel that handwashing is the single most important means of preventing the spread of infection. (The Brevis Corp.—1986). (Rev. 1998)

E3245 Wash Your Hands—(5 minute videotape). Handwashing is the single most important means of preventing the spread of infection. This video presents why handwashing is important and the correct way to wash your hands. (LWB Company-1995)

E3250 Waste Not: Reducing Hazardous Waste—(35 minute videotape). This tape looks at the progress and promise of efforts to reduce the generation of hazardous waste at the source. In a series of company profiles, it shows activities and programs within industry to minimize hazardous waste in the production process. Waste Not also looks at the obstacles to waste reduction, both within and outside of industry, and considers how society might further encourage the adoption of pollution prevention, rather than pollution control, as the primary approach to the problems posed by hazardous waste. (Umbrella films)

FOOD

F2260 100 Degrees of Doom... The Time & Temperature Caper—(14 minute videotape). Video portraying a private eye tracking down the cause of a *Salmonella* poisoning. Temperature control is emphasized as a key factor in preventing foodborne illness. (Educational Communications, Inc.-1987) (Rev. 1998)

F2440 Cleaning & Sanitizing in Vegetables Processing Plants: Do It Well, Do It Safely!—(16 minute videotape) This training video shows how to safely and effectively clean and sanitize in a vegetable processing plant. It teaches how it is the same for processing plant as it is for washing dishes at home. (University of Wisconsin Extension-1996) (Available in Spanish)

F2005 A Lot on the Line—(25 minute videotape). Through a riveting dramatization, "A Lot on the Line" is a powerful training tool for food manufacturing and food service employees. In the video, a food plant supervisor and his pregnant wife are eagerly awaiting the birth of their first child. Across town, a deli manager is taking his wife and young daughter away for a relaxing weekend. Both families, in a devastating twist of fate, will experience the pain, fear, and disruption caused by foodborne illness. This emotionally charged video will enthrall new and old employees alike and strongly reinforce the importance of incorporating GMPs into everyday work routines. Without question, "A Lot on the Line" will become an indispensable part of your company's training efforts. (Silliker Laboratories-2000)

F2010 Close Encounters of the Bird Kind—(18 minute videotape). A humorous but in-depth look at *Salmonella* bacteria, their sources, and their role in foodborne disease. A modern poultry processing plant is visited, and the primary processing steps and equipment are examined. Potential sources of *Salmonella* contamination are identified at the different stages of production along with the control techniques that are employed to insure safe poultry products. (Topek Products, Inc.) (Rev. 1998)

F2015 Controlling Listeria: A Team Approach—(16 minute videotape). In this video, a small food company voluntarily shuts down following the implication of one of its products in devastating outbreak of *Listeria monocytogenes*. This recall dramatization is followed by actual in-plant footage highlighted key practices in controlling *Listeria*. This video provides workers with an overview of the organism, as well as practical steps that can be taken to control its growth in plant environments. Finally, the video leaves plant personnel with a powerful, resounding message: Teamwork and commitment are crucial in the production of safe, quality foods. (Silliker Laboratories-2000)

F2037 Cooking and Cooling of Meat and Poultry Products—(2 videotapes - 176 minutes). (See Part 1 Tape F2035 and Part 2 Tape F2036). This is session 3 of a 3-part Meat and Poultry Teleconference cosponsored by AFDO and the USDA Food Safety Inspection Service. Upon completion of viewing these videotapes, the viewer will be able to (1) recognize inadequate processes associated with the cooking and cooling of meat and poultry at the retail level; (2) Discuss the hazards associated with foods and the cooking and cooling processes with management at the retail level; (3) Determine the adequacy of control methods to prevent microbiological hazards in cooking and cooling at the retail level, and (4) Understand the principle for determining temperature with various temperature measuring devices. (AFDO/USDA-1999)

F2030 "Egg Games" Foodservice Egg Handling and Safety—(18 minute videotape). Develop an effective egg handling and safety program that is right for your operation. Ideal for manager training and foodservice educational programs, this video provides step-by-step information in an entertaining, visually-exciting format. (American Egg Board-1999)

F2020 Egg Handling & Safety—(11 minute videotape). Provides basic guidelines for handling fresh eggs which could be useful in training regulatory and industry personnel. (American Egg Board-1997)

- F2036 Emerging Pathogens and Grinding and Cooking Comminuted Beef**—(2 videotapes - 165 minutes.) (See Part 1 Tape F2035 and Part 3 Tape F2037.) This is session 2 of a 3-part Meat and Poultry Teleconference co-sponsored by AFDO and the USDA Food Safety Inspection Service. These videotapes present an action plan for federal, state, local authorities, industry, and trade associations in a foodborne outbreak. (AFDO/USDA-1998)
- F2035 Fabrication and Curing of Meat and Poultry Products**—(2 videotapes - 145 minutes). (See Part 2 Tape F2036 and Part 3 Tape F2037). This is session 1 of a 3-part Meat and Poultry Teleconference cosponsored by AFDO and the USDA Food Safety Inspection Service. Upon viewing, the sanitarian will be able to (1) Identify typical equipment used for meat and poultry fabrication at retail and understand their uses; (2) Define specific terms used in fabrication of meat and poultry products in retail establishments, and (3) Identify specific food safety hazards associated with fabrication and their controls. (AFDO/USDA-1997)
- F2040 Food Irradiation**—(30 minute videotape). Introduces viewers to food irradiation as a new preservation technique. Illustrates how food irradiation can be used to prevent spoilage by microorganisms, destruction by insects, overripening, and to reduce the need for chemical food additives. The food irradiation process is explained and benefits of the process are highlighted. (Turnelle Productions, Inc.) (Rev. 1998)
- F2045 Food Microbiological Control**—(6-videotapes - approximate time 12 hours). Designed to provide information and demonstrate the application of basic microbiology, the Good Manufacturing Practices (GMPs), retail Food Code, and sanitation practices when conducting food inspections at the processing and retail levels. Viewers will enhance their ability to identify potential food hazards and evaluate the adequacy of proper control methods for these hazards. (FDA-1998)
- F2050 Food Safe—Food Smart—HACCP & Its Application to the Food Industry**—(2-16 minute videotapes). (1)—Introduces the seven principles of HACCP and their application to the food industry. Viewers will learn about the HACCP system and how it is used in the food industry to provide a safe food supply. (2)—Provides guidance on how to design and implement a HACCP system. It is intended for individuals with the responsibility of setting up a HACCP system. (Alberta Agriculture, Food and Rural Development) (Rev. 1998)
- F2060 Food Safe—Series I**—(4-10 minute videotapes). (1) "Receiving & Storing Food Safely," details for food-service workers the procedures for performing sight inspections for the general conditions of food, including a discussion of food labeling and government approval stamps. (2) "Food-service Facilities and Equipment," outlines the requirements for the proper cleaning and sanitizing of equipment used in food preparation areas. Describes the type of materials, design, and proper maintenance of this equipment. (3) "Microbiology for Food-service Workers," provides a basic understanding of the microorganisms which cause food spoilage and foodborne illness. This program describes bacteria, viruses, protozoa, and parasites and the conditions which support their growth. (4) "Food-service Housekeeping and Pest Control," emphasizes cleanliness as the basis for all pest control. Viewers learn the habits and life cycles of flies, cockroaches, rats, and mice. (Perennial Education-1991) (Rev. 1998)
- F2070 Food Safe—Series II**—(4-10 minute videotapes). Presents case histories of foodborne disease involving (1) *Staphylococcus aureus*, (sauces) (2) *Salmonella*, (eggs) (3) *Campylobacter*, and (4) *Clostridium botulinum*. Each tape demonstrates errors in preparation, holding or serving food; describes the consequences of those actions; reviews the procedures to reveal the cause of the illness; and illustrates the correct practices in a step-by-step demonstration. These are excellent tapes to use in conjunction with hazard analysis critical control point training programs. (Perennial Education-1991) (Rev. 1998)
- F2080 Food Safe—Series III**—(4-10 minute videotapes). More case histories of foodborne disease. This set includes (1) Hepatitis "A", (2) *Staphylococcus aureus* (meats), (3) *Bacillus cereus*, and (4) *Salmonella* (meat). Viewers will learn typical errors in the preparation, holding and serving of food. Also included are examples of correct procedures which will reduce the risk of food contamination. (Perennial Education-1991) (Rev. 1998)
- F2133 Food Safety First**—(50 minute videotape). This food safety training video presents causes of foodborne illness in foodservice and ways to prevent foodborne illness. Individual segments include personal hygiene and handwashing, cleaning and sanitizing, preventing cross contamination and avoiding time and temperature abuse. Foodhandling principles are presented through scenarios in a restaurant kitchen. (Glo-Germ 1998)

- F2090 Food Safety: An Educational Video for Institutional Food-Service Workers**—(10 minute videotape). Provides a general discussion on food safety principles with special emphasis on pathogen reductions in an institutional setting from child care centers to nursing homes. (U.S. Department of Health & Human Services-1997)
- F2120 Food Safety: For Goodness Sake, Keep Food Safe**—(15 minute videotape). Teaches foodhandlers the fundamentals of safe food handling. The tape features the key elements of cleanliness and sanitation, including: good personal hygiene, maintaining proper food product temperature, preventing time abuse, and potential sources of food contamination. (Iowa State University Extension-1990) (Rev. 1998)
- F2110 Food Safety is No Mystery**—(34 minute videotape). This is an excellent training visual for food-service workers. It shows the proper ways to prepare, handle, serve and store food in actual restaurant, school and hospital situations. A policeman sick from food poisoning, a health department sanitarian, and a food-service worker with all the bad habits are featured. The latest recommendations on personal hygiene, temperatures, cross-contamination, and storage of foods are included. (USDA-1987). Also available in Spanish. — (Rev. 1998)
- F2130 Food Safety: You Make the Difference**—(28 minute videotape). Through five food workers from differing backgrounds, this engaging and inspirational documentary style video illustrates the four basic food safety concepts: handwashing, preventing cross-contamination, moving foods quickly through the danger zone, and hot/cold holding (Seattle-King County Health Department-1995)
- F2140 GMP Basics — Employee Hygiene Practices**—(20 minute videotape). Through real-life examples and dramatization, this video demonstrates good manufacturing practices that relate to employee hygiene, particularly hand washing. This video includes a unique test section to help assess participants' understanding of common GMP violations. (Silliker Laboratories-1997)
- F2143 GMP Basics: Guidelines for Maintenance Personnel**—(21 minute videotape). Developed specifically for maintenance personnel working in a food processing environment, this video depicts a plant-wide training initiative following a product recall announcement. Maintenance personnel will learn how GMPs relate to their daily activities and how important their roles are in the production of safe food products. (Silliker Laboratories-1999)
- F2148 GMP-GSP Employee**—(38 minute videotape). This video was developed to teach food plant employees the importance of "Good Manufacturing Practices" and "Good Sanitation Practices." Law dictates that food must be clean and safe to eat. This video emphasizes the significance of each employee's role in protecting food against contamination. Tips on personal cleanliness and hygiene are also presented. (L.J. Bianco & Associates)
- F2150 GMP: Personal Hygiene & Practices in Food Manufacturing**—(14 minute videotape). This video focuses on the personal hygiene of food-manufacturing workers, and explores how poor hygiene habits can be responsible for the contamination of food in the manufacturing process. This is an instructional tool for new food-manufacturing line employees and supervisors. It was produced with "real" people in actual plant situations, with only one line of text included in the videotape. (Penn State-1993)—(Available in Spanish and Vietnamese)
- F2147 GMP Basics: Process Control Practices**—(16 minute videotape). In actual food processing environments, an on-camera host takes employees through a typical food plant as they learn the importance of monitoring and controlling key points in the manufacturing process. Beginning with receiving and storing, through production, and ending with packaging and distribution, control measures are introduced, demonstrated, and reviewed. Employees will see how their everyday activities in the plant have an impact on product safety. (Silliker Laboratories-1999)
- F2160 GMP: Sources & Control of Contamination during Processing**—(20 minute videotape). This program, designed as an instructional tool for new employees and for refresher training for current or reassigned workers, focuses on the sources and control of contamination in the food-manufacturing process. It was produced in actual food plant situations. A concise description of microbial contamination and growth and cross-contamination, a demonstration of food storage, and a review of aerosol contaminants are also included. (Penn State-1995)
- F2135 Get with a Safe Food Attitude**—(40 minute videotape). Consisting of nine short segments which can be viewed individually or as a group, this video presents safe food handling for moms-to-be. Any illness a pregnant woman contracts can affect her unborn child whose immune system is too immature to fight back. The video follows four pregnant women as they learn about food safety and preventing foodborne illness. (US Department of Agriculture-1999)

- F2165 HACCP and Its Application to the Food Industry**—(2-17 minute videotapes). Looking to develop a comprehensive food safety and quality control program for your organization? Part one introduces the concept of the HACCP system and the seven principles behind it. Part two takes the viewer through each of the 12 stages in setting up such a system. (Alberta Agriculture-1993) (Rev. 1999)
- F2180 HACCP: Safe Food Handling Techniques**—(22 minute videotape). The video highlights the primary causes of food poisoning and emphasizes the importance of self-inspection. An explanation of potentially hazardous foods, cross-contamination, and temperature control is provided. The main focus is a detailed description of how to implement a Hazard Analysis Critical Control Point (HACCP) program in a foodservice operation. A leader's guide is provided as an adjunct to the tape. (The Canadian Restaurant & Food-services Association-1990) (Rev. 1998)
- F2170 The Heart of HACCP**—(22 minute videotape). A training video designed to give plant personnel a clear understanding of the seven HACCP principles and practical guidance on how to apply these principles to their own work environment. This video emphasizes the principles of primary concern to plant personnel such as critical limits, monitoring systems, and corrective actions that are vital to the success of a HACCP plan. (Silliker Laboratories Group-1994)
- F2175 Inspecting For Food Safety—Kentucky's Food Code**—(100 minute videotape). Kentucky's Food Code is patterned after the Federal Food Code. The concepts, definitions, procedures, and regulatory standards included in the code are based on the most current information about how to prevent foodborne diseases. This video is designed to prepare food safety inspectors to effectively use the new food code in the performance of their duties. (Department of Public Health Commonwealth of Kentucky-1997) (Rev. 1999)
- F2190 Is What You Order What You Get? Seafood Integrity**—(18 minute videotape). Teaches seafood department employees about seafood safety and how they can help insure the integrity of seafood sold by retail food markets. Key points of interest are cross-contamination control, methods and criteria for receiving seafood and determining product quality, and knowing how to identify fish and seafood when unapproved substitutions have been made. (The Food Marketing Institute) (Rev. 1998)
- F2210 Northern Delight—From Canada to the World**—(15 minute videotape). A promotional video that explores the wide variety of foods and beverages produced by the Canadian food industry. General in nature, this tape presents an overview of Canada's food industry and its contribution to the world's food supply. (Temelle Production, Ltd.) (Rev. 1998)
- F2240 On the Front Line**—(18 minute videotape). A training video pertaining to sanitation fundamentals for vending service personnel. Standard cleaning and serving procedures for cold food, hot beverage and cup drink vending machines are presented. The video emphasizes specific cleaning and serving practices which are important to food and beverage vending operations. (National Automatic Merchandising Association-1993) (Rev. 1998)
- F2250 On the Line**—(30 minute videotape). This was developed by the Food Processors Institute for training food processing plant employees. It creates an awareness of quality control and regulations. Emphasis is on personal hygiene, equipment cleanliness and good housekeeping in a food plant. It is recommended for showing to both new and experienced workers. (Available in Spanish) The Food Processors Institute. 1993. (Rev. 1998)
- F2270 Pest Control in Seafood Processing Plants**—(26 minute videotape). Videotape which covers procedures to control flies, roaches, mice, rats and other common pests associated with food processing operations. The tape will familiarize plant personnel with the basic characteristics of these pests and the potential hazards associated with their presence in food operations. (Rev. 1998)
- F2280 Principles of Warehouse Sanitation**—(33 minute videotape). This videotape gives a clear, concise and complete illustration of the principles set down in the Food, Drug and Cosmetic Act and in the Good Manufacturing Practices, as well as supporting legislation by individual states. (American Institute of Baking-1993)
- F2290 Product Safety & Shelf Life**—(40 minute videotape). Developed by Borden Inc., this videotape was done in three sections with opportunity for review. Emphasis is on providing consumers with good products. One section covers off-flavors, another product problems caused by plant conditions, and a third the need to keep products cold and fresh. Procedures to assure this are outlined, as shown in a plant. Well done and directed to plant workers and supervisors. (Borden-1987) — (Rev. 1997)
- F2220 Proper Handling of Peracetic Acid**—(15 minute videotape). Introduces peracetic acid as a chemical sanitizer and features the various precautions needed to use the product safely in the food industry.

- F2230 Purely Coincidental**—(20 minute videotape). A parody that shows how foodborne illness can adversely affect the lives of families that are involved. The movie compares improper handling of dog food in a manufacturing plant that causes the death of a family pet with improper handling of human food in a manufacturing plant that causes a child to become ill. Both cases illustrate how handling errors in food production can produce devastating outcomes. (The Quaker Oats Company-1993.) (Rev. 1998)
- F2310 Safe Food: You Can Make a Difference**—(25 minute videotape). A training video for food-service workers which covers the fundamentals of food safety. An explanation of proper food temperature, food storage, cross-contamination control, cleaning and sanitizing, and handwashing as methods of foodborne illness control is provided. The video provides an orientation to food safety for professional foodhandlers. (Tacoma-Pierce County Health Department-1990). (Rev. 1998)
- F2320 Safe Handwashing**—(15 minute videotape). Twenty-five percent of all foodborne illnesses are traced to improper handwashing. The problem is not just that handwashing is not done, the problem is that it's not done properly. This training video demonstrates the "double wash" technique developed by Dr. O. Peter Snyder of the Hospitality Institute for Technology and Management. Dr. Snyder demonstrates the procedure while reinforcing the microbiological reasons for keeping hands clean. (Hospitality Institute for Technology and Management-1991) (Rev. 1998)
- F2325 Safe Practices for Sausage Production**—(3 hour videotape). This videotape is based on a series of educational broadcasts on meat and poultry inspections at retail food establishments produced by the Association of Food and Drug Officials (AFDO) and USDA's Food Safety and Inspection Service (FSIS), along with FDA's Center for Food Safety and Applied Nutrition. The purpose of the broadcast was to provide training to state, local, and tribal sanitarians on processes and procedures that are being utilized by retail stores and restaurants, especially those that were usually seen in USDA-inspected facilities. The program will cover the main production steps of sausage products, such as the processes of grinding, stuffing, and smoking, and typical equipment used will be depicted. Characteristics of different types of sausage (fresh, cooked and smoked, and dry/semi-dry) will be explained. Pathogens of concern and outbreaks associated with sausage will be discussed. The written manual for the program is available at www.fsis.usda.gov/fofo/hrds/STATE/RETAIL/manual.htm. (1999)
- F2330 Sanitation for Seafood Processing Personnel**—(20 minute videotape). A training video suited for professional foodhandlers working in any type of food manufacturing plant. The film highlights Good Manufacturing Practices and their role in assuring food safety. The professional foodhandler is introduced to a variety of sanitation topics including: (1) foodhandlers as a source of food contamination, (2) personal hygiene as a means of preventing food contamination, (3) approved food storage techniques including safe storage temperatures, (4) sources of cross-contamination, (5) contamination of food by insects and rodents, (6) garbage handling and pest control, and (7) design and location of equipment and physical facilities to facilitate cleaning. (Rev. 1998)
- F2340 Sanitizing for Safety**—(17 minute videotape). Provides an introduction to basic food safety for professional foodhandlers. A training pamphlet and quiz accompany the tape. Although produced by a chemical supplier, the tape contains minimal commercialism and may be a valuable tool for training new employees in the food industry. (Clorox-1990) (Rev. 1998)
- F2350 SERVSAFE® Serving Safe Food**—(4-20 minute videotapes). This video series illustrates and reinforces important food safety practices in an informative and entertaining manner. The material is presented in an easy to understand format, making it simpler for employees to learn and remember this essential information. Each video includes a leader's guide that provides all the information managers need to direct a productive training session. (Educational Foundation of the National Restaurant Association-1993) (Rev. 1998)
- F2360 SERVSAFE® Serving Safe Food Second Edition**—(6-10 minute videotapes). The program still covers all the major areas of food safety training, but there is an added emphasis on training employees to follow HACCP procedures. The second edition program includes an Employee Guide, Leader's Guide and six instructional videos. (Educational Foundation of the National Restaurant Association-1993)
- F2430 Smart Sanitation: Principles & Practices for Effectively Cleaning Your Food Plant**—(20 minute videotape) A practical training tool for new sanitation employees or as a refresher for veterans. Employees will understand the food safety impact of their day-to-day cleaning and sanitation activities and recognize the importance of their role in your company's food safety program. (Silliker Laboratories Group-1996)
- F2370 Supermarket Sanitation Program—"Cleaning & Sanitizing"**—(13 minute videotape). Contains a full range of cleaning and sanitizing information with minimal emphasis on product. Designed as a basic training program for supermarket managers and employees. (1989) (Rev. 1998)

- F2380 Supermarket Sanitation Program—"Food Safety"**—(11 minute videotape). Contains a full range of basic sanitation information with minimal emphasis on product. Filmed in a supermarket, the video is designed as a basic program for manager training and a program to be used by managers to train employees. (1989) (Rev. 1998)
- F2390 Take Aim at Sanitation**—(8 minute videotape). This video features tips on food safety and proper disposal of single service items. Also presented is an emphasis on food contact surfaces as well as the manufacture, storage and proper handling of these items. (Foodservice and Packaging Institute, Inc.-1995). (Available in Spanish)
- F2410 Wide World of Food-Service Brushes**—(18 minute videotape). Discusses the importance of cleaning and sanitizing as a means to prevent and control foodborne illness. Special emphasis is given to proper cleaning and sanitizing procedures and the importance of having properly designed and constructed equipment (brushes) for food preparation and equipment cleaning operations. (1989) (Rev. 1998)
- F2420 Your Health in Our Hands—Our Health in Yours**—(8 minute videotape). For professional foodhandlers, the tape covers the do's and don'ts of foodhandling as they relate to personal hygiene, temperature control, safe storage and proper sanitation. (Jupiter Video Production-1993). (Rev. 1998)

OTHER

- M4010 Diet, Nutrition & Cancer**—(20 minute videotape). Investigates the relationship between a person's diet and the risk of developing cancer. The film describes the cancer development process and identifies various types of food believed to promote and/or inhibit cancer. The film also provides recommended dietary guidelines to prevent or greatly reduce the risk of certain types of cancer.
- M4020 Eating Defensively: Food Safety Advice for Persons with Aids**—(15 minute videotape). While HIV infection and AIDS are not acquired by eating foods or drinking liquids, persons infected with the AIDS virus need to be concerned about what they eat. Foods can transmit bacteria and viruses capable of causing life-threatening illness to persons infected with AIDS. This video provides information for persons with AIDS on what foods to avoid and how to better handle and prepare foods. (FDA/CDC-1989)
- M4030 Ice: The Forgotten Food**—(14 minute videotape). This training video describes how ice is made and where the critical control points are in its manufacture, both in ice plants and in on-premises locations (convenience stores, etc.); it documents the potential for illness from contaminated ice and calls on government to enforce good manufacturing practices, especially in on-premises operations where sanitation deficiencies are common. (Packaged Ice Association-1993)
- M4040 Legal Aspects of the Tampering Case**—(25 minute videotape). This was presented by Mr. James T. O'Reilly, University of Cincinnati School of Law at the fall 1986 Central States Association of Food and Drug Officials Conference. He emphasizes three factors from his police and legal experience—know your case, nail your case on the perpetrator, and spread the word. He outlines specifics under each factor. This should be of the greatest interest to regulatory sanitarians, in federal, state and local agencies. (1987)
- M4050 Personal Hygiene & Sanitation for Food Processing Employees**—(15 minute videotape). Illustrates and describes the importance of good personal hygiene and sanitary practices for people working in a food processing plant. (Iowa State-1993)
- M4060 Psychiatric Aspects of Product Tampering**—(25 minute videotape). This was presented by Emanuel Tanay, M.D. from Detroit, at the fall 1986 conference of CSAFDA. He reviewed a few cases and then indicated that abnormal behavior is like a contagious disease. Media stories lead to up to 1,000 similar alleged cases, nearly all of which are false. Tamper-proof packaging and recalls are essential. Tampering and poisoning are characterized by variable motivation, fraud and greed. Law enforcement agencies have the final responsibilities. Tamper proof containers are not the ultimate answer. (1987)
- M4070 Tampering: The Issue Examined**—(37 minute videotape). Developed by Culbro Machine Systems, this videotape is well done. It is directed to food processors and not regulatory sanitarians or consumers. A number of industry and regulatory agency management explain why food and drug containers should be made tamper evident. (Culbro-1987)



International Association for Food Protection

Formerly IAMFES

6200 Aurora Avenue, Suite 200W
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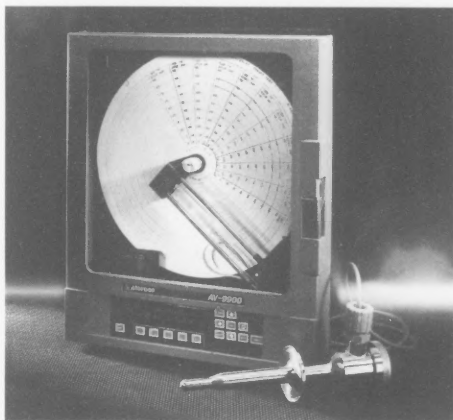
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CALL FOR SYMPOSIA

2001 Annual Meeting

August 5-8, 2001

Minneapolis, Minnesota

The Program Committee invites International Association for Food Protection Members and other interested individuals to submit a symposium proposal for presentation during the 2001 Annual Meeting, August 5-8, 2001 in Minneapolis, Minnesota.

WHAT IS A SYMPOSIUM?

A symposium is an organized, half-day session emphasizing a central theme relating to food safety and usually consists of six 30-minute presentations by each presenter. It may be a discussion emphasizing a scientific aspect of a common food safety and quality topic, issues of general interest relating to food safety and quality, a report of recent developments, an update of state-of-the-art materials, or a discussion of results of basic research in a given area. The material covered should include current work and the newest findings. Symposia will be evaluated by the Program Committee for relevance to current science and to Association Members.

SUBMISSION GUIDELINES

To submit a symposium, complete the Symposium Proposal form. The title of symposium; names, telephone numbers, fax numbers, and complete mailing addresses of the person(s) organizing the symposium and convenors of the session; topics for presentation, suggested presenters, affiliations; description of audience to which this topic would be of greatest interest; and signature of organizer. When submitting a proposal, the presenters do not need to be confirmed, only identified. Confirmation of presenters takes place after acceptance of your symposium.

SYMPOSIUM FORMAT

Symposium sessions are 3 and 1/2 hours in length including a 30-minute break. A typical format is six 30-minute presentations. However, variations are permitted as long as the changes fit within the allotted time frame. If varying from the standard format, be sure to indicate this on the Symposium Proposal form.

SYMPOSIUM PROPOSAL DEADLINE

Proposals may be submitted by mail to International Association for Food Protection office for receipt no later than July 17, 2000 or by presenting the proposal to the Program Committee at its meeting on Sunday, August 6, 2000 in Atlanta, Georgia. Proposals may be prepared by individuals, committees, or professional development groups.

The Program Committee will review submitted symposia and organizers will be notified in October 2000 as to the disposition of their proposal.

PRESENTERS WHO ARE NOT MEMBERS

International Association for Food Protection does not reimburse invited presenters for travel, hotel, or other expenses incurred during the Annual Meeting. However, invited presenters who are not Association members will receive a complimentary registration. Presenters who are Association Members are expected to pay normal registration fees.

ASSOCIATION FOUNDATION SPONSORSHIP

The International Association for Food Protection Foundation has limited funds for travel sponsorship of presenters. Symposia organizers may make requests in writing to the Program Committee Chairperson. Requests are reviewed on an individual and first-come-first-served basis. The maximum funding grant will be \$500. Organizers are welcome to seek funding from other sources and the Association will provide recognition for these groups in our program materials. Organizers are asked to inform the Association if they obtain outside funding.

HAVE AN IDEA BUT YOU ARE UNABLE TO ORGANIZE IT?

Many Association Members have excellent suggestions for symposia topics, but are unable to organize the session. Such ideas are extremely valuable and are welcome. If you have an idea for a symposium topic, please inform the Program Committee Chairperson as soon as possible. Symposia topics are among the most valuable contribution an Association Member can make to assure the quality of our Annual Meeting.

WHO TO CONTACT:

Bev Corron
International Association for Food Protection
6200 Aurora Ave., Suite 200W
Des Moines, IA 50322-2863, USA
Phone: 800.369.6337; 515.276.3344
Fax: 515.276.8655
E-mail: bcorron@foodprotection.org

SYMPOSIUM PROPOSAL

**2001 Annual Meeting
August 5–8, 2001
Minneapolis, Minnesota**

Title: _____

Organizer's Name: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Topic – Suggested Presenter, Affiliation

(Example: 1. HACCP Implementation – John Smith, University of Georgia)

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

Suggested Convenors:

Description of Audience: _____

Signature of Organizer: _____

Receipt by mail
by July 17, 2000 to:

International Association for Food Protection
Symposium Proposal
6200 Aurora Ave., Suite 200W
Des Moines, IA 50322-2863, USA

Submit in person
on August 6, 2000 to:

Program Committee
International Association for Food Protection 87th Annual Meeting
Atlanta, GA

or Contact:

Bev Corron
International Association for Food Protection
6200 Aurora Ave., Suite 200W
Des Moines, IA 50322-2863, USA
Phone: 800.369.6337; 515.276.3344
Fax: 515.276.8655
E-mail: bcorron@foodprotection.org

2000 IAFP Awards



To be Presented at the
International Association
for Food Protection
87th Annual Meeting

Black Pearl

Zep Manufacturing Company

Honorary Life Membership

William Arledge
Robert L. Sanders

Fellows

John C. Bruhn, Cameron R. Hackney,
Bruce E. Langlois, and Lloyd O. Luedeeke

Harry Haverland Citation

F. Ann Draughon

Educator

Susan S. Sumner

Sanitarian

Norris A. Robertson, Jr.

Harold Barnum Industry

Kenneth Anderson

NFPA Food Safety

Elmer H. Marth

Samuel J. Crumbine

Olmsted County Public Health Services
Rochester, Minnesota

2000 Affiliate Awards

C.B. Shogren Memorial

Michigan Environmental Health Association

Best Affiliate Communication Materials

New York State Association
of Milk and Food Sanitarians

Best Affiliate Annual Meeting

Florida Association of Milk, Food
and Environmental Sanitarians, Inc.

Best Affiliate Educational Conference

Associated Illinois Milk, Food
and Environmental Sanitarians

Ivan Parkin Lecture

Presented by: Douglas Powell, Ph.D.

Reclaiming Dinner: Enhancing Food Safety and Consumer Confidence

Sunday, August 6, 2000

Opening Session – 7:00 p.m.



Lecturer:

Douglas Powell, Ph.D.
University of Guelph
Guelph, Ontario, Canada

In 1986, the International Association for Food Protection (IAFP) established the Ivan Parkin Lecture to honor Ivan Parkin, a Dairy Extension Specialist at Pennsylvania State University. Dr. Parkin was IAFP President from 1954 to 1955 and remained active in the Association for many years following. He served as an example to others as a loyal Member, a professional, and an educator dedicated to protecting the food supply. Dr. Parkin is remembered by those who knew him as a kind and warm person.

This year, Dr. Douglas Powell, Assistant Professor in the department of plant agriculture at the University of Guelph, will deliver the lecture. As Director of the five-year Agri-Food Risk Management and Communication project at Guelph, he leads a diverse research team that integrates scientific knowledge with public perceptions to garner the benefits of a particular agricultural technology or product while managing and mitigating identified risks.

Dr. Powell led the development and implementation of an on-farm food safety program for the Ontario Greenhouse Vegetables Growers Association, a producer-led program to minimize microbial risks in fresh produce. He also led research to better understand producer perceptions that could impede adoption of refugia guidelines to mitigate the development of resistance when growing genetically engineered Bt-corn. Dr. Powell is now helping the Ontario Cattlemen's Association implement good production practices for the use of antimicrobials in cattle. He also teaches and conducts research into the broader public discussions involving technology and society, which shape public attitudes and policy decisions. Such work included the creation and daily editing of the listserve, the Food Safety Network (FSnet).

Dr. Powell completed a BSc (honors) in molecular biology and genetics at the University of Guelph in 1985. After two years of graduate work he entered journalism through the student press. He has served as editor of several community newspapers, has written for a diverse range of magazines, and continues as a freelance journalist. His book, *Mad Cows and Mother's Milk*, co-authored with Bill Leiss of Queen's University, was published by McGill-Queen's University Press in 1997.

Dr. Powell completed a doctoral degree in the department of food science at the University of Guelph in 1996. His thesis concerned applying risk communication theory to issues of food safety and agricultural biotechnology.



International Association for Food Protection

87th Annual Meeting

Preliminary Program



SUNDAY EVENING – AUGUST 6, 2000

7:00 p.m. – 8:00 p.m.

Opening Session

- Presentation of the International Association for Food Protection Fellows Awards
- Ivan Parkin Lecture – **Reclaiming Dinner: Enhancing Food Safety and Consumer Confidence**, Douglas Powell, Ph.D., University of Guelph, Guelph, Ontario, Canada
Cheese and Wine Reception will follow in the Exhibit Hall

MONDAY MORNING – AUGUST 7, 2000

S1 *Listeria monocytogenes*: Current Issues and Concerns – Session I: Pathology, Virulence, and Risk Assessment of *L. monocytogenes*

(Sponsored by ILSI-NA)

Co-Convenors: Jean E. Anderson and Don L. Zink

- 8:30 • Relevance of Animal Models to Study Virulence of *L. monocytogenes* – JEFFREY M. FARBER, Health Canada, Microbiology Research Division, Ottawa, Ontario, Canada
- 9:00 • Primates as a Model for *L. monocytogenes* Infective Dose: A Progress Report – MARY ALICE SMITH, University of Georgia, Athens, GA, USA
- 9:30 • Relationship between Virulence in *L. monocytogenes* Genotypes – MARTIN WIEDMANN, Cornell University, Ithaca, NY, USA
- 10:00 • Break
- 10:30 • Risk Assessment of *L. monocytogenes*: Prevalence in the Food Supply – BENTE OJENIYI, The Royal Veterinary and Agricultural University, Stigbojlen, Frederiksberg C, Denmark
- 11:00 • Risk Assessment of *L. monocytogenes*: Impact of Cooking and Food Handling Procedures in the Home – CHRISTINE M. BRUHN, University of California-Davis, Davis, CA, USA

- 11:30 • Update on FDA's Risk Assessment of *L. monocytogenes* – RICHARD C. WHITING, FDA, Washington, D.C., USA

S2 Safer Production of Sprouts from Seeds

Co-Convenors: Peter J. Slade and Larry Beuchat

- 8:30 • Overview: Outbreaks Associated with Consumption of Sprouts and the Response from Government, Industry and Academia – MICHELLE SMITH, FDA-CFSAN, Washington, D.C., USA
- 9:00 • Pathogen Monitoring during Sprouting of Alfalfa Seeds – T. J. FU, NCFST/FDA, Summit-Argo, IL, USA
- 9:30 • Effectiveness of Chemical Sanitizers Applied to Seeds and Sprouts – LARRY BEUCHAT, University of Georgia, Griffin, GA, USA
- 10:00 • Break
- 10:30 • Sanitizing Laboratory Inoculated and Naturally Contaminated Alfalfa Seed with Chemicals – BILL FETT, USDA-ARS, Wyndmoor, PA, USA
- 11:00 • Elimination of *E. coli* O157:H7 and Control of *Salmonella* on Alfalfa Seed by Gamma Irradiation – DON THAYER, USDA-ARS, Wyndmoor, PA, USA
- 11:30 • What Have We Learned, and Where Do We Go from Here? Implications for the Sprout Industry and Others – PETER J. SLADE, NCFST/IIT, Summit-Argo, IL, USA

S3 Cook-chill/Sous Vide Technology

Co-Convenors: O. Peter Snyder, Jr. and Kristel Hauben

- 8:30 • European Cook-chill Technology – KRISTEL HAUBEN, Alma University Restaurants, Leuven, Belgium
- 9:00 • US Processor Cook-chill Technology – ERIC CARRE, Erdatek, Inc., Chicago, IL, USA

- 9:30 • Commercial Cook-chill in Europe – O. PETER SNYDER, JR., Hospitality Institute of Technology and Management, St. Paul, MN
- 10:00 • Break
- 10:30 • US Institutional Cook-chill – MARY COTTER, OHM, Cook Chill Production Center, Orangeburg, NY, USA
- 11:00 • Cook-chill Equipment Technology – LEN BUNDY, George E. Bundy and Associates, Seattle, WA, USA
- 11:30 • The Microbiological Safety of Cook-chill Foods – JOHN AUSTIN, Banting Research Center, Microbiology Research Division, Ottawa, Ontario, Canada

S4 The Role of Molecular Techniques for Vibrios and Viruses in Making Risk Management Decisions

Co-Convenors: Carlos Abeyta, Jr. and Custy F. Fernandes

- 8:30 • Infective Dose for *Vibrio parahaemolyticus*, *V. vulnificus* and Viruses, in Raw Oysters and Its Correlation to counts with Oysters during Harvesting – KEN MOORE, Interstate Shellfish Sanitation Conference, Columbia, SC, USA
- 9:00 • Molecular Approaches for the Detection of Bacteria with Special Reference to *Vibrios* in Seafood – ASIM K. BEJ, University of Alabama-Birmingham, Birmingham, AL, USA
- 9:30 • Molecular Techniques for Viruses and Their Limitations: New Frontiers in Non-molecular Methods – GARY P. RICHARDS, USDA, Dover, DE, USA
- 10:00 • Break
- 10:30 • Risk Assessment on the Public Health Impact of *Vibrio parahaemolyticus* in Oysters – MARIANNE MILIOTIS, FDA, Office of Seafood, Washington, D.C., USA
- 11:00 • Industries Perspective on Use of Molecular Biological Techniques as a Preventive Tool – CHRIS NELSON, Bon Secour Fisheries Inc., Bon Secour, AL, USA
- 11:30 • Panel Discussion

T1 Foodborne Pathogens

- 8:30 • Survival and Heat Resistance of Alkali-stressed T1 *Listeria monocytogenes* – PETER J. TAORMINA, and Larry R. Beuchat, University of Georgia, Griffin, GA, USA
- 8:45 • *Listeria monocytogenes* in UHT Milk: A Case Study – CHARLES N. CARVER, Karen Kinnberg, and Ronald Johnson, Land O'Lakes/R-Tech Laboratories, Arden Hills, MN, USA
- 9:00 • The Ability of Sublethally Heat-injured *Listeria monocytogenes* Cells to Compete with a Commercial Mesophilic Lactic Acid Starter Culture during Milk Fermentation – FINNY P. MATHEW, and Elliot T. Ryser, Michigan State University, East Lansing, MI, USA

- 9:15 • Growth of *Listeria monocytogenes* and T4 *Escherichia coli* O157:H7 is Enhanced in Ready-to-eat Lettuce Washed in Warm Water – PASCAL J. DELAQUIS, P. M. Toivonen, and S. Stewart, Agriculture and Agri-Food Canada, Pacific Agri-Food Research Centre, Summerland, British Columbia, Canada
- 9:30 • A Survey of US Orchards to Identify Potential T5 Sources of *Escherichia coli* O157:H7 – DENISE C. R. RIORDAN, G. M. Sapers, and B. A. Annous, USDA-ARS-ERRC, Wyndmoor, PA, USA
- 9:45 • Attachment of *Escherichia coli* O157:H7 T6 to the Epidermis and Internal Structures of Apples as Demonstrated by Confocal Scanning Laser Microscopy – SCOTT L. BURNETT, Jinru Chen, and Larry R. Beuchat, University of Georgia, Griffin, GA, USA
- 10:00 • Break
- 10:30 • Quinolone Resistance among Clinical and T7 Food Isolates of *Campylobacter* spp. – JEFFREY M. FARBER, Diane Medeiros, Greg Sanders, John Austin, Catherine Graham, Health Canada, Ottawa, Ontario, Canada
- 10:45 • The Survival and Culturability of *Campylobacter* T8 *jejuni* Micro-colonies under Modified Atmospheres at 4°C and 8°C Using a Model Food System – WENDY HARRISON, Adrian Peters, and Louise Fielding, University of Wales Institute, Cardiff, Wales, UK
- 11:00 • Survival of *Campylobacter jejuni* in Biofilms T9 Isolated from Chicken Houses – NATHANON TRACHOO, Joseph F. Frank, and Norman J. Stern, University of Georgia, Athens, GA, USA
- 11:15 • Comparative Tolerance of *Salmonella* Typhimurium DT104 to Heat and Desiccation – T10 ARTHUR J. MILLER, and Marsha H. Golden, Center for Food Safety and Applied Nutrition, FDA, Washington, D.C., USA
- 11:30 • Routes of Infiltration, Survival, and Growth T11 of *Salmonella enterica* Serovar Hartford and *Escherichia coli* O157:H7 in Oranges – MARK O. WALDERHAUG, Sharon G. Edelson-Mammel, Antonio J. DeJesus, B. Shawn Eblen, Arthur J. Miller, and Robert L. Buchanan, US FDA CFSAN, Washington, D.C., USA
- 11:45 • A Descriptive Analysis of *Giardiasis* Cases T12 Reported in Ontario, 1990-1997 – JUDY D. GREIG, Pascal Michel, Jeff B. Wilson, Scott A. McEwen, and Dean Middleton, Ontario Veterinary College, University of Guelph, Guelph, Ontario, Canada

P1 Inactivation and Control Methods I

10:00 a.m. – 1:00 p.m.
(Authors present 10:30 a.m. – 12:30 p.m.)

Co-Convenors: Scott Burnett and Peter Taormina

- P1 • Cleaning Practices and the Cleanliness of Food Surfaces – CARYS DAVIES, Chris Griffith, and Adrian Peters, University of Wales Institute, Cardiff, UK

- P2 • Evaluation of Household Cutting Board Clean-up Techniques – Vidhya Gangar, Eric Meyers, Heidi Johnson, Michael S. Curiale, and BARRY MICHAELS, Georgia Pacific Corp., Palatka, FL, USA
- P3 • Ozone: An Alternative Disinfectant for the Food Industry – GINNY MOORE, Chris Griffith, and Adrian Peters, Food Safety Research Group, University of Wales Institute, Cardiff, UK
- P4 • Removal of Microorganisms from Industrial Surfaces Using Peracetic Acid – LEO KUNIGK, Maria O. Portella, Maria C. B. Almeida, and Bernadette D.G.M. Franco, Escola de Engenharia Maua, Sao Caetano do Sul, Sao Paulo, Brazil
- P5 • Efficacy of Two Sanitizers against Food Spoilage *Bacillus* Isolates – ESTER PETA, Denise Lindsay, and Alex von Holy, University of the Witwatersrand, Wits, South Africa
- P6 • Effects of Cleaners of Biofouled Stainless-steel Surfaces in Yogurt Manufacturing Equipment – GUN WIRTANEN, Sami Kontulainen, and Satu Salo, VTT BioTech., Espoo, Finland
- P7 • Influence of Processing Flow Velocity on Attachment Rates of *Pseudomonas fluorescens* Isolated from the Egg Industry – FABRICE BOURION, and T. Benezech, ASEPT, Laval, France
- P8 • Comparative Biocidal Capacities of Oxidative and Non-oxidative Sanitizers vs. *Listeria monocytogenes*, *Escherichia coli* O157:H7, and *Salmonella* Typhimurium Using a Modified Surface-dried Film Assay Method – CHARLES J. GIAMBRONE, George Diken, and Jonathan Lalli, FMC Corp., Princeton, NJ, USA
- P9 • Ultrasound Cleaning in Cheese Mold Hygiene – GUN WIRTANEN, Antti Heino, and Satu Salo, VTT BioTech., Espoo, Finland
- P10 • Evaluation of Cetylpyridinium Chloride Immersion as a Method to Reduce Pathogenic Bacteria in Fresh Vegetables – HONG WANG, Ming Ji, and Michael F. Slavik, University of Arkansas, Fayetteville, AR, USA
- P11 • Attachment and Survival of *Salmonella stanley* on Cantaloupe Surface: Efficacy of Washing Treatments and Possibility of Transfer to Fresh-cut Tissues – D. O. UKUKU, and G. M. Sapers, USDA-ARS-ERRC, Wyndmoor, PA, USA
- P12 • Combination of Chemical Treatments with Gamma Irradiation for Elimination of Foodborne Pathogens from Fresh Produce – DONALD E. CONNER, S. A. Berry, C. A. Sundermann, C. I. Wei, S. J. Weese, and F. M. Woods, Auburn University, Auburn, AL, USA
- P13 • Inactivation of Bacterial Foodborne Pathogens on Fresh Produce Using Water-based Chemical Treatments – DONALD E. CONNER, S. A. Berry, C. A. Sundermann, C. I. Wei, S. J. Weese, and F. M. Woods, Auburn University, Auburn, AL, USA
- P14 • Growth of *Escherichia coli* O157:H7 and Naturally Present Microorganisms in Heated Fresh-cut Lettuce – YUE LI, and Robert E. Brackett, University of Georgia, Griffin, GA, USA
- P15 • Bactericidal Effect of Chlorine Dioxide against *Salmonella* spp., *Escherichia coli* O157:H7, and *Listeria monocytogenes* Inoculated on Apples and Lettuce – CHEN I-HSUAN, J. Kim, T. S. Huang, D. E. Conner, S. J. Weese, F. M. Woods, and C. I. Wei, Auburn University, Auburn, AL, USA
- P16 • Modeling UV Inactivation of *Escherichia coli* in Apple Cider for Quantitative Risk Assessment – SIOBAIN MARIE DEIRDRE DUFFY, John Churey, Randy Worobo, and Donald Schaffner, Food Risk Analysis Initiative, Rutgers University, New Brunswick, NJ, USA
- P17 • Efficacy of Surface Heat Treatment on Apples in the Production of Apple Cider – SUSANNE E. KELLER, Robert Merker, Stuart Chirtel, Carla Bator, and Tan Hsu Ling, FDA-CFSAN-DFPP, Summit-Argo, IL, USA
- P18 • Survival and Spatial Location of *Salmonella stanley* in Alfalfa Seed and Sprouts – MEGHA GANDHI, Sima Yaron, Kinga Kiss, and Karl R. Matthews, Rutgers University, New Brunswick, NJ, USA
- P19 • Assessment of the Microbial Efficacy of a Prototype GRAS Produce Wash on Apples – LINDA J. HARRIS, Charles A. Pettigrew, and Charles H. Taylor, University of California-Davis, Davis, CA, USA
- P20 • Inactivation of *E. coli* O157:H7 and *Salmonella* in Apple Cider and Orange Juice by Ozone – ROBERT C. WILLIAMS, C. A. Lakins, D. A. Golden, and S. S. Sumner, University of Tennessee, Knoxville, TN, USA
- P21 • Efficacy of Allyl Isothiocyanate in Killing Enterohemorrhagic *Escherichia coli* O157:H7 on Alfalfa Seeds – Chung-Myeon Park, PETER J. TAORMINA, and Larry R. Beuchat, University of Georgia, Griffin, GA, USA
- P22 • Evaluation of Chemicals for Their Effectiveness in Killing *Salmonella* on Alfalfa Seeds – WILLIAM R. WEISSINGER, and Larry R. Beuchat, University of Georgia, Griffin, GA, USA
- P23 • Factors Affecting the Thermal Inactivation of Bacteria in Poultry Products during Air Convection Cooking – Rong Y. Murphy, BRADLEY P. MARKS, Ellen R. Johnson, and Michael G. Johnson, Michigan State University, East Lansing, MI, USA
- P24 • Fate of *Salmonella* spp. during Heating at Different Rates in Sous-vide Cooked Beef – VIJAY K. JUNEJA, and H. M. Marks, ERRC-USDA-ARS, Wyndmoor, PA, USA

- P25 • Survival of Inoculated *Escherichia coli* O157: H7 on Beef Jerky Dried at 62.5°C Following Four Preparation Treatments – S. N. Albright, JOHN N. SOFOS, and P. A. Kendall, Colorado State University, Fort Collins, CO, USA
- P26 • Physical Variables and Yeast Inactivation during Thermo-ultrasonication – AURELIO LOPEZ-MALO, Universidad de las Americas-Puebla, Puebla, Mexico
- P27 • Effects of Pulsed Electric Field Processing Using a Static Chamber on the Survival of *Listeria monocytogenes* – SADHANA RAVISHANKAR, Gregory J. Fleischman, Robert Tetzloff, Kenneth Ghiron, V. M. Balasubramaniam, and Rukma N. Reddy, The National Center for Food Safety and Tech., Illinois Institute of Tech., Summit-Argo, IL, USA
- P28 • Inactivation of *Listeria monocytogenes* in Brine Chiller Water for Thermally Processed Meat Products Using a Recirculating Electrochemical Treatment System – JIANMING YE, Hong Yang, Hoi-Kyung Kim, Carl Griffis, and Yanbin Li, University of Arkansas, Fayetteville, AR, USA
- P29 • Influence of Gamma Irradiation on *Salmonella* spp. Incorporated into Oysters – M. Jakabi, D. S. Gelli, M. T. Destro, and MARIZA LANDGRAF, Faculty of Pharmaceutical Sciences, University of Sao Paulo, Sao Paulo, Brazil
- P30 • Loss of Crystal Violet Binding Activity in *Yersinia enterocolitica* Following Gamma Irradiation – CHRISTOPHER H. SOMMERS, USDA-ARS-NAA-ERRC-FS, Wyndmoor, PA, USA
- P31 • Efficacy of Disinfectants in Killing Spores of *Alicyclobacillus acidoterrestris* and Performance of Media for Enumerating Survivors – Rachel V. Orr and LARRY R. BEUCHAT, University of Georgia, Griffin, GA, USA
- P32 • Efficiency of Sanitation Procedures against *Listeria monocytogenes*: Application to Cold-smoked Fish Industry in France – M. Gay, and FABRICE BOURION, ASEPT, Laval, France
- P33 • Influence of Sodium Pyrophosphate on Thermal Inactivation of *Listeria monocytogenes* in Pork Slurry and Ground Pork – MAKUBA AIME LIHONO, Aubrey F. Mendonca, and James S. Dickson, Iowa State University, Ames, IA, USA
- P34 • Withdrawn
- P35 • Evaluation of Spray Application of Acidified Sodium Chlorite on Frankfurters and Its Effect on Reduction of *Listeria monocytogenes* – MAHA N. HAJMEER, James L. Marsden, Harshavardhan Thippareddi, Randall K. Phebus, Nahed Kotrola, and Kere Kemp, Kansas State University, Manhattan, KS, USA
- P36 • Bactericidal and Bacteriostatic Effect of Bovine Lactoferrin and Its Pepsin Hydrolysate for Foodborne Pathogens – CHRISTOPHER ALLEN MURDOCK, and Karl R. Matthews, Rutgers University, New Brunswick, NJ, USA
- P37 • Limitations in the Use of Ozone to Disinfect Maple Sap – RONALD LABBE, M. Kinsley, and J. Wu, University of Massachusetts, Amherst, MA, USA

ALL DAY POSTER SYMPOSIUM – MONDAY, AUGUST 7, 2000

8:30 a.m. – 5:00 p.m.

(Authors present 9:30 a.m. – 10:30 a.m.
and 2:30 p.m. – 3:30 p.m.)

S5 Approaches to Control Pathogens in the Next Millennium

**Co-Convenors: Kathleen T. Rajkowski
and Jim Dickson**

- Consumer Expectations and Response to Food Safety Technology – CHRISTINE BRUHN, University of California-Davis, Davis, CA, USA
- Beam Irradiation – JIM DICKSON, Iowa State University, Ames, IA, USA
- Gamma Irradiation – KATHLEEN T. RAJKOWSKI, USDA-ARS-ERRC, Wyndmoor, PA, USA
- Pasteurization of Intact Shell Eggs – W. J. STADELMAN, Purdue University, W. Lafayette, IN, USA
- Competitive Exclusion – J. STAN BAILEY, USDA-ARS-RRR, Athens, GA, USA
- Decontamination of Beef Carcass Surface Tissue by Steam Vacuuming Alone and Combined with Hot Water and Lactic Acid Sprays – GARY ACUFF, Texas A & M University, College Station, TX, USA
- Inactivation of Microorganisms by Pulsed Electric Fields: A Critical Review – G. V. BARBOSA-CANOVAS, Washington State University, Pullman, WA, USA
- Factors Affecting Ability of Microorganisms to Survive Microwave Cooking – SUSAN S. SUMNER, Virginia Tech, Blacksburg, VA, USA
- Integration of Semi-continuous High Pressure Processing with Aseptic Packaging – CHUCK SIZER, National Center for Food Safety and Technology, Summit Argo, IL, USA
- Plasma Destruction of Foodborne Pathogens – DAVID GOLDEN, University of Tennessee, Knoxville, TN, USA

MONDAY AFTERNOON – AUGUST 7, 2000

S6 *Listeria monocytogenes*: Current Issues and Concerns – Session II: Detection, Enumeration, and Intervention Strategies for *L. monocytogenes* (Sponsored by ILSI-NA)

**Co-Convenors: Jean E. Anderson
and Don L. Zink**

- 1:30 • A Comparison of Rapid Genetic Methods for the Detection of *L. monocytogenes* – ROY BETTS, Campden & Chorleywood Food Research Association, Gloucestershire, UK

Monday p.m., *continued*

- 2:00 • Ecology of *L. monocytogenes*: Studies on Incidence, Growth and Microbial Competition in Primary Production – DAVID R. FENLON, Scottish Agricultural College, Bucksburn, Aberdeen, Scotland
- 2:30 • Production Intervention Strategies to Control *L. monocytogenes*: Prospects for the Use of Irradiation (or Pasteurization) for Packaged Ready-to-Eat Meats – JAMES S. DICKSON, Iowa State University, Ames, IA, USA
- 3:00 • Break
- 3:30 • Production Intervention Strategies to Control *L. monocytogenes*: Barrier Technology and High Risk Production Area Control – JOHN T. HOLAH, Campden & Chorleywood Food Research Association, Gloucestershire, UK
- 4:00 • Panel Discussion

S7 Current International Issues in Produce Safety

Co-Convenors: Randy Worobo and Donna Garren

- 1:30 • Current Issues in Produce Safety – LINDA J. HARRIS, University of California-Davis, Davis, CA, USA
- 2:00 • Domestic and International Traceback Farm-Level Investigations – ART MILLER, FDA-CFSAN, Washington, D.C., USA
- 2:30 • Produce Safety – A Canadian Perspective – MARIE-CLAUDE THIBAUT, Canadian Produce Marketing Association, Ottawa, Ontario, Canada
- 3:00 • Break
- 3:30 • Government and Private Sector Programs to Improve Produce Safety in Mexico – ALEJANDRO CASTILLO, University of Guadalajara, Guadalajara, Jal., Mexico
- 4:00 • Education of US Growers/Packers in Good Agricultural Practices – BOB GRAVANI, Cornell University, Ithaca, NY, USA
- 4:30 • Consumer Education/Perceptions of Produce Safety – CHRISTINE BRUHN, University of California-Davis, Davis, CA, USA

S8 Relevance of Testing to Reduce Risk

Co-Convenors: Donald Schaffner and Richard C. Whiting

- 1:30 • Legal and Regulatory Implications of Testing – A Company Perspective – To be announced
- 2:00 • Statistical Sampling – An Overview – RUSSELL FLOWERS, Silliker Labs, Inc., Homewood, IL, USA
- 2:30 • Scientific Advances to Improve Testing Strategies – LEE-ANN JAYKUS, North Carolina State University, Raleigh, NC, USA
- 3:00 • Break
- 3:30 • Statistical Sampling for Specific Foodborne Pathogens – TODD MCALOON, Cargill, Inc., Minneapolis, MN, USA

- 4:00 • The Impact of Sampling Strategies on Risk Analysis and Risk Mitigation – DONALD SCHAFFNER, Rutgers University, New Brunswick, NJ, USA
- 4:30 • Panel Discussion

S9 HACCP-based Strategies for Cooked Ready-to-eat Seafoods Based on Quantitative Risk Assessment

Co-Convenors: Bob Collette and Custy F. Fernandes

- 1:30 • Seafood-Associated Infection: A Review of the Public Health Data – ROBERT TAUXE, CDC, Atlanta, GA, USA
- 2:00 • FDA's Update on Compliance with Seafood HACCP Regulations and Their Policy for Handling and Storing Cooked and Ready-to-eat Seafoods – ROBERT BECK, FDA, Mobile, AL, USA
- 2:30 • HACCP-based Post-cook Handling and Storage Options for Cooked Ready-to-eat Seafood Products – MIKE MOODY, Louisiana State University, Baton Rouge, LA, USA
- 3:00 • Break
- 3:30 • Growth Patterns of Pathogenic Microbes in Cooked and Ready-to-eat Seafoods Using Optional Processing Strategies – GEORGE J. FLICK, Virginia Tech, Blacksburg, VA, USA
- 4:00 • Gulf Blue Crab HACCP Economics: Proposed and Actual Effects – BRIAN PERKINS, Auburn University, Mobile, AL, USA

T2 Microbiological Methods

- 1:30 • Development of a Standard Method to Detect Parasitic Protozoa on Fresh Vegetables – T13 Noreen Wilkinson, C. A. Paton, R. A. B. NICHOLS, N. COOK, and H. V. Smith, Central Science Laboratory, York, UK
- 1:45 • Development of Custom Identification T14 Patterns for *Salmonella* Based on the Use of the Restriction Enzyme PvuII with an Automated Ribotyping System – JAMES L. BRUCE, Elizabeth Mangiaterra, and Timothy R. Dambaugh, Qualicon, Inc, Wilmington, DE, USA
- 2:00 • The Development and Testing of an Instru- T15 timent for the Homogeneous Detection of PCR Products – George Tice, and W. MARK BARBOUR, Qualicon Inc., Wilmington, DE, USA
- 2:15 • Evaluation of Immuno-Concentration T16 Procedure to Detect Salmonellae in Poultry Samples – J. STAN BAILEY, and Doug E. Cosby, USDA-ARS-RRC, Athens, GA, USA
- 2:30 • Rapid Enumeration of *Lactobacillus* spp. in T17 Salad Dressings Using the BioSys – LORALYN H. LEDENBACH, and Paul A. Hall, Kraft Foods, Inc., Glenview, IL, USA

- 2:45 • Paper Kits for the Rapid Enumeration
T18 of Total and Coliforms/*E. coli* – Sujira Maneerat, Kooranee Tuitemwong, PRAVATE TUTIEMWONG, and Warapa Mahakarnchanakol, Food Science & Tech., KMUT Thonburi, Bangkok, 10140, Thailand
- 3:00 • Break
- 3:30 • Inoculum Size of *Clostridium botulinum*
T19 56A Spores Influences Time-to-detection and Percent Growth-positive Samples – LIHUI ZHAO, Thomas J. Montville, and Donald W. Schaffner, Cook College/Rutgers University, New Brunswick, NJ, USA
- 3:45 • Estimating the Growth of *Listeria mono-*
T20 *cytogenes* and *Yersinia enterocolitica* Microcolonies under Modified Atmospheres at 4°C and 8°C Using a Model Food System – WENDY ANNE HARRISON, Adrian Peters, and Louise Fielding, Food Safety Research Group, University of Wales Institute, Cardiff, South Glamorgan, Wales, UK
- 4:00 • The Development of a Quantitative Assay
T21 for the Detection of Genetically Modified Soy Protein – Mark A. Jensen, Susan Y. Tseng, SCOTT J. FRITSCHER, and Gregory Elliott, Qualicon, Inc., Wilmington, DE, USA
- 4:15 • A Comparison of the Traditional Three-tube
T22 Most Probable Number (MPN) Method with the Petrifilm, SimPlate, Bactometer Conductance, and BioSys Optical Methods for Enumerating *Escherichia coli* from Broiler Carcasses and Ground Beef – SCOTT M. RUSSELL, University of Georgia, Athens, GA, USA
- 4:30 • Evaluation of the BioSys Optical Method for
T23 Rapidly Enumerating Populations of Aerobic Bacteria, Coliforms, and *Escherichia coli* from Ground Beef – SCOTT M. RUSSELL, University of Georgia, Athens, GA, USA
- 4:45 • A Survey of *Campylobacter* Diversity in
T24 Poultry Samples Using a Network of Automated Ribotyping Systems with the Restriction Enzyme PstI – JAMES L. BRUCE, S. J. Fritschel, N. J. Stern, J. Van Der Plas, M. Havekes, H. Rahaoui, D. Koster, P. De Boer, J. Wagenaar, and W. Jacobs-Reitsma, Qualicon Inc., Wilmington, DE, USA
- P2 Inactivation and Control Methods II**
3:00 p.m. – 6:00 p.m.
(Authors present 3:30 p.m. – 5:30 p.m.)
Co-Convenors: Junsup Lee and Yongsoo Jung
- P38 • Effect of Freezing on the Isolation and Survival of Plasmid-bearing Virulent *Yersinia enterocolitica* in Pork – SAUMYA BHADURI, USDA-ARS-NAA-ERRC, Wyndmoor, PA, USA
- P39 • Effect of Growth Temperature or Starvation on the Radiation Resistance of *Escherichia coli* O157:H7 in a Model System and Ground Beef – ELAD I. STOTLAND, A. F. Mendonca, J. S. Dickson, and D. G. Olson, Iowa State University, Ames, IA, USA
- P40 • Susceptibilities of *Staphylococcus aureus*, *Listeria* and *Salmonella* Isolates Associated with Poultry Processing to Six Antimicrobial Agents – Ifigenia Geornaras, and ALEX VON HOLY, University of the Witwatersrand, Wits, South Africa
- P41 • Invasive Ability and Tolerance of Acid-adapted and Non-adapted *Salmonella* Typhimurium DT104 to Stress Conditions – PINA M. FRATAMICO, USDA-ARS-ERRC, Wyndmoor, PA, USA
- P42 • Heat Adaptation Induced Cross-protection against Osmotic Stress in *Salmonella* Typhimurium DT104 – Suree Nanasombat, and JOSEPH FRANK, University of Georgia, Athens, GA, USA
- P43 • Multiple Stress Studies in *Arcobacter* Species – ELAINE M. D'SA, M. A. Harrison, and V. K. Juneja, University of Georgia, Athens, GA, USA
- P44 • Influence of Fruit Variety, Harvest Technique, Culling, and Storage on the Microbial Composition and Patulin Contamination of Unpasteurized Apple Cider – ROBERT I. MERKER, Suzanne Keller, Hsu Ling Tan, Stuart Chirtel, Kirk Taylor, Lauren Jackson, and Arthur Miller, FDA-CFSAN-OSRS, Washington, D.C., USA
- P45 • Organic Acids and Hydrogen Peroxide Inhibit Microbial Viability in Fresh Juices – KALI KNIEL PHELPS, J. Koontz, S. S. Sumner, D. A. Golden, C. R. Hackney, and B. W. Zoecklin, Virginia Tech, Blacksburg, VA, USA
- P46 • Survival of Enterohemorrhagic *Escherichia coli* O157:H7 Strains in Wounded Apple Tissue during Temperature Abuse – MARLENE E. JANES, Shoreh Kooshesh, Rama Nannapaneni, and Michael G. Johnson, University of Arkansas, Fayetteville, AR, USA
- P47 • Loss of Fumonisin during the Corn Flake Process with and without Sugars – MAURICIO M. CASTELO, and Lloyd B. Bullerman, University of Nebraska-Lincoln, Lincoln, NE, USA
- P48 • Peroxidative Stress Adaptation and Thermal Cross-resistance in *Escherichia coli* O157:H7 933 Subjected to Sublethal Doses of Peroxyacetic Acid Sanitizer – C. D. ZOOK, F. F. Busta, and L. J. Brady, University of Minnesota, St. Paul, MN, USA
- P49 • Effect of Inhibitors of Branched-chain Keto Acid Dehydrogenase on the Growth, Fatty Acid Composition, and Enzyme Activity of *Listeria monocytogenes* – Tonia Wooldridge, Thanoja Sirimanne, Pascal Drouin, David Labeda, Philip D. Morse II, and BRIAN JAMES WILKINSON, Illinois State University, Normal, IL, USA

Monday p.m., *continued*

- P50 • *Zygosaccharomyces bailii* Time-to-growth as Affected by Temperature, Water Activity, pH and Antimicrobials – ENRIQUE PALOU, and A. Lopez-Malo, Universidad de las Américas-Puebla, Puebla, Mexico
- P51 • Effect of Salt on Survival of *Shigella flexneri* as Affected by Temperature and pH – LAURA L. ZAIKA, USDA-ARS-NAA-ERRC, Wyndmoor, PA, USA
- P52 • Use of Polystyrene Foam Net Containing Silver-coated Ceramic to Extend Shelf Life of Longissimus Steaks from Korean Cattle – Hyung Jung Kim, Chanyoung Park, JONG-BANG EUN, and Chonnam National University, Kwangju, South Korea
- P53 • Impact of Heating Stress on the Behavior of Two *Listeria monocytogenes* Strains in a Broth which Mimics the Camembert Cheese Composition – EMMANUELLE HELLOIN, Marielle Gay, and Françoise Ergon, ASEPT, Laval, France
- P54 • Unrelatedness of Nisin Resistance and Antibiotic Resistance in *Listeria monocytogenes* – Michael Chikindas, Jennifer Cleveland, Jie Li, and THOMAS J. MONTVILLE, Cook College, New Brunswick, NJ, USA
- P55 • Changes in Populations and Acid Tolerance of *Listeria monocytogenes* in Fresh Beef Decontamination Fluids – JOHN SAMELIS, J. N. Sofos, P. A. Kendall, and G. C. Smith, Colorado State University, Fort Collins, CO, USA
- P56 • Evaluation of *Listeria monocytogenes* in Vacuum-packed Gravada Salmon – E. M. Kinoshita, F. A. Silvestre, MARIZA LANDGRAF, and M. T. Destro, University of Sao Paulo, Sao Paulo, Brazil
- P57 • Fate of *Escherichia coli* O157:H7 in Channel Catfish Pond Water – RICO SUHALIM, Y. W. Huang, and G. Burtle, University of Georgia, Athens, GA, USA
- P58 • Internalization of *Escherichia coli* Outside Laboratory Conditions – BROOKE SEEMAN, K. K. Phelps, and S. S. Sumner, Virginia Tech, Blacksburg, VA, USA
- P59 • Localization and Tissue Damage Induced by Enterohemorrhagic *Escherichia coli* O157:H7 in Apple Tissue – MARLENE E. JANES, Rama Nannapaneni, and Michael G. Johnson, University of Arkansas, Fayetteville, AR, USA
- P60 • Modeling the Survival of Enterohemorrhagic *Escherichia coli* in Uncooked Fermented Salami – DIANE S. WOOD, Mansel W. Griffiths, Shai Barbut, and Trevor Pond, Canadian Research Institute for Food Safety, Guelph, Ontario, Canada
- P61 • Growth of *Escherichia coli* O157:H7 in Biofilms with Microorganisms Isolated from Meat Processing Environments – DONG KWAN JEONG, K. Y. Park, and J. S. Lee, Kosin University, Pusan, Korea
- P62 • Growth and Survival of *Escherichia coli* O157:H7 and Nonpathogenic *E. coli* in Cheddar Cheese Curds – KATHLEEN A. GLASS, Ann Larson, Angelique Smith, Kendra Thornton, and Eric A. Johnson, University of Wisconsin-Madison, Madison, WI, USA
- P63 • Survival of Enterohemorrhagic *Escherichia coli* O157:H7 in Retail Mustard – CAROLYN M. MAYERHAUSER, Reckitt Benckiser, Montvale, NJ, USA
- P64 • Environmental Conditions Affecting Survival of *Escherichia coli* O157:H7 and *Salmonella* Typhimurium DT104 in Land-spread Manure – Anthony Richard Arment, and STEVEN C. INGHAM, University of Wisconsin-Madison, Madison, WI, USA
- P65 • Effect of Antacid on Survival of *Vibrio vulnificus* and *Vibrio vulnificus* Phage in a Simulated Gastrointestinal Model – JAHEON KOO, Angelo DePaola, and Douglas L. Marshall, Virginia Seafood Agricultural Research and Extension Center, Hampton, VA, USA
- P66 • Survival of *Vibrio vulnificus* in Raw and Fried Mussels (*Mytilus galloprovincialis*) being Consumed as Traditionally in Turkey – GURHAN CIFTCIOGLU, and Acar M. Susur, Istanbul University, Avcilar, Istanbul, Turkey
- P67 • Microbial Population, Chemical Status and Shelf Stability of Smoked and Non-smoked Country-cured Hams – SUSANA M. PORTOCARRERO, M. Newman, B. Mikel, and B. Moody, University of Kentucky, Lexington, KY, USA
- P68 • Fate of Bacterial Pathogens Inoculated on Fresh Pork during Simulated Temperature Abuse at Distribution – K. Segomelo, M. L. Kain, G. Bellingier, K. E. Belk, J. Scanga, JOHN N. SOFOS, and G. C. Smith, Colorado State University, Fort Collins, CO, USA
- P69 • Cooling Rate Effect on Outgrowth of *Clostridium perfringens* in Cooked Turkey Products – FROST M. STEELE, and Kevin H. Wright, Brigham Young University, Provo, UT, USA
- P70 • Comparing Attachment Strength, Heat Tolerance and Alkali Resistance of Pathogenic and Non-pathogenic Bacteria on Orange Surfaces – STEVEN PAO, and Craig L. Davis, Florida Dept. of Citrus, Lake Alfred, FL, USA
- P71 • Potential for Transference of Inoculated and Indigenous Bacteria from the Non-wounded Rind of Melons to the Interior Edible Flesh – TREVOR V. SUSLOW, M. Zuñega, J. Wu, L. J. Harris, and T. Parnell, University of California-Davis, Davis, CA, USA
- P72 • Survival of Poliovirus on Fresh Produce – A. S. Kurdziel, N. Wilkinson, and NIGEL COOK, Central Science Laboratory, York, UK

TUESDAY MORNING – AUGUST 8, 2000

S10 *Campylobacter* Performance Standards: Implementation and Control

(Sponsored by IAFP Foundation Fund)

Co-Convenors: Anne Marie McNamara and Norman J. Stern

- 8:30 • Update on FSIS *Campylobacter* Programs – GERALDINE RANSON, USDA Food Safety and Inspection Service, Washington, D.C., USA
- 9:00 • Control of *Campylobacter* in Poultry from Farm to Table – ERIC LINE, USDA-ARS-RRC, Athens, GA, USA
- 9:30 • Control of *Campylobacter* in Pork from Farm through Slaughter – JAMES S. DICKSON, Iowa State University, Ames, IA, USA
- 10:00 • Break
- 10:30 • Current *Campylobacter* Research Needs on Behalf of Public Health – F. J. (ERIC) BOLTON, Central Public Health Laboratory, London, UK
- 11:00 • Perspectives and Possibilities for *Campylobacter* Performance Standards – NORMAN J. STERN, USDA-ARS-RRC, Athens, GA, USA
- 11:30 • Panel Discussion

S11 Genetic Methods to Track Microorganisms in Food Production and Processing

Co-Convenors: Stan Bailey and Paul Hall

- 8:30 • Advantages and Disadvantages of Different Genetic Techniques – MARTIN WIEDMANN, Cornell University, Ithaca, NY, USA
- 9:00 • Interpreting Genetic Results – What do the Results Mean? – TIM BARRETT, CDC, Atlanta, GA, USA
- 9:30 • Tracking *E. coli* O157:H7 in Wisconsin Dairy Farms – JACK SHERE, University of Wisconsin, Madison, WI, USA
- 10:00 • Break
- 10:30 • Tracking *Campylobacter* in Poultry Production and Processing – KELLI HIETT, USDA-ARS-RRC, Athens, GA, USA
- 11:00 • Using Genetic Tests to Understand Microbial Ecology of Food Production Systems – JOSEPH MEYER, Kraft Foods, Glenview, IL, USA
- 11:30 • Using Genetic Methods to Identify/Detect Microorganisms that Effect Quality in the Brewing Industry – MIKE BARNEY, Miller Brewing Company, Milwaukee, WI, USA

S12 Issues Facing Today's Large Dairy Producers

Convenor: John C. Bruhn

- 8:30 • Management Issues of Expanding an Operation – RON ST. JOHN, Producer, Trenton, FL, USA

- 9:00 • Nutrient Management and Waste Issues – JOHN WORLEY, University of Georgia, Athens, GA, USA
- 9:30 • Design of Milking Center and Other Buildings – BILL BICKERT, Michigan State University, East Lansing, MI, USA
- 10:00 • Break
- 10:30 • Decisions in Choosing a Milking System – BILL BICKERT, Michigan State University, East Lansing, MI, USA
- 11:00 • Employee and Labor Issues – WILLIAM THOMAS, University of Georgia Extension Service, Athens, GA, USA
- 11:30 • Dairy Farming and Environment Regulatory Issues – CARISSA ITLE, National Milk Producers Federation, Arlington, VA, USA

S13 Approaches to Food Safety in Latin America and Caribbean Countries

Co-Convenors: Ewen Todd and James Estupinan

- 8:30 • Surveillance of Foodborne Diseases in Countries of Latin America and the Caribbean with Emphasis in Emerging Pathogens – JAMES ESTUPINAN, Pan America Health Organization/WHO, Buenos Aires, Argentina
- 9:00 • Food Safety Approaches in Latin America and the Caribbean – JAIRO ROMERO, Ingeniero en Alimentos, Bogota, Colombia
- 9:30 • Latin America Network of Food Analysis Laboratories – MARITZA COLON PULANO, FDA, Rockville, MD, USA
- 10:00 • Break
- 10:30 • Food Safety Initiative in Caribbean Countries – RONALD GORDON, CARICOM Secretariat, Georgetown, Guyana
- 11:00 • Food Safety Aspects of Meat Exportation from Latin America and the Caribbean – PABLO GUILLERMO GALLI, Animal Health and Agri-food National Service, Buenos Aires, Argentina
- 11:30 • Food Safety Aspects for Fruits and Vegetables Exportation from Latin America and the Caribbean – JAIME ALMONTE

T3 Inactivation and Control Methods I

- 8:30 • Inactivation of Bacterial Foodborne Pathogens on Fresh Produce by Low-dose Gamma Irradiation – DONALD E. CONNER, S. A. Berry, C. A. Sundermann, C. I. Wei, S. J. Weese, and F. M. Woods, Auburn University, Auburn University, AL, USA
- 8:45 • Effect of Irradiation Temperature on Inactivation of *E. coli* O157:H7 and *Staphylococcus aureus* – DONALD W. THAYER, and Glenn Boyd, USDA-ARS-ERRC, Wyndmoor, PA, USA
- 9:00 • Non-thermal Processing Alternatives for the Effective Elimination of *E. coli* O157:H7 in Apple Cider – NESE BASARAN, John Churey, and Randy W. Worobo, Cornell University, Geneva, NY, USA

Tuesday a.m., *continued*

- 9:15 • Inactivation of *Escherichia coli* O157:H7 and
T28 *Listeria monocytogenes* on Apples and
in Fresh Apple Cider Using Sonication and
Copper Ion Water – STEPHANIE L. RODGERS,
J. N. Cash, and E. T. Ryser, Michigan State
University, East Lansing, MI, USA
- 9:30 • Influence of Environmental Stresses on Biocide
T29 Susceptibility of *Escherichia coli* O157:H7 –
KAREN ELIZABETH MIDDLETON, Michael
P. Whitehead, David J. Hill, John T. Holah and
Hazel Gibson, University of Wolverhampton,
School of Applied Sciences, Wolverhampton,
England
- 9:45 • Inhibition of *Listeria monocytogenes*, *Salmon-*
T30 *ella* Typhimurium DT104 and *Escherichia coli*
O157:H7 on Bologna and Summer Sausage Using
Whey Protein Isolate-based Edible Films Con-
taining Antimicrobials – ARZU CAGRI, Z. Ustunol,
and E. Ryser, Michigan State University, East
Lansing, MI, USA
- 10:00 • Break
- 10:30 • Disinfection of Bacterial Pathogens and
T31 Selected Viruses on Fresh Romaine Lettuce –
MICHAEL LEE BRADLEY, George Lukasik, and
Samuel Farrah, University of Florida,
Gainesville, FL, USA
- 10:45 • The Antimicrobial Efficacy of Herbs in Marinated
T32 Chicken – MONDONNA F. CATE, F. A. Draughon,
J. R. Mount, and D. A. Golden, University of
Tennessee, Knoxville, TN, USA
- 11:00 • Effect of Fat Content, Evaporative Cooling
T33 and Food Type on Pathogen Survival during
Microwave Heating – APRIL HIX, S. Sumner,
K. Mallikarjunan, and C. Hackney, Virginia
Tech, Blacksburg, VA, USA
- 11:15 • Microbiological Evaluation and Manufactur-
T34 ing Practices of Sprouts in Canada – MARIA
NAZAROWEC-WHITE, F. Veillette, and
I. Laberge, Canadian Food Inspection Agency,
Nepean, Ontario, Canada
- 11:30 • Effect of Blanching Cucumbers on the Micro-
T35 flora of Non-acidified Refrigerated Pickles –
FREDERICK BREIDT, JR., L. Reina, and H. P.
Fleming, USDA-ARS, Raleigh, NC, USA
- 11:45 • Effects of Water Washing and Rinsing
T36 Temperature on Handwashing Efficacy –
Vidhya Gangar, Maria Arenas, Ann Schultz,
Daryl Paulson, and BARRY MICHAELS, Georgia
Pacific Corp., Palatka, FL, USA
- P3 General Food Microbiology
and Education**
- 10:00 a.m. – 1:00 p.m.
(Authors present 10:30 a.m. – 12:30 p.m.)
- Co-Convenors: Yue Li and Manan Sharma**
- P73 • Cytotoxicity and Buffering Capacity of an
Alkaline Tolerant Dairy-associated *Bacillus*
Isolate – DENISE LINDSAY, Volker Brözel,
and Alex von Holy, University of the
Witwatersrand, Wits, South Africa
- P74 • Two Novel Genes Related to Low Temperature
Growth of *Listeria monocytogenes* as Identified
Using Transposon-induced Cold Sensitive
Mutants cld-14 and cld-27 – SIQING LIU, Philip
D. Morse II, and Brian J. Wilkinson, Illinois State
University, Normal, IL, USA
- P75 • Transposon Insertions in Branched-chain Alpha-
keto Acid Dehydrogenase Region of Two Cold-
sensitive *Listeria monocytogenes* Mutants –
KUN ZHU, Anming Xiong, R. K. Jayaswal, Philip
D. Morse II, and Brian J. Wilkinson, Illinois State
University, Normal, IL, USA
- P76 • A Risk-based Evaluation of Traditional and Social
Marketing Methods of Food Hygiene Education
– ELIZABETH CLAIRE REDMOND, C. Griffith
and A. Peters, Food Safety Research Group,
University of Wales Institute, Cardiff, Cardiff,
South Glamorgan, Wales, UK
- P77 • Foodborne Disease Reporting in America:
Closing the Gaps in Our Federal Food-safety Net
– CAROLINE SMITH DEWAAL, Lucy Alderton,
and Michael Jacobson, Center for Science in
the Public Interest, Food Safety Program,
Washington, D.C., USA
- P78 • Food Handlers' Beliefs about Food Safety
Procedures and Risks – DEBBIE CLAYTON,
Chris Griffith, Adrian Peters, and Patricia Price,
University of Wales Institute, Cardiff, UK
- P79 • The Repeatability and Reproducibility of Food
Safety Behavior in the Domestic Environment –
ELIZABETH CLAIRE REDMOND, C. Griffith,
and A. Peters, Food Safety Research Group,
University of Wales Institute, Cardiff, South
Glamorgan, Wales, UK
- P80 • Prevalence of Unsafe Practices during
Preparation of Homemade Food in Argentina –
ALICIA NOEMÍ CALIFANO, Graciela De Antoni,
Leda Gianuzzi, and Rodolfo Mascheroni,
CIDCA, Universidad Nacional de La Plata,
Facultad de Ciencias Exactas, La Plata, Buenos
Aires, Argentina
- P81 • Evaluation of a Targeted Intervention Food
Safety Program for Women Who are Pregnant
and/or Have Young Children – JODI R. BUNDE,
and Virginia N. Hillers, Oregon State University,
Corvallis, OR, USA
- P82 • Cost, Benefits and Attitudes Towards HACCP
Implementation in English Butchers' Shops –
Matthew Mortlock, ADRIAN PETERS, and Chris
Griffith, University of Wales Institute, Cardiff
(UWIC), Cardiff, England
- P83 • Development of a Competitive Exclusion
Product to Reduce *Escherichia coli* O157:H7
in Cattle – DIVYA JARONI, Mindy Brashears,
and Joy Trimble, University of Nebraska-Lincoln,
Lincoln, NE, USA
- P84 • Isolation and Selection of Lactic Acid Bacteria
from Meat Products to Inhibit Foodborne
Pathogens – ALEJANDRO AMEZQUITA, Mindy
Brashears, and Joy Trimble, University of
Nebraska-Lincoln, Lincoln, NE, USA

- P85 • Biocontrol of Mold Growth Using *Bacillus pumilus* and *Lactobacillus* Species Isolated from Foods – JITKA STILES, C. Munimbazi, M. Plockova, J. Chumchalova, and L. B. Bullerman, University of Nebraska-Lincoln, Lincoln, NE, USA
- P86 • Employing *Citrobacter rodentium* as a Surrogate for *Escherichia coli* O157:H7 in a Mouse Model to Investigate the Effects of the Probiotic *Lactobacillus acidophilus* on Pathogen Binding in the Large Intestine – JEFFREY J. VARCOE, Frank Busta, and Linda Brady, University of Minnesota, St. Paul, MN, USA
- P87 • Purification and Characterization of an Antilisterial Bacteriocin Produced by *Leuconostoc* sp. W65 – SEJONG OH, John J. Churey, Saehun Kim, and Randy W. Worobo, Cornell University, Geneva, NY, USA
- P88 • Resistance of *Listeria monocytogenes* to Bacteriocins of Lactic Acid Bacteria – ANNE BOUTTEFROY, and Jean-Bernard Milliere, ASEPT, Laval, France
- P89 • Botulinal Toxin Production in Reduced-fat and Fat-free Pasteurized Process Cheese Products – KATHLEEN A. GLASS, and Eric A. Johnson, Food Research Institute, UW-Madison, Madison, WI, USA
- P90 • Antimicrobial Activity of Several Spices and Organic Acid Solutions Tested against *Arcobacter butzleri* – ROBERT TODD HANCOCK, and Mark A. Harrison, University of Georgia, Athens, GA, USA
- P91 • Trans-2-Hexenal, as an Antimicrobial Agent – M. A. Anandappa, and MELISSA C. NEWMAN, University of Kentucky, Lexington, KY, USA
- P92 • Carvacrol, Citral, Eugenol, Thymol, Vanillin, Potassium Sorbate and Sodium Benzoate Inhibitory Concentrations for *Aspergillus flavus* at Selected Water Activities and pHs – AURELIO LÓPEZ-MALO, and S. M. Alzamora, Universidad de las Americas-Puebla, Puebla, Mexico
- P93 • Antimicrobial Effect of Honey on Hydrated Batter Mix – YAO-WEN HUANG, H.Y. Chu, and M. Harrison, University of Georgia, Athens, GA, USA
- P94 • Natural Antimicrobials as Potential Replacements for Calcium Propionate in Bread – Tracey-Lee Pattison, and ALEX VON HOLY, University of the Witwatersrand, Wits, South Africa
- P95 • Effect of Natural Antimicrobials on Bakers' Yeast – Tracey-Lee Pattison, and ALEX VON HOLY, University of the Witwatersrand, Wits, South Africa
- P96 • Prevalence of *Pseudomonas* spp. in Process Water, Recycled Water and Dairy Products – JILL GEBLER, Murray Goulburn Co-op Co. Ltd, Yarram, Victoria, Australia
- P97 • Population Changes of Pathogenic Bacteria Inoculated in Fresh Pork Following Chilled Storage and Simulated Consumer Temperature Abuse – K. Segomelo, M. L. Kain, G. Bellinger, K. E. Belk, J. Scanga, JOHN N. SOFOS, and G. C. Smith, Colorado State University, Fort Collins, CO, USA
- P98 • Prevalence of *Listeria monocytogenes*, *Salmonella* Typhimurium and *Yersinia enterocolitica* on Incoming Hogs and Fresh Pork during and after Slaughter – RAJESH K. SHARMA, Elliot T. Ryser, and Wesley N. Osburn, Michigan State University, East Lansing, MI, USA
- P99 • Levels of Microbial Contamination in United States Pork Retail Products – ELIZABETH ANNE DUFFY, G. R. Bellinger, A. Pape, K. E. Belk, J. N. Sofos, and G. C. Smith, Colorado State University, Fort Collins, CO, USA
- P100 • Microbial Contamination Occurring on Lamb Carcasses Processed in the United States – ELIZABETH ANNE DUFFY, S. B. LeValley, M. L. Kain, K. E. Belk, J. N. Sofos, J. D. Tatum, G. C. Smith, and C. V. Kimberling, Colorado State University, Fort Collins, CO, USA
- P101 • Sampling of Dairy Cattle for *Listeria monocytogenes* – MATTHEW R. EVANS, Valerie W. Ling, F. Ann Draughon, and Stephen P. Oliver, University of Tennessee, Knoxville, TN, USA
- P102 • Incidence and Antibiotic Resistance of *Salmonella* spp. Cultures Isolated from Animal Hide and Beef Carcasses – RICHARD TODD BACON, John N. Sofos, Keith E. Belk, and Gary C. Smith, Colorado State University, Fort Collins, CO, USA
- P103 • Surveillance of *Arcobacter* in Various Environmental Sources – LEE G. JOHNSON, and Elsa Murano, Texas A&M University, College Station, TX, USA
- P104 • Presence of *Campylobacter*, *Escherichia coli* and *Salmonella* in Retail Meats – CUIWEI ZHAO, B. Ge, J. De Villena, R. Sudler, E. Yeh, and J. Meng, University of Maryland, College Park, MD, USA
- P105 • Antibiotic Resistance Pattern of *Campylobacter* spp. Isolated from Boilers Processed in Air and Immersion Chill Processing Facilities – MARCOS XAVIER SANCHEZ, W. M. Fluckey, M. Brashears, and S. R. McKee, University of Nebraska-Lincoln, Lincoln, NE, USA
- P106 • Characterization of Antibiotic Resistance in Shiga Toxin-producing *Escherichia coli* – SHAOHUA ZHAO, D. White, S. Ayers, S. Friedman, B. Ge, J. Meng, L. English, D. Wagner, and S. Gaines, FDA, Laurel, MD, USA
- P107 • Evidence of Toxin Production by *Bacillus* Strains Isolated from Street-vended Foods in Johannesburg, South Africa – Francina Mosupye, Denise Lindsay, and ALEX VON HOLY, University of the Witwatersrand, Wits, South Africa

Tuesday a.m., *continued*

- P108 • Microbiological Quality of Bottled Water – HASSAN GOURAMA, Lynette Heffner, and Lauren Anton, Pennsylvania State University, Reading, PA, USA
- P109 • Identification and Molecular Characterization of Amine-producing Strains of *Stenotrophomonas maltophilia* Isolated from White Muscle of Fresh and Frozen Albacore Tuna (*Thunnus alalunga*) – Begoña Ben-Gigirey, Juan M. Vieites, Tomás G. Villa, and JORGE BARROS-VELÁZQUEZ, University of Santiago de Compostela, Lugo, Spain
- P110 • Microbial Ecology of Muffins Based on Cassava and Other Non-wheat Flours – Shobna Chauhan, Christine Rey, Denise Lindsay, and ALEX VON HOLY, University of the Witwatersrand, Wits, South Africa

TUESDAY AFTERNOON – AUGUST 8, 2000

General Session

S14 Bioterrorism and Food Protection

Co-Convenors: F. Ann Draughon and Richard V. Lee

- 1:30 • Food as a Weapon – RICHARD LEE, State University of New York, Lancaster, NY, USA
- 1:50 • Strategic Bioterrorism and the Food Supply – RAYMOND HARBISON, University of South Florida, Tampa, FL, USA
- 2:10 • Bioterrorist Targets in the Agricultural Industry – DALE HANCOCK, Washington State University, Pullman, WA, USA
- 2:30 • Bioterrorism as a Public Health Event – JEREMY SOBEL, CDC, Atlanta, GA, USA
- 2:50 • Responding to a Bioterrorist Event – GARY HURST and CRAIG THRASHER, Environment and Ecology, Inc., Lancaster, NY, USA
- 3:10 • The Role of Food Protection Associations in Preparedness against Bioterrorist Events – ANN DRAUGHON, University of Tennessee, Knoxville, TN, USA

Business Meeting (4:00 p.m. – 5:00 p.m.)

WEDNESDAY MORNING – AUGUST 9, 2000

S15 Food Biotechnology: Perspectives, Challenges and Opportunities

Co-Convenors: Robert B. Gravani and Sylvia Rowe

- 8:30 • Perspectives on Biotechnology: Past, Present and Future – MICHAEL PHILLIPS, Biotechnology Industry Organization, Washington, D.C., USA
- 9:00 • Understanding Consumer Perceptions of Biotechnology – SYLVIA ROWE, International Food Information Council, Washington, D.C., USA

- 9:30 • Biotechnology in Production Agriculture: A Scientific Perspective – MARTINA MCGLOUGHLIN, University of California-Davis, Davis, CA, USA
- 10:00 • Break
- 10:30 • EPAs Regulation of Agricultural Biotechnology Products – JANET ANDERSEN, US Environmental Protection Agency, Washington, D.C., USA
- 11:00 • Food Product Enhancement through Biotechnology – ADRIANNE MASSEY, Massey and Associates, Chapel Hill, NC, USA
- 11:30 • Detecting Biotechnologically Derived Ingredients in Food – DONALD KENDALL, USDA-GIPSA, Kansas City, MO, USA

S16 Biosensors and Real Time Detection Systems

Co-Convenors: Kathleen Glass and Eric Johnson

- 8:30 • Fundamentals of Biosensors and Real-Time Detection Systems – ROBERT BRACKETT, FDA, Washington, D.C., USA
- 9:00 • Use of Colorimetric Sensors for Detection of Foodborne Pathogens – PETER DAVID, Dtek, Los Altos Hills, CA, USA
- 9:30 • Rapid Detection of *Salmonella* Using an Immunoassay-based Biosensor – DAVID S. GOTTFRIED, Georgia Tech Research Institute, Atlanta, GA, USA
- 10:00 • Break
- 10:30 • Detection of Pathogens by Immunomagnetic-electrochemiluminescence (IM-ECL) – GERRY CRAWFORD, USDA-REE-ARS-NAA-ERRC-MB&BR, Wyndmoor, PA, USA
- 11:00 • Application of Flow Cytometry Techniques as Real Time Detectors – ERIC JOHNSON, University of Wisconsin, Madison, WI, USA
- 11:30 • Integration and Application of Real Time Detection and Information Systems for Food Safety – DONALD CONNER, Auburn University, Auburn, AL, USA

S17 Transportation of Raw Milk and Finished Dairy Products

Convenor: Gaylord Smith

- 8:30 • Regulating Haulers/Drivers – MIKE CULPEPPER, Georgia Dept. of Ag., Atlanta, GA, USA
- 9:00 • Inspection of Farm Bulk Tankers – DAN ERICKSON, Minnesota Dept. of Ag., St. Paul, MN, USA
- 9:30 • Cleaning and Sanitizing Farm Bulk Tankers – PATRICK BOYLE, Readington Farms, Inc., Whitehouse, NJ, USA
- 10:00 • Break
- 10:30 • Sampling Issues – MIKE CULPEPPER, Georgia Dept. of Ag., Atlanta, GA, USA

- 11:00 • Owner/Operator Issues – RICK BAREFOOT, H. Fred Barefoot Trucking, Inc., Alum Bank, PA, USA
- 11:30 • Hauling of Finished Dairy Products – RUTH FUQUA, Quality Chekd Dairies Inc., Mt. Juliet, TN, USA

S18 Significance of Mycotoxins in the Global Food Supply

(Sponsored by ILSI-NA)

Co-Convenors: Karen Huether and Morris E. Potter

- 8:00 • Worldwide Mycotoxin Problems – J. DAVID MILLER, Carleton University, Ottawa, Ontario, Canada
- 8:45 • Toxicology of Aflatoxin B1 – THOMAS E. MASSEY, Queen's University, Kingston, Ontario, Canada
- 9:30 • Fumonisinis – WILLIAM P. NORRED, USDA-ARS-RRC, Athens, GA, USA
- 10:15 • Break
- 10:30 • Deoxynivalenol – JAMES J. PESTKA, Michigan State University, East Lansing, MI, USA
- 11:15 • Detection Methods for Mycotoxins in Foods – ANGELO VISCONTI, National Research Council, Bari, Italy
- 11:45 • Control of Mycotoxins in the Food Supply: A Food Industry Perspective – To be announced

T4 Inactivation and Control Methods II

- 8:30 • Continuous On-line Processing of Fecal and T37 Food Contaminated Poultry Carcasses – G. KERE KEMP, M. A. Aldrich, and M. Guerra, Alcide Corp., Redmond, WA, USA
- 8:45 • Efficacy of Electrolyzed Water in Inactivating T38 *Listeria monocytogenes* and *Salmonella enteritidis* on Shell eggs – Chung-Myeon Park, YEN-CON HUNG, Chyi-Shen Lin, and Robert E. Brackett, CFSQE, University of Georgia, Griffin, GA, USA
- 9:00 • Effect of Pre-chill Skinning on the Level of T39 *Campylobacter* Recovered from Broiler Parts – MARK E. BERRANG, and S. R. Ladely, USDA-ARS-RRC, Athens, GA, USA
- 9:15 • Ability of Oleic Acid to Reduce the Number T40 of Bacteria on Poultry Skin and in Rinsates of Poultry Skin – ARTHUR HINTON, JR., and Kimberly D. Ingram, RRC, Athens, GA, USA
- 9:30 • Comparison of Three Commercial Competitive T41 Exclusion Products on Reducing *Salmonella* in Broilers – ANOTONIO JOSE PIANITINO FERREIRA, C. S. A. Ferreira, T. Knobl, A. M. Moreno, M. R. Bacarro, M. Chen, and M. Robach, University of Sao Paulo, Sao Paulo, Brazil
- 9:45 • Effectiveness of Potassium Lactate and Lactic T42 Acid Against *Campylobacter* and Psychrotrophic Bacteria on Chicken Breasts – DAVID RASMUSSEN, S. Sumner, J. Eifert, C. Hackney, and S. Duncan, Virginia Tech, Blacksburg, VA, USA
- 10:00 • Break

- 10:30 • Application of Natural Antimicrobial Systems T43 for Control of *L. monocytogenes* in Foods – XINTIAN MING, Jeff Lambeseder, Fred Bender, and Bill King, Food Bioprotection, Rhodia Foods, Madison, WI, USA

- 10:45 • Comparative Study of Semisynthetic T44 Derivative of Natamycin and the Parent Antibiotic on the Spoilage of Shredded Cheddar Cheese – ERIC C. SULOFF, J. E. Marcy, C. R. Hackney, and S. S. Sumner, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA

- 11:00 • Co-60 Irradiation for Inactivation of *Giardia* T45 *lamblia* Cysts in Water and on Tomatoes – CHRISTINE A. SUNDERMANN, B. Estridge, F. Woods, D. Conner, J. Weese, and C. Wei, Auburn University, Auburn University, AL, USA

- 11:15 • Inhibitory Effect of Gamma Irradiation on T46 the Growth of *Fusarium moniliforme* and Fumonisin Production – DEOG-HWAN OH, C. C. Yoo, and B. K. Park, Kangwon National University, Korea

- 11:30 • Resistance of Poliovirus to Inactivation by T47 High Hydrostatic Pressures – N. Wilkinson, NIGEL COOK, A. S. Kurdziel, S. Langton, and E. Needs, Central Science Laboratory, York, UK

- 11:45 • The Effect of Thermal Processing Schedules T48 and Unit Operations on the Quality of Blue Crab (*Callinectes sapidus*) Meat – Jennifer L. Smith, Robert Lane, Michael Jahnce, Robert Croonenberghs, and GEORGE JOSEPH FLICK, JR., Virginia Tech, Blacksburg, VA, USA

P4 Microbiological Methods

10:00 a.m. – 1:00 p.m.

(Authors present 10:30 p.m. – 12:30 p.m.)

Co-Convenors: Gloria Tetteh and Xuan Guo

- P111 • Evaluation of Universal Preenrichment Broth for Growth of Heat-injured Pathogens – TONG ZHAO, and Michael P. Doyle, University of Georgia, Griffin, GA, USA
- P112 • Characterization of *Listeria monocytogenes* from Cold-Smoked Fish Plant by Pulsed-field Gel Electrophoresis (PFGE) – ANITA METTIVIER, Antoine Berthier and Marielle Gay, ASEPT, Laval, France
- P113 • *Listeria monocytogenes* Detection in Food Using an ELISA-based Method – Marie-Laure Sorin, Sébastien Faure, Sandrine Pomerol, and PATRICE ARBAULT, Diffchamb SA, Lyon, France
- P114 • Factors Affecting the Isolation and Enumeration of *Escherichia coli* O157:H7 on Alfalfa Seeds – FONE MAO WU, Bala Swaminathan, Joy Wells, Larry Slutsker, Michael P. Doyle, and Larry R. Beuchat, University of Georgia, Griffin, GA, USA
- P115 • Efficacy of Various Non-selective Resuscitation Media for Increased Detection of Heat-injured *Escherichia coli* O157:H7 – EDWARD E. FETZER, and Aubrey F. Mendonca, Iowa State University, Ames, IA, USA

Wednesday a.m., *continued*

- P116 • Phosphate Buffer Increases Recovery of *Escherichia coli* O157:H7 from Frozen Apple Juice – SHERYL A. YAMAMOTO, and Linda J. Harris, University of California-Davis, Davis, CA, USA
- P117 • Evaluation of FDA/BAM and Rapid Methods for Enumeration and Detection of *Escherichia coli* O157:H7 from Farm Animal Environments – CHRISTOPHER A. KIEFER, D. A. Golden, F. A. Draughon, A. G. Mathew, and S. P. Oliver, University of Tennessee, Knoxville, TN, USA
- P118 • Rapid and Sensitive Identification of Viable *Escherichia coli* O157:H7 in Food by Reverse Transcription PCR – SIMA YARON, and Karl R. Matthews, Rutgers University, New Brunswick, NJ, USA
- P119 • Comparison of Selective Media for Evaluating Survival of *Escherichia coli* O157:H7 in Fruit Juices – CHARITY A. LAKINS, B. L. Knox, D. A. Golden, and S. S. Sumner, University of Tennessee, Knoxville, TN, USA
- P120 • Withdrawn
- P121 • Media Evaluation for Recovery of Injured Cells of *Escherichia coli* O157:H7 and *Salmonella* spp. – ALEJANDRO AMEZQUITA, and Mindy Brashears, University of Nebraska- Lincoln, Lincoln, NE, USA
- P122 • Comparison of Selective Enrichment Media to Recover *Salmonella* from Acidified Barbecue and Liquid Non-dairy Products – KAMESH ELLAJOSYULA, John Shields, Nadia Melnyk, and Cecelia Marshall, Rich Products Corp., Buffalo, NY, USA
- P123 • Evaluation of a Lateral Flow Device for Detecting *Salmonella enteritidis* in Raw Eggs and Chicken Feces – KUN-HO SEO, P. S. Holt, B. W. Mitchell, and R. K. Gast, USDA-ARS, Athens, GA, USA
- P124 • Improved Isolation of *Salmonella* from Chocolate – PETER J. STEPHENS, and Elaine E. M. Fraser, Oxoid Ltd., Basingstoke, Hampshire, England, UK
- P125 • Recovery of *Salmonella* from Artificially Contaminated Dairy Feeds – YOBOUET DJE, F. A. Draughon, David A. Golden, P. Stephen Oliver, and J. Willie Taylor, University of Tennessee, Knoxville, TN, USA
- P126 • Selective and Differential Properties of Chromogenic Media for Isolation of Salmonellae from Foodstuffs – PETER J. STEPHENS, and Tom Sadler, Oxoid Ltd., Basingstoke, Hampshire, UK
- P127 • Detection of *Campylobacter jejuni* in Dairy Silage – WILLIE JAMES TAYLOR, F. A. Draughon, David Golden, Stephen Oliver, and Michelle Saul, University of Tennessee Knoxville, TN, USA
- P128 • A Comparison of Isolation Protocols for Recovery of *Campylobacter jejuni* from Cattle Feces – WILLIE JAMES TAYLOR, F. A. Draughon, David Golden, Stephen Oliver, and Michelle Saul, University of Tennessee Knoxville, TN, USA
- P129 • A Rapid Method to Identify and Enumerate Foodborne Pathogens Using Machine Vision – OMAR TRUJILLO, Carl Griffis, Michael Slavik, and Yanbin Li, University of Arkansas, Fayetteville, AR, USA
- P130 • Detection of Guaiacol Produced by *Allicyclobacillus acidoterrestris* in Apple Juice by Sensory and Chemical Analyses – Rachel V. Orr, Robert L. Shewfelt, C. J. Huang, Sebhat Tefera, and LARRY R. BEUCHAT, University of Georgia, Griffin, GA, USA
- P131 • Sampling Technique Efficacy for *Arcobacter butzleri* from Live Chickens – ROBERT MATTHEW CASTLE, J. D. Eifert, F. W. Pierson, C. T. Larsen, and C. R. Hackney, Virginia Tech, Blacksburg, VA, USA
- P132 • Detection of Coliforms on Food Contact Surfaces – GINNY MOORE, Chris Griffith, and Adrian Peters, Food Safety Research Group, University of Wales Institute Cardiff (UWIC), Cardiff, UK
- P133 • Detection of Zearalenone by Fluorescence Polarization Immunoassay and Its Application to Corn – JUNG-HYUN PARK, Mi-Ja Park, Kwang-Soo Ha, and Duck-Hwa Chung, Gyeongsang National University, Chinju, Gyeongnam, Korea
- P134 • Screening of Deoxynivalenol Producing Fungi from Greenhouse Horticulture Soils and Products by ALP/NADP Method – DUCK-HWA CHUNG, Mi-Ja Park, Jung-Hyun Park, and Kwang-Soo Ha, Gyeongsang National University, Chinju, Gyeongnam, Korea
- P135 • A Comparison of Methods for Monitoring Food Contact Surface Cleanliness – CRAIG DAVIDSON, Chris Griffith, Adrian Peters, and Louise Fielding, University College of Worcester, Henwick Grove, Worcester, UK
- P136 • Spreadsheet Tool for Recording and Evaluating Microbiological Environmental Sampling Data – JOSEPH DANIEL EIFERT, H. Wang, and T. Tu, Virginia Tech, Blacksburg, VA, USA
- P137 • Reverse Dot-Blot DNA/DNA Hybridization Method for the Detection of Bacteria Involved in Amine Formation in Albacore Tuna (*Thunnus alalunga*) – Begoña Ben-Gigirey, Juan M. Vicites, Shin-Hee Kim, Haejung An, Tomás G. Villa, and JORGE BARROS-VELÁZQUEZ, University of Santiago de Compostela, Lugo, Spain
- P138 • The Use of MALDI-TOF and Nanospray-Ion Trap Mass Spectrometry to the Characterization of Specific Proteins Separated by Two-dimensional Electrophoresis: Application of Proteomics to the Control of Species Substitution in Fish Products – C. Piñeiro, J. Vázquez, A. Marina, JORGE BARROS-VELÁZQUEZ, R. I. Pérez-Martín, and J. M. Gallardo, Universidad de Santiago de Compostela, Lugo, Spain
- P139 • Detection of *Shigella* Using a Digoxigenin-labeled Polynucleotide DNA Probe – JOSEPH L. FERREIRA, Mark Harrison, and Paul Edmonds, FDA, Southeast Regional Laboratory, Atlanta, GA, USA

WEDNESDAY AFTERNOON – AUGUST 9, 2000

Special Session

The Results of the FDA Risk Assessments on *Vibrio parahaemolyticus* and *Listeria monocytogenes*

Convenor: Robert Buchanan

- 1:30 • Risk Assessment on the Public Health Impact of *Vibrio parahaemolyticus* in Raw Molluscan Shellfish – MARIANNE MILIOTIS, FDA, Washington, D.C., USA
- 2:10 • Panel Discussion
- 2:55 • Break
- 3:30 • Risk Assessment: Public Health Impact of Foodborne *Listeria monocytogenes* – RICHARD WHITING, FDA, Washington, D.C., USA
- 4:10 • Panel Discussion

S19 The Role of Norwalk-like Viruses (NLVs) in Foodborne Disease

Co-Convenors: Dean O. Cliver and Lee-Ann Jaykus

- 1:30 • The Role of NLVs in Foodborne Disease – STEPHAN S. MONROE, CDC, Atlanta, GA, USA
- 2:00 • Environmental Contamination in a Large Hotel with a Prolonged NLV Outbreak – JOHN D. CHEESBROUGH, Public Health Laboratory, PHLS Northwest, Preston, UK
- 2:30 • Detection of NLVs in Foods – DORIS D. D'SOUZA, North Carolina State University, Raleigh, NC, USA
- 3:00 • Break
- 3:30 • Genetic Relatedness of NLVs in Foodborne Disease Outbreaks – STEPHAN S. MONROE, CDC, Atlanta, GA, USA
- 4:00 • Dose-Response Relationships of Norwalk Virus from Human Challenge Studies – CHRISTINE MOE, University of North Carolina, Chapel Hill, NC, USA
- 4:30 • Control of NLV Outbreak in a Large Hotel Casino – DANIEL J. MAXSON, Clark Co. Health District, Las Vegas, NV, USA

S20 International Trends in On-Farm Food Safety

Convenor: Albert Chambers

- 1:30 • The Australian Experience – PHILLIP CORRIGAN, Embassy of Australia, Washington, D.C., USA
- 1:55 • The Irish Experience – The Clean Green Island – Food Safety Assurance Schemes – THOMAS QUIGLEY, Food Safety Authority of Ireland, Dublin, Ireland
- 2:20 • The Canadian Experience – Canadian On-Farm Food Safety Program – ALBERT CHAMBERS, Canadian On-Farm Safety Program, Monachus Consulting, Ottawa, Ontario, Canada

- 2:45 • The US Experience – DAVE PYBURN, National Pork Producers Council, Des Moines, IA, USA
- 3:10 • Break
- 3:40 • The Latin American Experience – IVONE DELAZARI, Sadia, Concordia, Brazil
- 4:05 • Comparison of EU/US/Australian On-Farm QA/Food Safety Schemes – RICHARD BAINES, Royal Agricultural College, Cirencester, UK
- 4:30 • The Emerging International Standard: On-Farm Food Safety & Codex – BONNIE BUNTAIN, USDA-FSIS-OPHS, Washington, D.C., USA

S21 The Earth is Curved (And so are Kinetic Data)

(Sponsored by IAFP Foundation Fund and Nabisco, Inc.)

Co-Convenors: Cindy Stewart and David Legan

- 1:30 • Introduction
- 1:40 • Historical Perspective on Microbial Inactivation Data Analysis: Linear Treatments – What, How, Why (not) – FRANK BUSTA, University of Minnesota, St. Paul, MN, USA
- 2:10 • Non-linear Treatments of Microbial Inactivation Data – What, How, Why – MICHA PELEG, University of Massachusetts, Amherst, MA, USA
- 2:40 • Modeling Thermal Inactivation of *Clostridium botulinum* Spores – PETER MCCLURE, Unilever Research, Sharnbrooke, Bedford, UK
- 3:10 • Break
- 3:30 • Modeling the Effect of Relative Humidities on Heat Resistance of *Salmonella* Typhimurium DT104 – KAREN MATTICK, PHLS Food Microbiology Research Unit, Heavitree, Exeter, Devon, UK
- 4:00 • Implications of Non-Linear Inactivation Kinetics for Risk Assessment – MARTIN COLE, Food Safety and Quality, Food Science Australia, North Ryde, Australia
- 4:30 • Panel Discussion

T5 Risk Assessment and Miscellaneous

- 1:30 • Risk Assessment of *Salmonella enteritidis* in Canadian Shell Eggs – GREG M. PAOLI, E. C. D. Todd, and W. Ross, Decisionalysis Risk Consultants, Inc., Ottawa, Ontario, Canada
- 1:45 • A Risk Assessment Model for *Salmonella* spp., *Campylobacter jejuni*, and Chicken – THOMAS PATRICK OSCAR, USDA-ARS, Princess Anne, MD, USA
- 2:00 • Risk Assessment for Harmful Algal Blooms – Can *Vibrio vulnificus* be a Model for These Agents? – EWEN C. TODD, William Ross, and Mark Smith, Health Protection Branch, Health Canada, Ottawa, Ontario, Canada

Wednesday p.m., *continued*

- 2:15 • *Cyclospora oocysts* on Raspberries from
T52 Guatemala – A Qualitative Risk Assessment –
EWEN TODD, Brent Dixon, Helene Couture,
Andrea Ellis, Isabelle Laberge, and Rene
Cardinal, Food Directorate, Health Canada,
Ottawa, Ontario, Canada
- 2:30 • Safety and Quality Evaluation of Thai
T53 Fermented Sausage (Nham) – KWANTAWEE
VICHENROJ PAUKATONG, and S. Kunawasen,
National Center for Genetic Engineering
and BioTech., Bangkok, Thailand
- 2:45 • The Use of Household Shopping Patterns
T54 to Identify Sources of Foodborne Disease –
SUSAN POWELL, Richard Attwell, and Michael
Painter, Manchester Metropolitan University,
Manchester, UK
- 3:00 • Break
- 3:30 • Quantification and Variability Analysis of
T55 Bacterial Cross-contamination Rates in the
Kitchen – YUHUAN CHEN, Fabiola P. Chea,
Kristin M. Jackson, and Donald W. Schaffner,
Food Risk Analysis Initiative, Rutgers University,
New Brunswick, NJ, USA
- 3:45 • The Use of Notational Analysis to Assess
T56 Cross Contamination during Domestic Food
Preparation – CHRIS GRIFFITH, Craig
Davidson, Adrian Peters, and Andrew Lewis,
University of Wales Institute, Cardiff, UK
- 4:00 • Contamination of Kitchen Surfaces after
T57 Domestic Food Preparation – CHRIS GRIFFITH,
Elizabeth Redmond, and Adrian Peters,
University of Wales Institute, Cardiff, UK
- 4:15 • The Significance of Hand Drying after
T58 Handwashing – Vidhya Gangar, Eric Meyers,
Heidi Johnson, Michael S. Curiale, and
BARRY MICHAELS, Georgia Pacific Corp.,
Palatka, FL, USA
- 4:30 • Changes of Aflatoxins during the Ripening
T59 and Storage of Korean Soy Sauce and Soybean
Paste and the Characteristics of the Changes –
JONG-GYU KIM, Woo-Sup Roh, Yong-Wook
Lee, and Lloyd B. Bullerman, Keimyung
University, Taegu, Korea
- 4:45 • Migration of *Penicillium spinulosum* from
T60 Paperboard Packaging to Extended Shelf-life
Milk – LAURA SAMMONS, S. S. Sumner,
C. R. Hackney, J. Marcy, S. E. Duncan, and
W. Eigel, Virginia Tech, Blacksburg, VA, USA

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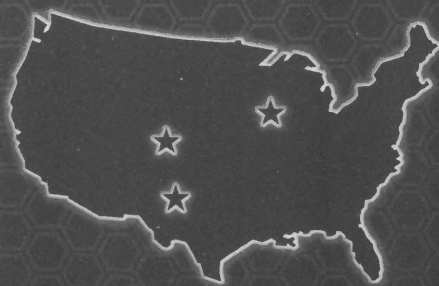
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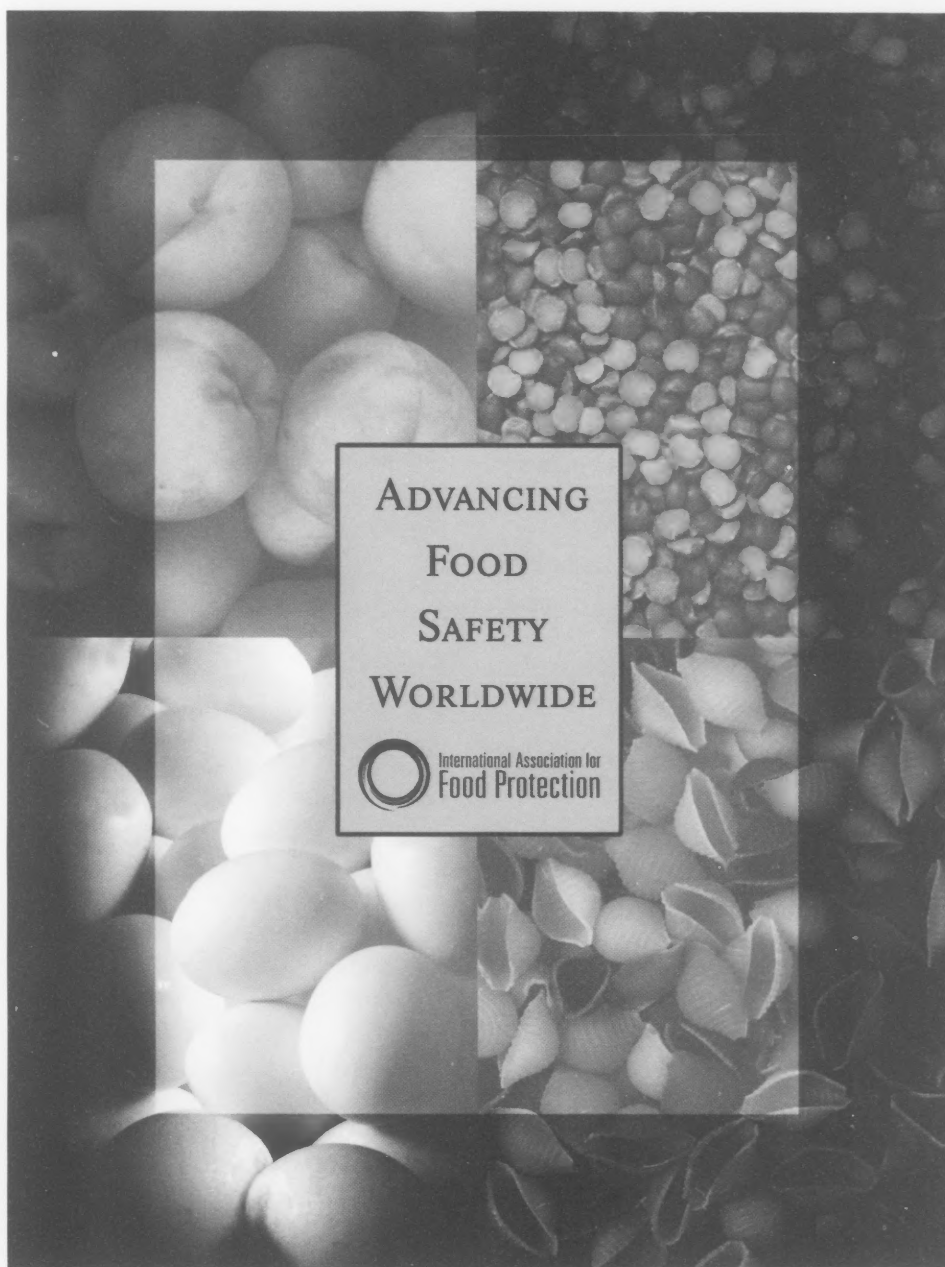
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EVENT INFORMATION

Evening Events

Cheese and Wine Reception

Sunday, August 6, 2000 (8:00 p.m. – 10:00 p.m.)

A tradition continues for attendees and guests. The reception begins in the exhibit hall immediately following the Ivan Parkin Lecture on Sunday evening.

Exhibit Hall Reception

Monday, August 7, 2000 (5:00 p.m. – 6:30 p.m.)

Relax with colleagues and friends in the exhibit hall at the end of the day. Exhibitors showcase the latest developments in the industry during this informal reception.

Monday Night Social – Fernbank Museum of Natural History

Monday, August 7, 2000 (6:00 p.m. – 9:30 p.m.)

A world of exciting adventure awaits you at Fernbank Museum of Natural History. At your leisure you will have the opportunity to dine with colleagues and explore unique state-of-the-art galleries and exhibitions. Fernbank uses innovative design and programming to draw natural history out of display cases and bring it to life. For a limited time only, Fernbank is featuring the world renowned collection of Egyptian art from the National Museum of Antiquities in Leiden, The Netherlands. Mummies, sculptures, jewelry and papyrus pages from the Book of the Dead are among the antiquities featured. This is the only time that these pieces will be on view in the United States before they return to The Netherlands for permanent reinstallation. Don't miss this rare opportunity!

Dinner at Stately Oaks

Tuesday, August 8, 2000 (6:30 p.m. – 10:00 p.m.)

Stately Oaks, a Greek Revival plantation home, was built in 1839 and housed Yankee officers during the Battle of Jonesboro. The home is furnished with period pieces and offers a glimpse of life in the Antebellum

Atlanta, Georgia

period. A guide will take you on an informative tour throughout the house, painting a picture of the rural South during the mid 1800s. Guests will then enjoy a delicious Southern cooked meal. You will not go away hungry!

Awards Banquet

Wednesday, August 9, 2000 (7:00 p.m. – 9:30 p.m.)

A special occasion to formally recognize the accomplishments of deserving food safety professionals. An elegant reception and dinner are followed by the awards ceremony. Business attire requested.

Daytime Tours

(Lunch included in all daytime tours)

Pop Topics

Sunday, August 6, 2000 (9:30 a.m. – 2:30 p.m.)

Today's tour will not only quench your thirst for knowledge but will also quench your thirst. Enjoy a tour of CNN and the world of Coca-Cola Museum. Watch as writers, editors, producers and technicians bring round-the-clock news coverage to over 200 countries worldwide. Take your taste buds on a trip around the globe when you sample Coke's most popular products from other countries at the first museum dedicated to the world famous soft drink, Coca-Cola. Your tour will continue to The Varsity, an Atlanta legacy, where you can order the best chili dogs and hamburgers in town. A stop at Underground Atlanta, the most popular visitor attraction in Georgia, will complete your tour.

Daytime Tours *(continued)*

Peach Buzz

Monday, August 7, 2000 (9:30 a.m. – 2:30 p.m.)

Enjoy a driving tour of Atlanta sites and take a glimpse into the lives of Atlanta's historical hometown heroes. Be a part of history at the Carter Presidential Center where you will find exhibits that focus on important twentieth century events. Continue your historical journey to the Martin Luther King, Jr. Historic District on "Sweet Auburn Avenue" and see the MLK Center, Dr. King's birth home and tomb. You will then experience a revival of genuine Southern hospitality and the finest selection of Southern homestyle food in the city at Mary Mac's Tea Room.

Diaries of the South

Tuesday, August 8, 2000 (9:30 a.m. – 2:30 p.m.)

Be swept away to one of the most exclusive areas of Georgia with a driving tour of Buckhead. Today, Buckhead is considered Atlanta's "Little Hollywood". Step back in time at the Atlanta History Center and see how locals lived over 100 years ago. Continue your journey to the elegant Swan House to witness the glitz and glamour of yesteryear. This beautiful home was built around 1920 for Mr. Inman, one of Atlanta's wealthiest citizens. Walk through the Tullie Smith Plantation, an original farmhouse circa 1800s. Personnel dressed in period costume enhance the multi-sensory experience and offer a charming look at turn-of-the-century fashions. The highlight of the day will be the final stop at the Swan Coach House for lunch. The Swan Coach House presents gourmet cuisine, accented with Southern flavors. Encircled by colorful gardens and natural woodlands, this early 20th century carriage house was once part of the Inman estate.

Affiliate Educational Session

Affiliate Educational Session

Saturday, August 5, 2000 (2:00 p.m. – 4:00 p.m.)

Attention Affiliate delegates, gain insights on Affiliate organizational issues. Be a leader for your Affiliate and participate in this educational experience.

New Member Reception and Orientation

New Member Reception

Saturday, August 5, 2000 (4:30 p.m. – 5:30 p.m.)

Is this your first time attending the Annual Meeting? If so, you are invited to attend this orientation session.

Learn how to get involved in Committees and get the most out of attending the Meeting. We look forward to your participation.

Committee Meetings

Committee Meetings

Sunday, August 6, 2000 (7:00 a.m. – 5:00 p.m.)

Share a wealth of knowledge and expertise. Committees and Professional Development Groups (PDGs) plan, develop and institute many of the Association's projects. Technical challenges facing the food safety industry are discussed, examined and debated. Volunteer to serve on any number of committees or PDGs that plan and implement activities to meet the Association's mission. Everyone is welcome.

Student Luncheon

Student Luncheon

Sunday, August 6, 2000 (12:00 p.m. – 1:30 p.m.)

Take charge of your career today! A Student Professional Development Group (PDG) has formed to provide students the opportunity to network with peers and serve as a point for food safety employers to seek qualified applicants. Sign up for the luncheon today to get involved. The purpose of the luncheon is to establish objectives and responsibilities as a PDG and discuss plans for the future. Dr. Anna Lammerding, Chief of Microbial Food Safety Risk Assessment from Health Canada and Mr. Gale Prince, Director of Regulatory Compliance at The Kroger Co. will speak about challenges and opportunities in the field of food safety.

Golf Tournament

The Golf Club at Bradshaw Farm

Sunday, August 6, 2000 (6:00 a.m. – 2:00 p.m.)

Enjoy spectacular views of the northern Georgia mountains as you join your friends and colleagues in a round of golf at The Golf Club at Bradshaw Farm. Everyone is invited to participate in this best-ball tournament. Built on historic farm property, the unique barn-style club house is reminiscent of the great history attached to the course. With elevated tees, tree-lined bermuda fairways and meticulously groomed bentgrass greens, Bradshaw Farm remains one of the most highly regarded layouts in the Atlanta metro area and is perfect for golfers of all skill levels. What an ideal way to kick off the 87th Annual Meeting!



International Association for Food Protection

87th Annual Meeting

6200 Aurora Avenue, Suite 200W
Des Moines, IA 50322-2863, USA
Phone: 800.369.6337 • 515.276.3344
Fax: 515.276.8655
E-mail: info@foodprotection.org
Web site: www.foodprotection.org

IMPORTANT! Please read this information before completing your registration form.

Meeting Information

Register to attend the world's leading food safety conference.

Registration includes:

- Technical Sessions
- Symposia
- Poster Presentations
- Ivan Parkin Lecture
- Exhibit Hall Admittance
- Cheese and Wine Reception
- Exhibit Hall Reception
- Awards Banquet
- Program and Abstract Book

4 Easy Ways to Register

To register, complete the Attendee Registration Form and submit it to the International Association for Food Protection by:



Phone: 800.369.6337; 515.276.3344



Fax: 515.276.8655



Mail: 6200 Aurora Avenue, Suite 200W,
Des Moines, IA 50322-2863



Web site: www.foodprotection.org

The early registration deadline is June 30, 2000. After June 30, late registration fees are in effect. Registration materials may be picked up on site at the Hilton Atlanta.

Refund/Cancellation Policy

Registration fees, less a \$50 administration fee and any applicable bank charges, will be refunded for written cancellations received by July 14, 2000. No refunds will be made after July 14; however, the registration may be transferred to a colleague with written notification. Refunds will be processed after August 14, 2000. Additional tickets purchased are nonrefundable.

Exhibit Hours

Sunday, August 6, 2000 — 8:00 p.m. – 10:00 p.m.
Monday, August 7, 2000 — 9:30 a.m. – 1:30 p.m.
3:00 p.m. – 6:30 p.m.
Tuesday, August 8, 2000 — 9:30 a.m. – 1:30 p.m.

August 6-9, 2000, Atlanta, Georgia

Hotel Information

For reservations, contact the hotel directly and identify yourself as an International Association for Food Protection Annual Meeting attendee to receive a special rate of \$119 per night, single or double. Make your reservations as soon as possible; this special rate is available only until July 7, 2000.

Hilton Atlanta
255 Courtland Street, NE
Atlanta, Georgia 30303
404.659.2000

Evening Events

Sunday, August 6, 2000

Cheese and Wine Reception (8:00 p.m. – 10:00 p.m.)

Monday, August 7, 2000

Exhibit Hall Reception (5:00 p.m. – 6:30 p.m.)

Monday Night Social **Fernbank Museum of Natural History**
(6:00 p.m. – 9:30 p.m.)

Tuesday, August 8, 2000

Dinner at Stately Oaks (6:30 p.m. – 10:00 p.m.)

Wednesday, August 9, 2000

Awards Banquet (7:00 p.m. – 9:30 p.m.)

Daytime Tours

(Lunch included in all daytime tours)

Sunday, August 6, 2000

Pop Topics (9:30 a.m. – 2:30 p.m.)

Monday, August 7, 2000

Peach Buzz (9:30 a.m. – 2:30 p.m.)

Tuesday, August 8, 2000

Diaries of the South (9:30 a.m. – 2:30 p.m.)

Golf Tournament

Sunday, August 6, 2000

Golf Tournament (6:00 a.m. – 2:00 p.m.)



International Association for Food Protection

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6200 Aurora Avenue, Suite 200W
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 Fax: 515.276.8655
 E-mail: info@foodprotection.org
 Web site: www.foodprotection.org

Attendee Registration Form

August 6-9, 2000, Atlanta, Georgia



Name (Print or type your name as you wish it to appear on name badge) _____

Title _____ Employer _____

Mailing Address (Please specify: Home Work) _____

City _____ State/Province _____ Country _____ Postal/Zip Code _____

Telephone _____ Fax _____ E-mail _____

First time attending meeting

Member since: _____

Regarding the ADA, please attach a brief description of special requirements you may have.

Member Number: _____

REGISTER BY JULY 21, 2000

REGISTRATION FEES:

Registration (Awards Banquet included) _____
 Association Student Member* _____
 Retired Association Member* _____
 One Day Registration: Mon. Tues. Wed. _____
 Spouse/Companion* (Name): _____
 Children 15 & Over* (Names): _____
 Children 14 & Under* (Names): _____
 *Awards Banquet not included

MEMBERS	NONMEMBERS	TOTAL
\$ 310	\$ 445	_____
\$ 55	Not Available	_____
\$ 55	Not Available	_____
\$ 170	\$ 225	_____
\$ 40	\$ 40	_____
\$ 25	\$ 25	_____
FREE	FREE	_____

EVENTS:

Golf Tournament (Sunday, 8/6) _____
 Student Luncheon (Sunday, 8/6) _____
 Monday Night Social, Fernbank Museum (Monday, 8/7)
 Children 14 and under _____
 Dinner at Stately Oaks (Tuesday, 8/8)
 (Limited tickets available) _____
 Awards Banquet (Wednesday, 8/9) _____

PER PERSON	# OF TICKETS	TOTAL
\$ 105	_____	_____
\$ 10	_____	_____
\$ 44	_____	_____
\$ 39	_____	_____
\$ 65	_____	_____
\$ 45	_____	_____

DAYTIME TOURS:

(Lunch included in all daytime tours)
 Pop Topics (Sunday, 8/6) _____
 Peach Buzz (Monday, 8/7) _____
 Diaries of the South (Tuesday, 8/8) _____

TOTAL AMOUNT ENCLOSED \$ _____
 US FUNDS on US BANK

Payment Options:

Check Enclosed

Name on Card _____

Signature _____

JOIN TODAY AND SAVE!!!
 (Attach a completed Membership application)
 (See page 591 of this issue
 for a membership application)

Expiration Date _____

EXHIBITORS DO NOT USE THIS FORM



Annual Meeting Workshops

Sponsored by



International Association for
Food Protection

Atlanta Hilton
Atlanta, Georgia
Saturday, August 5, 2000

Workshop I — Microbiological Sampling Plans and Sample Collection for Food Processors

This hands-on workshop is intended for food processor personnel who have responsibility for microbiological sampling plans, sample analysis, data interpretation, and sample collection.

WORKSHOP TOPICS

- Module A: Sample Collection Protocols and Recordkeeping**
- Module B: Sampling Plans for Foodborne Pathogens and HACCP Programs**
- Module C: Sampling Plans for Food Processing Environments**
- Module D: Investigational (biased) and Attribute (random) Sampling**
- Module E: Sampling Plans for Storage or Shelf-life Studies**

INSTRUCTORS

- Joseph D. Eifert, Ph.D.**, Department of Food Science & Technology, Virginia Tech, Blacksburg, VA
- W. Payton Pruett, Jr., Ph.D.**, ConAgra Refrigerated Prepared Foods, Downers Grove, IL
- Gary M. Smith**, Silliker Laboratories Group, Inc., Homewood, IL

WHAT PARTICIPANTS WILL LEARN

Participants will learn proper techniques for sample collection, sample handling, designing appropriate sampling plans for their products and processes. Also, how to evaluate microbiological sample analysis data and adjust their sampling plans. This workshop emphasizes microbiological sampling, rather than analytical testing.

WHO SHOULD ATTEND?

Quality Assurance and Quality Control personnel; Laboratory personnel from food processing industry and private testing laboratories; and Food Technologists and Research and Development personnel.

HOURS FOR WORKSHOP

- Saturday, August 5, 2000**
- Registration** — 8:00 a.m. Continental Breakfast
- Workshop** — 8:30 a.m. — 4:30 p.m.
- Lunch** — Provided

Workshop II — Using Information Technology to Manage Food Safety Risks

This workshop promises to be a thought provoking, timely, and multi-disciplinary look at how Information Technology (IT) is being used in the field of food safety.

WORKSHOP TOPICS

- From EpiInfo to FoodNet: Improving Surveillance and Outbreak Response**
- Automating Audits and Inspections with Mobile Computing Solutions**
- eHACCP: Temperature Data Acquisition and Electronic Data Management**
- Improving Lab Information Management for Better Decision-Making**
- Clean Behind the Ears: Using Handheld Technology for Audits and HACCP Verification**

INSTRUCTORS

- Arthur Liang, Ph.D.**, Centers for Disease Control and Prevention (CDC), Atlanta, GA
- John E. Griggs, Ph.D.**, GSC Mobile Solutions, East Lansing, MI
- Dick Ohaus**, Tangent Systems, Inc., Charlotte, NC
- Karen Mullery**, 3M Microbiology Products, St. Paul, MN
- Frank Yiannas**, Walt Disney World, Co., Lake Buena Vista, FL

WHAT PARTICIPANTS WILL LEARN

Come learn from industry and regulatory leaders the historical perspectives on information management for food safety solutions; the current uses of IT ranging from foodborne disease surveillance, laboratory data management, food safety audits, HACCP and more; available software and hardware options for your unique needs; see real world examples of food safety IT applications; and perform hands-on exercises using state-of-the-art products.

WHO SHOULD ATTEND?

Food safety professionals, regulatory officials or information technology professionals involved with food processing and retail inspections, HACCP, or risk management decisions utilizing laboratory data.

HOURS FOR WORKSHOP

- Saturday, August 5, 2000**
- Registration** — 8:00 a.m. Continental Breakfast
- Workshop** — 8:30 a.m. — 4:30 p.m.
- Lunch** — Provided


For additional information visit our Web site at www.foodprotection.org


IAFP 87th Annual Meeting

Exhibitors


(Companies scheduled to exhibit as of June 2, 2000)

 Indicates IAFP Sustaining Members

 **3-A Sanitary Standards Symbol Administrative Council**
1500 Second Avenue SE
Cedar Rapids, IA 52403
Phone: 319.286.9221 Fax: 319.286.9290
Web site: zeus.ia.net/~aaasansb

 **3M Microbiology Products**
3M Center
St. Paul, MN 55144
Phone: 800.228.3957 Fax: 651.737.1994
Web site: www.mmm.com

AATI (Advanced Analytical Technologies, Inc.)
2901 South Loop Drive
Ames, IA 50010
Phone: 515.296.6600 Fax: 515.296.6789
Web site: www.advanced-analytical.com

 **ABC Research Corporation**
3437 SW 24th Avenue
Gainesville, FL 32607
Phone: 352.372.0436 Fax: 352.378.6483
Web site: www.abcr.com

American Engineering Corporation
P.O. Box 336
Collegedale, TN 37315
Phone: 423.396.3666 Fax: 423.396.3668
Web site: www.americanengr.com

American Proficiency Institute
1159 Business Park Drive
Traverse City, MI 49686
Phone: 800.333.0958 Fax: 231.941.7287


AOAC International
481 N. Frederick Avenue
Gaithersburg, MD 20877-2417
Phone: 301.924.7077 ext. 151 Fax: 301.924.7089
Web site: www.aoac.org

 **Applied Research Institute**
3N Simm Lane
Newtown, CT 06470
Phone: 203.270.7692 Fax: 203.426.3299
Web site: www.arillc.com

Aquionics Inc.
21 Kenton Lands Road
Erlanger, KY 41018
Phone: 859.341.0710 Fax: 859.341.0350
Web site: www.aquionics.com

 **ASI Food Safety Consultants, Inc.**
7625 Page Boulevard
St. Louis, MO 63130
Phone: 800.477.0778 Fax: 314.727.2563
Web site: www.asifood.com

 **Audits International**
60 Revere Drive
Northbrook, IL 60062
Phone: 847.480.9898 Fax: 847.480.1838
Web site: www.audits.com

 **BCN Research Laboratories, Inc.**
P.O. Box 50305
Knoxville, TN 37950-0305
Phone: 800.236.0505 Fax: 865.584.3203

 **BD Biosciences**
7 Loveton Circle
Sparks, MD 21152
Phone: 410.316.4000 Fax: 410.316.4906

 **BioControl Systems, Inc.**
12822 SE 32nd Street
Bellevue, WA 98005
Phone: 425.603.1123 Fax: 425.603.0070
Web site: www.rapidmethods.com


 **bioMérieux, Inc.**
595 Anglum Road
Hazelwood, MO 63042-2320
Phone: 314.731.8500 Fax: 314.731.8678
Web site: www.biomerieux.com

Biopath Inc.
2611 Mercer Avenue
West Palm Beach, FL 33401
Phone: 561.655.2302 Fax: 561.655.3361
Web site: www.biopathinc.com

Biosys, Inc.
3810 Packard Road
Ann Arbor, MI 48108
Phone: 800.458.5101 Fax: 613.271.1148

BioteCon Diagnostics, Inc.
3 Cardiff Lane
Hamilton Square, NJ 08690
Phone: 609.588.8828 Fax: 609.588.6660
Web site: www.bc-diagnostics.com

 **Capitol Vial, Inc.**
151 Riverside Drive
Fultonville, NY 12072
Phone: 518.853.3377 Fax: 518.853.3409
Web site: www.capitolvial.com

 **Celsis, Inc.**
1801 Maple Avenue
Evanston, IL 60201
Phone: 847.467.7870 Fax: 847.467.6602
Web site: www.celsis.com

- Cogent Technologies, Ltd.**
11140 Lusckek Drive
Cincinnati, OH 45241
Phone: 513.469.6800 Fax: 513.469.6811
- Compliance Control Inc. — Hygienius**
1355 Piccard Drive
Rockville, MD 20850
Phone: 301.990.6780 Fax: 301.990.6768
Web site: www.hygienius.com
- Decagon Devices, Inc.**
P.O. Box 835
Pullman, WA 99163
Phone: 509.332.2756 Fax: 509.332.5158
Web site: www.decagon.com
- DiverseyLever**
255 E. 5th Street
Cincinnati, OH 45202
Phone: 513.762.6794 Fax: 513.762.6079
Web site: www.diverseylever.com
- DQCI Services, Inc.**
5205 Quincy Street
Mounds View, MN 55112
Phone: 612.785.0484 Fax: 612.785.0584
- DSM Food Specialties**
N89 W14475 Patrita Drive
Menomonee Falls, WI 53051
Phone: 262.255.7955 Fax: 262.255.7732
- DYNAL, Inc.**
5 Delaware Drive
Lake Success, NY 11042
Phone: 516.326.3270 Fax: 516.326.3298
Web site: www.dynal.no
- Elsevier Science**
655 Avenue of The Americas
New York, NY 10010
Phone: 212.633.3758 Fax: 212.633.3112
Web site: www.elsevier.com/locate/foodsci
- EM Industries, Inc./EM Science Division**
480 S. Democrat Road
Gibbstown, NJ 08027
Phone: 856.423.6300 ext. 430 Fax: 856.423.4389
Web site: www.emscience.com
- Food Processors Institute**
1350 I Street, NW
Washington, DC 20005-3377
Phone: 202.393.0890 Fax: 202.639.5941
Web site: www.fpi-food.org
- Food Quality Magazine**
208 Floral Vale Boulevard
Yardley, PA 19067
Phone: 215.860.7800 Fax: 215.860.7900
Web site: www.foodquality.com
- Food Safety Net Services, Ltd.**
221 West Rhapsody
San Antonio, TX 78216
Phone: 210.384.3424 Fax: 210.308.8730
- Food Testing & Analysis Magazine**
P.O. Box 5244
Glendale, CA 91221-1081
Phone: 818.842.4777 Fax: 818.769.2939
- FoodHandler**
514 Grand Boulevard
Westbury, NY 11590
Phone: 800.338.4433 Fax: 516.338.5486
Web site: www.foodhandler.com
- Foss North America, Inc.**
7682 Executive Drive
Eden Prairie, MN 55344
Phone: 952.974.9892 Fax: 952.974.9823
Web site: www.fossnorthamerica.com
- GENE-TRAK Systems**
94 South Street
Hopkinton, MA 01748
Phone: 508.435.7400 Fax: 508.435.0025
- Georgia Peanut Commission**
P.O. Box 967
Tifton, GA 31793
Phone: 912.386.3470 Fax: 912.386.3501
www.gapeanuts.com
- Glo Germ Company**
150 E. Center Street
Moab, UT 84532
Phone: 435.259.5931, ext. 117 Fax: 435.259.5930
Web site: www.glogerm.com
- GSC Mobile Solutions**
4660 Hagadorn Road
East Lansing, MI 48823-5353
Phone: 517.337.8960 Fax: 517.337.2868
- IDEXX Laboratories, Inc.**
One Idexx Drive
Westbrook, ME 04092
Phone: 207.856.0300 Fax: 207.856.0865
- IGEN International Inc.**
16020 Industrial Drive
Guithersburg, MD 20877
Phone: 301.869.9800 ext. 2127 Fax: 301.947.6990
Web site: www.igen.com
- International Association for Food Protection**
6200 Aurora Avenue, Suite 200W
Des Moines, IA 50322-2863
Phone: 515.276.3344 Fax: 515.276.8655
Web site: info@foodprotection.org
- International BioProducts, Inc.**
P.O. Box 0746
Bothell, WA 98041
Phone: 425.398.7993 Fax: 425.487.3924
Web site: www.intlbioproducts.com
- International Food Hygiene**
P.O. Box 4
East Yorkshire, YO25 9DJ
Phone: 44 (0)1377.241724 Fax: 44 (0)1377.253640
- International Fresh-cut Produce Association-IFPA**
1600 Duke Street
Alexandria, VA 22314-3421
Phone: 703.299.6282 Fax: 703.299.6288
Web site: www.fresh-cuts.org
- J. J. Keller & Associates, Inc.**
3003 W. Breezewood Lane
Neenah, WI 54957
Phone: 920.727.7318 Fax: 920.727.7526
- LabPlas Inc.**
1950 rue Bombardier Ste-Julie, Que J3E 2J9
Phone: 450.649.7343 Fax: 450.649.3113
Web site: www.labplas.com
- Medallion Laboratories**
9000 Plymouth Avenue North
Minneapolis, MN 55427
Phone: 612.764.4453 Fax: 612.764.4010

Exhibitors, *continued*

Microbiology International

97H Monocacy Boulevard
Frederick, MD 21701
Phone: 301.662.6835
Web site: www.microbiology-intl.com
Fax: 301.662.8096

NSF International

789 N. Dixboro Road
Ann Arbor, MI 48105
Phone: 734.769.5523
Web site: www.nsf.org
Fax: 734.769.0109

NASCO

901 Janesville Avenue
Fort Atkinson, WI 53538-0901
Phone: 920.563.2446
Web site: www.nascofa.com
Fax: 920.563.8296

The National Food Laboratory, Inc.

6363 Clark Avenue
Dublin, CA 94568-3097
Phone: 925.828.1440
Fax: 925.833.8795

Nelson-Jameson Inc.

2400 E. 5th Street
Marshfield, WI 54449
Phone: 715.387.1151
Fax: 715.387.8746

Neogen Corporation

620 Leshner Place
Lansing, MI 48912
Phone: 517.372.9200
Web site: www.neogen.com
Fax: 517.372.2006

ONLINE Engineering, Inc.

3802 Industrial Boulevard
Bloomington, IN 47403
Phone: 812.339.9511
Fax: 812.339.9512

Organon Teknika

100 Akzo Avenue
Durham, NC 27712
Phone: 919.620.2343
Web site: www.organonteknika.com
Fax: 919.620.2615

Orkin Pest Control

2170 Piedmont Road, NE
Atlanta, GA 30324
Phone: 404.888.2000
Fax: 404.888.2012

Oxoid, Inc.

1926 Merivale Road
Nepcan, ON K2G 1E8
Phone: 800.567.8378
Web site: www.oxoid.ca
Fax: 613.226.3728

PerkinElmer Instruments

761 Main Avenue
Norwalk, CT 06859
Phone: 800.762.4000
Fax: 203.762.4054

PestWest Electronics, Limited

Denholme Drive
West Yorkshire, WF5 9NB
Phone: 44.19242.77631
Fax: 44.19242.74385

Q Laboratories, Inc.

1400 Harrison Avenue
Cincinnati, OH 45214
Phone: 513.471.1300
Web site: www.qlaboratories.com
Fax: 513.471.5600

Qualicon, Inc.

P.O. Box 80357
Wilmington, DE 19880-0357
Phone: 302.695.5217
Web site: www.qualicon.com
Fax: 302.695.4106

REMEL Inc.

12076 Santa Fe Drive
Lenexa, KS 66215
Phone: 800.255.6730
Web site: www.remelinc.com
Fax: 800.447.5750

Rhodia, Inc.

2802 Walton Commons West
Madison, WI 53718
Phone: 630.916.9660
Web site: www.us.rhodia
Fax: 630.916.0393

Rochester Midland

333 Hollenbeck Street
Rochester, NY 14621
Phone: 716.336.2200
Web site: www.rochestermidland.com
Fax: 716.467.4406

rtech™ laboratories

P.O. Box 64101
St. Paul, MN 55164-0101
Phone: 651.481.2668
Web site: www.rtechlabs.com
Fax: 651.486.0837

Silliker Laboratories Group, Inc.

900 Maple Road
Homewood, IL 60430
Phone: 708.957.7878
Web site: www.silliker.com
Fax: 708.957.1483

SneezeGuard Solutions, Inc.

1123 Wilkes Boulevard
Columbia, MO 65201
Phone: 573.443.5756
Fax: 573.449.7126

Tangent Systems, Inc.

8030 B. England Street
Charlotte, NC 28273
Phone: 704.554.0830
Fax: 704.554.0820

Underwriters Laboratories, Inc.

333 Pfingsten Road
Northbrook, IL 60062
Phone: 847.272.8800
Fax: 847.509.6321

Universal Sanitizers and Supplies, Inc.

P.O. Box 50305
Knoxville, TN 37950-0305
Phone: 888.634.3196
Fax: 865.584.3203

VWR Scientific Products

1310 Goshen Parkway
West Chester, PA 19380
Phone: 610.431.1700
Web site: www.vwrsp.com
Fax: 610.429.9340

Warren Analytical Laboratory

650 "O" Street
Greeley, CO 80631
Phone: 800.945.6669
Web site: www.warrenlab.com
Fax: 970.351.6648

Weber Scientific

2732 Kuser Road
Hamilton, NJ 08691
Phone: 609.584.7677
Web site: www.weberscientific.com
Fax: 609.584.8388

ZEP Manufacturing Company

1310 Seaboard Industrial Boulevard
Atlanta, GA 30318
Phone: 404.352.1680
Web site: www.zepmfg.com
Fax: 404.350.2742

Zylux Corporation

1742 Henry G. Lane Street
Maryville, TN 37801
Phone: 865.379.6016
Web site: www.zylux.com
Fax: 865.379.6018



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www.sherrylabs.com

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lnaylor@sherrylabs.com

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Minimally processed foods are popular for their convenience (they are easy to prepare) and relative freshness. Foods processed by novel and non-thermal technologies are being developed to meet the needs of the health-conscious new generation. Unfortunately, hazards resulting from adaptation of pathogens to stress are more likely to occur in minimally- and nonthermally-processed than in traditional foods. Recent data in our laboratory indicate that some pathogens adapt to sublethal levels of high pressure processing. These high pressure-adapted pathogens became more resistant to lethal pressures and temperatures.


There are, however, some positive aspects to the adaptation of foodborne bacteria to stress. Probiotic bacteria (e.g., *Bifidobacterium* spp. and *Lactobacillus acidophilus*) are desirable supplements to some fermented products, such as yogurt. Counts of these bacteria, however, may decline rapidly during storage of such an acid food. Pre-adaptation to acid stress enhances survivability of probiotic bacteria in yogurt-like products.

Conclusion. Stressful conditions in food and in the environment may not damage cells of pathogenic

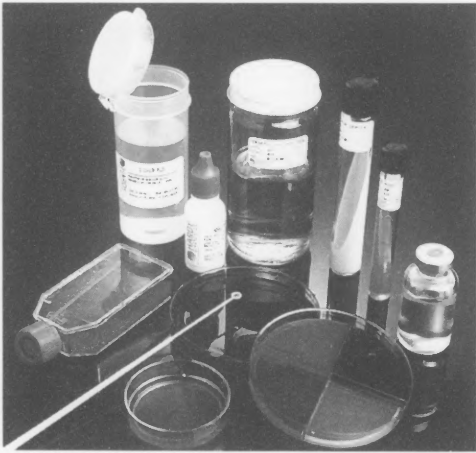
bacteria. However, these conditions, induce a stress adaptive response that makes bacteria resistant to lethal preservation factors. In novel processing technologies, pathogens are more likely to be stressed or injured than killed. Adaptation of pathogens to these stressful conditions may constitute safety hazards in this category of foods. It appears that the saying "what doesn't kill me only makes me stronger" applies equally well to bacteria and to humans.

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Coming Events

AUGUST

• **5, International Association for Food Protection Annual Meeting Workshops**, Atlanta, GA. Workshop I "Microbiological Sampling Plans and Sample Collection for Food Processors." Workshop II "Using Information Technology to Manage Food Safety Risks." Additional workshop information available in this issue of *DFES* on page 580 or, phone: 800.369.6337; 515.276.3344; fax: 515.276.8655; E-mail: info@foodprotection.org or visit our Web site at www.foodprotection.org for the most current Annual Meeting information.

• **6-9, International Association for Food Protection Annual Meeting**, Atlanta, GA. Registration information available in this issue of *DFES* on page 579 or contact Julie Cattanach at 800.369.6337; 515.276.3344; fax: 515.276.8655; E-mail: jcattanach@foodprotection.org. Visit our Web site at www.foodprotection.org for the most current Annual Meeting information.

• **15-16, Quality Systems for Food Processors**, New Orleans, LA. This course is designed to assist assurance and control professionals in the development, implementation, and maintenance of effective, regulatory compliant food safety programs. For further information, contact Silliker Laboratories Group, Inc., at 800.829.7879; Web site: www.Silliker.com.

SEPTEMBER

• **10-12, The International Exposition for Food Processors® (IEFP) 2001**, Sands Expo & Convention Center, Las Vegas, NV. For additional information, contact Nancy Janssen or Cheryl Clark at 703.684.1080; 800.331.8816 (US and Canada only); fax: 703.548.6563; Web site: info@fpmsa.org.

• **12-13, Upper Midwest Dairy Industry Association Annual Meeting**, Holiday Inn, St. Cloud, MN. For additional information, contact Paul Nierman at 612.785.0484.

• **12-13, Food Plant Sanitation Workshop**, Chicago, IL. For additional information, contact AIB, 1213 Bakers Way, P.O. Box 3999, Manhattan, KS 66505-3999; phone: 785.537.4750; fax: 785.537.1493.

• **12-14, Wyoming Environmental Health Association Annual Meeting**, Little America Hotel, Cheyenne, WY. For additional information, contact Nola Evans at 307.745.4591.

• **12-16, The National Society for Healthcare Foodservice Management 2000 Conference**, at the Registry Resort, Naples, FL. For further information, contact Sheila Crowley at 202.546.7236; fax: 202.547.6348.

• **14-15, Microbiological Concerns in Food Plant Sanitation and Hygiene**, Huntington Beach, CA. This course is designed for individuals responsible for implementing and monitoring sanitation programs. For further information, contact Silliker Laboratories Group, Inc., at 800.829.7879; Web site: www.Silliker.com.

• **19-21, New York State Assn. of Milk & Food Sanitarians**, Sheraton Inn, Syracuse, NY. For additional information, contact Janene Lucia at 607.255.2892.

• **19-21, Washington Assn. for Food Protection Annual Meeting**, WestCoast Wenatchee Center Hotel, Wenatchee, WA. For more information, contact Bill Brewer at 206.363.5411.

• **23-27, Plasticulture 2000**, Hershey Lodge and Convention Center, Hershey, PA. See active field demonstrations of machinery, crops grown in plasticulture systems and special tours. For more information,

contact The American Society for Plasticulture at 814.238.7045.

• **24-27, InterMopro 2000, InterCool 2000, and InterMeat 2000**, Düsseldorf, Germany. For further information, contact Messe Düsseldorf North America, 150 N. Michigan Ave., Suite 2920, Chicago, IL 60601; phone: 312.781.5180; fax: 312.781.5188; Web site: www.mdna.com.

• **25-27, Indiana Environmental Health Association, Inc. Fall Educational Conference**, Radisson, Evansville, IN. Contact Helene Uhlman at 219.853.6358 or Bob Schmidt at 812.349.2542.

• **27-28, Wisconsin Milk & Food Sanitarians Association Meeting**, Regency Suites, Green Bay, WI. For further information, contact Randy Dags at 608.266.9376.

• **29-Oct. 2, 2nd Biennial 5-A Day International Symposium**, Washington Monarch Hotel, Washington, D.C. Public health professionals and produce industry leaders interested in implementing or strengthening community-based public/private partnerships to improve health in their own countries should attend this conference. For more information, contact National Cancer Institute at 301.496.8520; E-mail: Margaret_Farrell@nih.gov; or Produce for Better Health Foundation at 302.235.2329, ext. 32; E-mail: mneilan@5aday.com.

OCTOBER

• **4-5, Iowa Assn. of Milk, Food & Environmental Sanitarians, Inc.**, Best Western Starlight Hotel, Ames, IA. For additional information, contact Monica Streicher at 319.933.4521, ext. 222.

• **5-6, Alberta Assn. of Milk, Food & Environmental Sanitarians Meeting**, Bernard Schnell Hall,

University of Alberta in Edmonton, Alberta, Canada. For additional information, contact Bonnie Jensen at 780.495.2188.

• **9-11, Eighth International Symposium on Animal, Agricultural and Food Processing Wastes (ISAAFPW)**, Marriott Conference Center, Des Moines, IA. Co-sponsored by IAFP. For additional information, phone Brenda West at 800.371.2723.

• **11-12, Associated Illinois Milk, Food & Environmental Sanitarians**, Stoney Creek Inn, East Peoria, IL. For additional information, contact Tom Gruetzmaier at 815.395.8797.

• **11-13, Second NSF International Conference on Food Safety: Preventing Foodborne Illness through Science and Education**. The conference will be held in Savannah, GA at the Hyatt Regency. Co-sponsored by IAFP and other organizations. For additional information, contact Wendy Raeder at 734.827.6888; fax: 734.827.7114/6831; E-mail: raeder@nsf.org.

• **12-13, HACCP Workshop**, Industry, CA. For additional information, contact AIB, 1213 Bakers Way, P.O. Box 3999, Manhattan, KS 66505-3999; phone: 785.537.4750; fax: 785.537.1493.

• **23-25, The 2000 New Mexico Environmental Health Conference**, Albuquerque Convention Center, Albuquerque, NM. For additional information, contact Tom Duker, P.O. Box 27176, Albuquerque, NM 87125-7176; Phone: 505.924.3667; fax: 505.924.3684; E-mail: tduker@mercury.berncgo.gov.

• **31, North Dakota Environmental Health Association Annual Conference**, Grand Forks Holiday Inn, Grand Forks, ND. For additional information, contact Debra Larson at 701.328.1292.

NOVEMBER

• **12, IAFP Workshop, Latin American Workshop on Safety of Exported Produce**, Guadalajara Mission Carlton Hotel, Guadalajara,

Mexico. Watch our Web site at www.foodprotection.org for more information.

• **13-16, Pacific Congress on Milk Quality and Mastitis Control**, Nagano, Japan. Co-sponsored by IAFP. For additional information, contact Secretariat for PC2000, Philpot and Associates International, P.O. Box 120, Homer, LA 71040; phone: 318.927.2388; fax: 318.927.3133; E-mail: philpot@homerla.com.

• **16-17, Alabama Association for Food Protection Annual Meeting**. For additional information, contact Patricia Lindsey at 256.734.0243.

• **21-23, Second National On-Farm Food Safety and Quality Assurance Conference**, Novotel Launceston, Tasmania. For more information, contact Tasmanian Quality Assured Inc., P.O. Box 193, Launceston 7250, Tasmania; phone: 03.6331.6377; fax: 03.6331.4344; E-mail: tqainc@microtech.com.au.



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THOUGHTS on Today's Food Safety...

The Stressful Life of Bacteria in Food and Safety Implications

Ahmed E. Yousef, Ph.D.

Department of Food Science and Technology

Department of Microbiology

The Ohio State University

Columbus, Ohio

Bacteria, like all other living beings, are exposed to stress and react to it. When humans are subjected to stress, their reactions vary from fatigue to endurance. Interestingly, bacteria behave similarly. When the stress cannot be tolerated, both humans and bacteria may suffer injury. Given time and rest, both humans and bacteria may recover from some types of injury. Severe injuries, however, may lead to death. The words "stress," "injury," "recovery," and "death" describe human experiences, and these expressions have been ported to the world of microbiology, with modifications, of course.

Stress in the environment and food. Bacteria are frequently exposed to stressful, injurious or lethal factors in the environment. Sunlight contains ultraviolet irradiation, which, depending on the dose, stresses, injures, or kills bacteria. Heat packed in this light may lead to similar effects. Acidity of fermented vegetation, salinity of sea water, and dryness of arid climates are examples of other stresses that bacteria may encounter in the environment. Additionally, bacteria live and swim in an environment that contains their own excretions (metabolites), some of which constitute unique stresses to bacteria. Lack of essential nutrients for growth or survival (i.e., starvation) stresses, injures or kills bacteria, depending on the severity and duration of starvation. In summary, bacteria in the environment are frequently exposed to physical, chemical, and physiological stresses of varying magnitudes. Bacteria in food are also exposed to stresses, including heat, acid, freezing, osmotic shock, desiccation, oxidation, and starvation.

Bacteria respond to stress! Although injurious and lethal factors cause measurable structural or functional damage to bacterial cells, stresses cause only slight, and often undetectable, damage. Reaction of bacteria to stress, however, is clearly noticeable. This reaction, known as stress adaptive response (SAR), results in a phenomenon called "stress hardening." In other words,

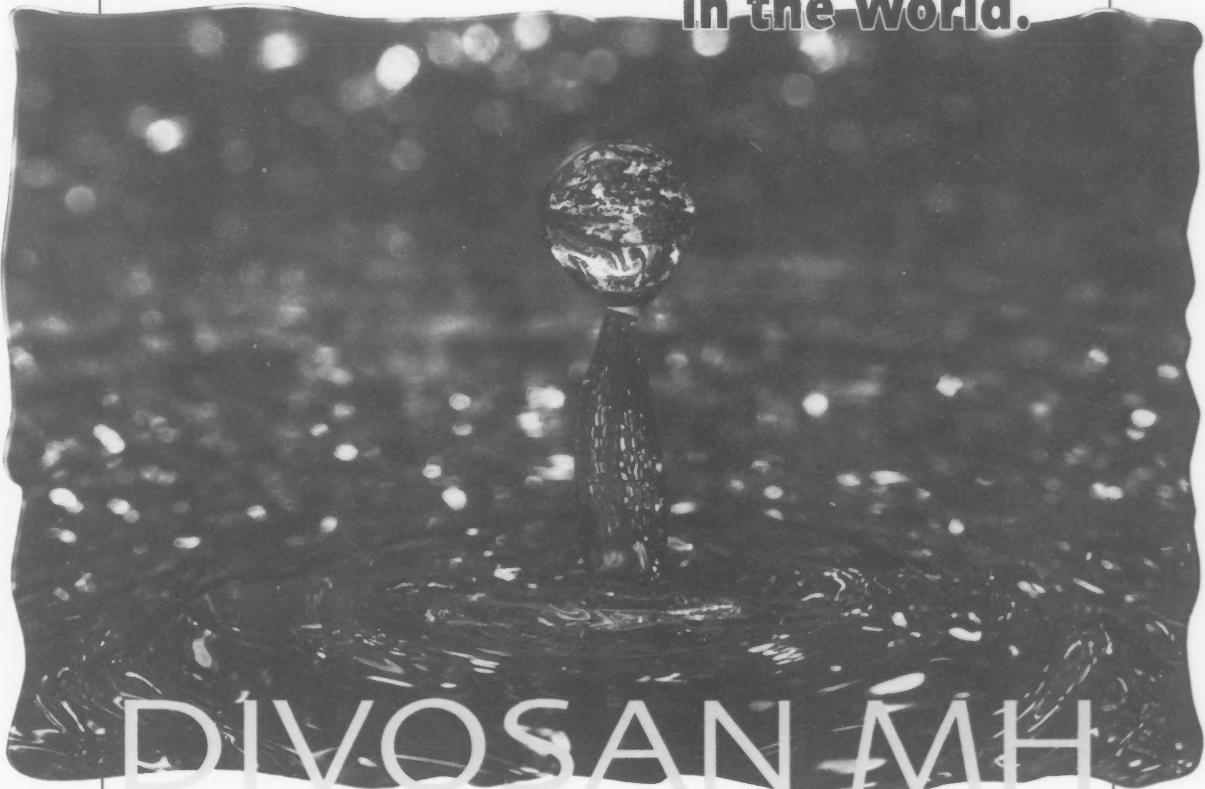
bacteria adapt to the applied stress. Stress-adapted bacteria are capable of resisting similar (homologous) or different (heterologous) stresses and in many cases survive injurious or even lethal factors. For example, when bacteria are subjected to a heat shock, cells respond to this stress by becoming resistant to lethal heat treatments (Bunning et al., 1990). When *Listeria monocytogenes* was stressed by mild heat (45°C for 60 min), it became significantly more resistant to lethal doses of ethanol, hydrogen peroxide, and sodium chloride (Lou and Yousef, 1997). There are indications that adaptation of bacterial pathogens to stress (e.g., acid stress) may increase their ability to cause diseases. Data about increased virulence in stress-adapted cells are still contradictory, but if confirmed, these results will have far reaching implications.

The genetic basis of stress adaptation resides on the "stimulon," which refers to all the operons that respond to one environmental stress and their protein products. When a stimulon is induced by an environmental stress, this may lead to the synthesis of stress proteins, which help the cells to combat further severe stresses. Stress proteins repair damages resulting from exposure to stress. There are overlaps among stress proteins resulting from the induction of more than one stimulon. For example, some heat shock proteins, such as DnaK and GroE, (induced by exposure to heat shocks), are also induced by ethanol, starvation, oxidation, acid, and ultraviolet radiation. Different stresses may induce the synthesis of the same stress proteins; these proteins may protect cells against not only further homologous stresses but heterologous stresses as well.

Stress adaptation and safety of food. During traditional food processing (e.g., pasteurization), bacterial cells are more likely killed than injured or stressed. However, some processing conditions cause stress and thus induce SAR in bacteria. For example, bacteria in milk heated at sub-pasteurization temperatures (e.g., for making certain varieties of cheese) may only suffer a heat shock (i.e., heat stress) and become resistant to subsequent severe processing. Adaptation of *Salmonella* to acid stress increased the survival of this pathogen in cheese (Leyer and Johnson, 1992). One may similarly hypothesize that certain other processing conditions cause stress adaptation that affects the safety of numerous foods. For example, acidity developed during sausage fermentation and the presence of salt in the formulation of this product may induce an acid adaptive response and osmotic shock response in pathogenic bacteria. Pathogens adapted to acid and osmotic stress during production of sausage may become resistant to the smoking step or may persist during storage of the product.

Continued on page 586

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